# APPENDIX D

## Noise and Vibration Assessment

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# *AQUAMARINE SOLAR PROJECT AND GEN-TIE LINE NOISE AND VIBRATION ASSESSMENT*

## *Kings and Fresno Counties, California*

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## INTRODUCTION

This report assesses the potential significance of noise and vibration impacts resulting from the Aquamarine Solar Project proposed in Kings County, California. The Project will occupy an approximately 1,825-acre site located at the intersection of the Laurel Avenue and the 25th Avenue alignments, approximately 1.5 miles southeast of Avenal Cutoff Road in central Kings County. The project also includes a 15.0 mile long generation-interconnection tie line (Gen-Tie) extending south from the Aquamarine site to Nevada Avenue, where it will turn west and follow Nevada Avenue and Jayne Avenue to the existing PG&E Gates Substation in Fresno County.

The Aquamarine Solar Project is planned to generate a total of 250 megawatts (MW) of electrical output from solar photovoltaic (PV) modules. The project is planned to be constructed over an approximate 24-month period from mid-2019 through mid-2021.

The solar modules will be mounted on a series of horizontal single-axis trackers which will be oriented north-south and rotate the solar arrays in an east-west direction. The solar modules output direct current (DC) power and the electricity travels to an inverter via underground cables to be converted to alternating current (AC) power.

The Gen-Tie line is planned as a 230-kV transmission line to be constructed within a 100- to 350-foot wide right-of-way along the north side of Nevada Avenue in Kings County and extending west into Fresno County along Jayne Avenue to the Gates Substation. The gen-tie is planned to be constructed over an 8-month period in 2019. The Kings County segments of the gen-tie line are to be completed over a 5-month period, and the Fresno County segments are scheduled to be completed over an additional 3 months.

The Setting Section of this report presents the fundamentals of environmental noise and vibration, provides a discussion of policies and standards applicable to the project, and presents the results of the ambient noise monitoring survey made at residential receptors in the project vicinity. The Impacts and Mitigation Measures section of the report summarizes the significance criteria used in the assessment of impacts, future noise and vibration levels expected from the construction and operation of the project, and the significance determinations of project-related noise and vibration impacts.

## SETTING

### Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel* (*dB*) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level* (*dBA*). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called $L_{eq}$. The most common averaging period is hourly, but $L_{eq}$ can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or $L_{dn}$) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

**Fundamentals of Groundborne Vibration**

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV) and another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this section, a PPV descriptor with units of inches/second (in/sec) is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of

people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess ground-borne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

**TABLE 1 Definition of Acoustical Terms Used in this Report**

| Term | Definition |
|---|---|
| Decibel, dB | A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals. |
| Sound Pressure Level | Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter. |
| Frequency, Hz | The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz. |
| A-Weighted Sound Level, dBA | The sound pressure level in decibels as measured on a sound level meter using the A-weighting 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. |
| Equivalent Noise Level, $L_{eq}$ | The average A-weighted noise level during the measurement period. |
| $L_{max}$, $L_{min}$ | The maximum and minimum A-weighted noise level during the measurement period. |
| $L_{01}$, $L_{10}$, $L_{50}$, $L_{90}$ | The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period. |
| Day/Night Noise Level, $L_{dn}$ or DNL | The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am. |
| Community Noise Equivalent Level, CNEL | The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am. |
| 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. |
| Intrusive | That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level. |

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

**TABLE 2 Typical Noise Levels in the Environment**

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

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

**TABLE 3 Reaction of People and Damage to Buildings From Continuous or Frequent Intermittent Vibration Levels**

| Velocity Level, PPV (in/sec) | Human Reaction | Effect on Buildings |
|---|---|---|
| 0.01 | Barely perceptible | No effect |
| 0.04 | Distinctly perceptible | Vibration unlikely to cause damage of any type to any structure |
| 0.08 | Distinctly perceptible to strongly perceptible | Recommended upper level of the vibration to which ruins and ancient monuments should be subjected |
| 0.1 | Strongly perceptible | Virtually no risk of damage to normal buildings |
| 0.3 | Strongly perceptible to severe | Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings |
| 0.5 | Severe - Vibrations considered unpleasant | Threshold at which there is a risk of damage to newer residential structures |

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

## Regulatory Criteria

The State of California, Kings County, and Fresno County establish regulatory criteria that are applicable in this assessment. The California Environmental Quality Act (CEQA) Guidelines are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

***State CEQA Guidelines.*** The CEQA Guidelines are used to evaluate the significance of noise or vibration impacts attributable to a proposed project. Applicable CEQA checklist questions ask whether the project would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies?

- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

- For a project located within an airport land use plan or, where such a plan has 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?

- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 1.5 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level is 65 $L_{dn}$/CNEL or greater, would be considered significant. Project-generated noise level increases of 3 dBA $L_{dn}$/CNEL or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard (60 dBA $L_{dn}$/CNEL for residential land uses). Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA $L_{dn}$/CNEL or greater would be considered significant. These commonly accepted criteria are also adopted as part of the Kings County Noise Standards for New Uses Affected by Transportation Noise Sources (Kings County 2035 General Plan Noise Element, Table N-7).

***Kings County 2035 General Plan.*** The Noise Element establishes goals, objectives, and policies to guide planning decisions and prevent the exposure of County residents and noise sensitive land uses from excessive noise levels.

Applicable goals and policies presented in the General Plan are as follows:

N GOAL B1 Protect the economic base of Kings County by preventing the encroachment of noise-sensitive land uses into areas affected by existing noise-producing uses. More specifically, to recognize that noise is an inherent byproduct of many land uses, including agriculture, and to prevent new noise-sensitive land uses from being developed in areas affected by existing noise-producing uses.

N OBJECTIVE B1.1 Reduce the potential for exposure of County residents and noise-sensitive land uses to excessive noise generated from Non-Transportation Noise Sources.

N Policy B1.1.1: Appropriate noise mitigation measures shall be included in a proposed project design when the proposed new use(s) will be affected by or include non-transportation noise sources and exceed the County's "Non-Transportation Noise Standards" (Table N-8). Mitigation measures shall reduce projected noise levels to a state of compliance with this standard within sensitive areas. These standards are applied at the sensitive areas of the receiving use.

N Policy B1.1.3: Noise associated with construction activities shall be considered temporary, but will still be required to adhere to applicable County Noise Element standards.

**Kings County General Plan Noise Element Table N-8**

**Table N-8 Non-Transportation Noise Standards**
**Average (Leq) / Maximum (Lmax)[1]**

| Receiving Land Use | Outdoor Area[2] Daytime | Outdoor Area[2] Nighttime | Interior[3] Day & Night | Notes |
|---|---|---|---|---|
| All Residential | 55 / 75 | 50 / 70 | 35 / 55 | |
| Transient Lodging | 55 / 75 | --- | 35 / 55 | 4 |
| Hospitals & Nursing Homes | 55 / 75 | --- | 35 / 55 | 5, 6 |
| Theaters & Auditoriums | --- | --- | 30 / 50 | 6 |
| Churches, Meeting Halls, Schools, Libraries, etc. | 55 / 75 | --- | 35 / 60 | 6 |
| Office Buildings | 60 / 75 | --- | 45 / 65 | 6 |
| Commercial Buildings | 55 / 75 | --- | 45 / 65 | 6 |
| Playgrounds, Parks, etc. | 65 / 75 | --- | --- | 6 |
| Industry | 60 / 80 | --- | 50 / 70 | 6 |

Notes:

1. The Table N-8 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table N-8, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.
2. Sensitive areas are defined acoustic terminology section.
3. Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
4. Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
5. Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
6. The outdoor activity areas of these uses (if any), are not typically utilized during nighttime hours.

N GOAL C1 Provide sufficient noise exposure information so that existing and potential noise impacts may be effectively addressed in the land use planning and project review processes, and allow flexibility in the development of infill properties which may be located in elevated noise environments.

N OBJECTIVE C1.1 Ensure the sufficient provision of project and site noise information is available along with alternative mitigation approaches to better inform County staff and land use decision makers.

N Policy C1.1.1: All noise analyses prepared to determine compliance with the noise level standards contained within this *Noise Element* shall be prepared in accordance with the County's "Requirements for Acoustical Analyses Prepared in Kings County" (Table N-9).

**Kings County General Plan Noise Element Table N-9**

**Table N-9 Requirements for Acoustical Analyses Prepared in Kings County**

An acoustical analysis prepared pursuant to the *Noise Element* shall:

A. Be the responsibility of the applicant.

B. Be prepared by qualified persons experienced in the fields of environmental noise assessment and architectural acoustics.

C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.

D. Estimate projected future (20 year) noise levels in terms of the Standards of Tables N-7 and N-8, and compare those levels to the adopted policies of the *Noise Element*.

E. Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the *Noise Element*.

F. Estimate interior and exterior noise exposure after the prescribed mitigation measures have been implemented.

N Policy C1.1.2: Where noise mitigation measures are required to satisfy the noise level standards of this *Noise Element*, emphasis shall be placed on the use of setbacks and site design, prior to consideration of the use of noise barriers.

***Kings County Code of Ordinances.*** Article 10 of the Code of Ordinances sets forth requirements and procedures for noise abatement in the County. Section 15-211 (Certain Noise Prohibited) provides as follows:

> "No person shall make, suffer, or permit upon any premises owned, occupied or controlled by such person any noises or sounds which are physically annoying to the senses of persons of ordinary sensitivity, or which are so harsh or so prolonged or unnatural or unusual in their use, time or place, as to cause physical discomfort to neighbors or to interfere with the comfortable use and enjoyment of life or property, or which constitutes a public or private nuisance, within any unincorporated territory of the County of Kings.

The Code of Ordinances provides no further detail on acceptable noise levels or limits on hours for operational or construction noise sources. As such, the General Plan Noise Element requirements and standards (reproduced above) are controlling with respect to quantitative noise thresholds.

The Kings County Subdivision Ordinance (Chapter 21 of the Kings County Code of Ordinances) provides that one of its objectives is to ensure that land developments will not adversely affect the values or enjoyment of nearby properties. Under Section 21-10 of the Ordinance, the Health Department is responsible for analyzing project elements affecting the environment such as noise.

***Fresno County 2000 General Plan.*** The Fresno County 2000 General Plan contains the following goals and policies related to noise that are relevant to the project:

**Health and Safety Element**

Goal HS-G To protect residential and other noise-sensitive uses from exposure to harmful or annoying noise levels; to identify maximum noise levels compatible with various land use designations; and to develop a policy framework necessary to achieve and maintain a healthful noise environment.

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

Policy HS-G.4 Acoustical Analysis for New Projects**.** 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:

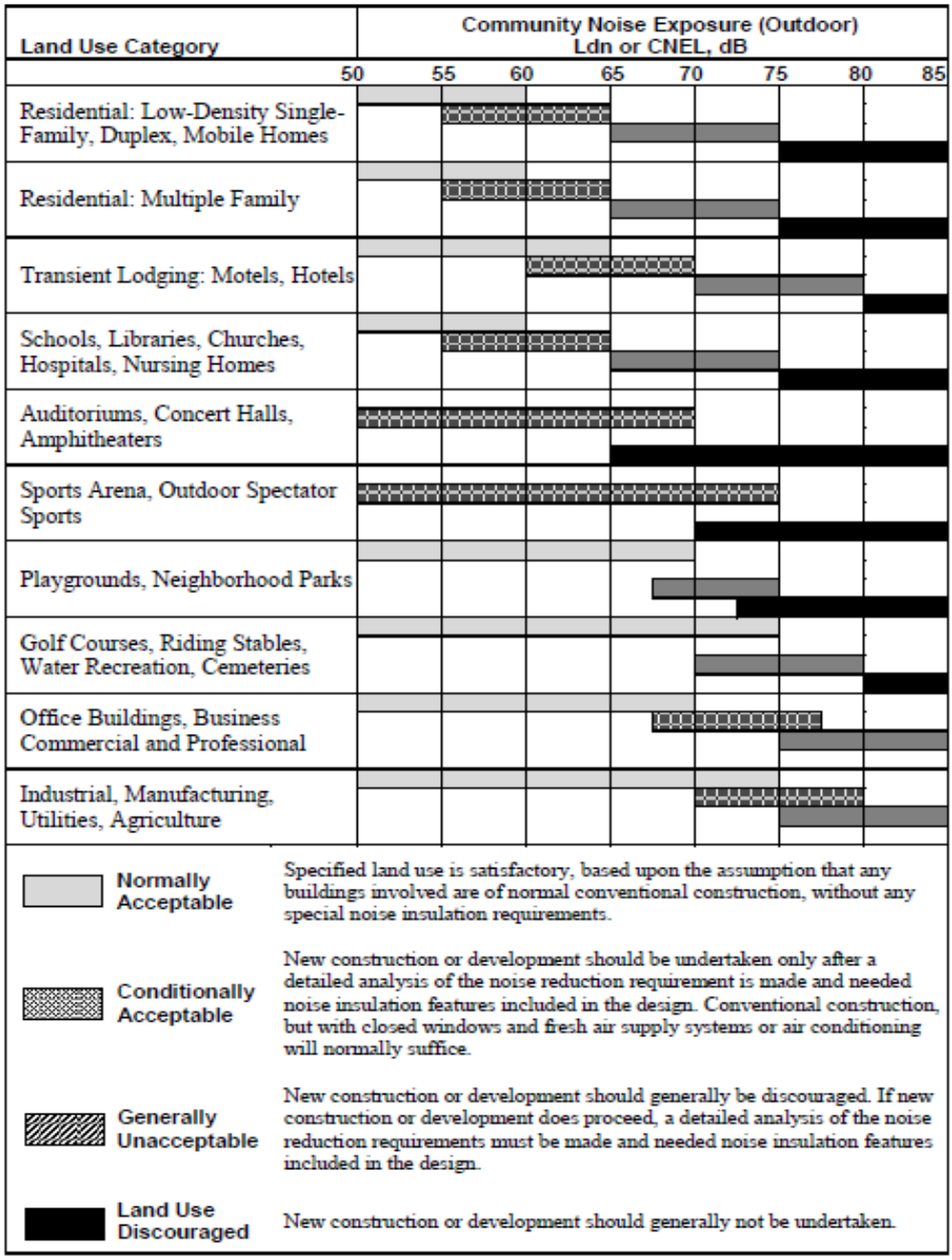
a. Noise sensitive land uses are proposed in areas exposed to existing or projected noise levels that are "generally unacceptable" or higher according to Chart HS-1: "Land Use Compatibility for Community Noise Environments;" (next page)
b. Proposed projects are likely to produce noise levels exceeding the levels shown in the County's Noise Control Ordinance at existing or planned noise-sensitive land uses.

Policy HS-G.5 Noise Mitigation for New Projects**.** 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 Construction-related Noise. 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.8 Noise Compatibility Standards. 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."

**Chart HS-1 – Land Use Compatibility for Community Noise Environments**




***Fresno County Ordinance Code.*** Chapter 8.40 of the Ordinance Code sets forth requirements and procedures for noise abatement in the County. The following sections apply to transmission lines:

Section 8.40.040 – Exterior Noise Standards

A. It is unlawful for any person, including an owner, whether through the owner or the owner's agent, lessee, sublessor, sublessee or occupant, at any location within the unincorporated area of the county, to create any noise, or to allow the creation of any noise, on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any affected single- or multiple-family residence, school, hospital, church or public library situation in either the incorporated or unincorporated area to exceed the noise level standards as set forth in the following table:

| Category | Cumulative Number of Minutes in any one-hour time period | Noise Level Standards, dBA | |
|---|---|---|---|
| | | Daytime 7a.m. to 10 p.m. | Nighttime 10 p.m. to 7 a.m. |
| 1 | 30 | 50 | 45 |
| 2 | 15 | 55 | 50 |
| 3 | 5 | 60 | 55 |
| 4 | 1 | 65 | 60 |
| 5 | 0 | 70 | 65 |

Section 8.40.060 - Noise Source Exemptions. The following activities shall be exempted from the provisions of this chapter:

C. Noise sources associated with construction, provided such activities do not take place before six a.m. or after nine p.m. on any day except Saturday or Sunday, or before seven a.m. or after five p.m. on Saturday or Sunday.

G. Noise sources associated with work performed by private or public utilities in the maintenance or modification of its facilities.

**Existing Noise Environment**

The existing noise environment in the project vicinity is typical of rural agricultural environments. The primary noise sources in the project vicinity include: 1) traffic on county roads (25th Avenue, Laurel Avenue, Nevada Avenue, and Avenal Cutoff Road in Kings County, and Jayne Avenue in Fresno County) and a State Highway 269 in Fresno County; 2) agricultural equipment and crop dusters; and 3) the occasional overflights by military aircraft from Naval Air Station Lemoore (NAS Lemoore or NASL).

The Aquamarine Solar site is located approximately 6.0 miles south of the airfield at NASL and is included in the study area for the NASL Joint Land Use Study (JLUSPC 2011). The project site is located within the NASL flight pattern and falls between the 60 dBA and 70 dBA CNEL noise contours as mapped in the NAS Lemoore Joint Land Use Study (JLUSPC 2011, p. 2-11).

There are no noise-sensitive residential receivers within 1.0 mile of the Aquamarine project site. The nearest residences consist of a series of 5 dispersed rural residences located along 22nd Avenue and Laurel Avenue at distances ranging from 1.0 to 2.0 miles east of the Aquamarine site. The next nearest residences consist of 20 single-family dwellings at the Shannon Ranch complex located at the southwest corner of Avenal Cutoff Road and Lincoln/Gale Avenue approximately 2.0 miles southwest of the project. The next nearest sensitive receptors consist of the base housing at NAS Lemoore, with the nearest base housing located on the north side of SR-198 approximately 3.0 miles north of the project site.

In order to document noise conditions at the receptors in the Shannon Ranch complex, a long-term noise measurement was conducted alongside Avenal Cutoff Road at the ranch between Monday, December 14, 2015 and Tuesday, December 15, 2015. The sound level meter was placed approximately 80 feet from the center of Avenal Cutoff Road to represent the noise exposure at residences in the immediate vicinity of the roadway. The noise measurements documented the existing daily trend in noise levels due to traffic. The day-night average noise level at this site was 75 dBA $L_{dn}$. Typical daytime hourly average noise levels were approximately 66 to 72 dBA $L_{eq}$. Data collected from the long-term noise measurement at Shannon Ranch are graphically displayed on Figure 1.

Along the gen-tie corridor there are two groups of rural dwellings located along the south side of Nevada Avenue and Jayne Avenue. The first group consists of two ranch dwellings at the Stone Land Company Ranch on the south side of Nevada Avenue, approximately 1.4 miles east of Avenal Cutoff Road, where the facades of both dwellings are 200 feet from the southern edge of the gen-tie right-of-way. The second group of dwellings consists of a series of eight rural dwellings located on the south side of Jayne Avenue, approximately 1.3 miles east of SR-269, where the nearest dwellings are located 140 feet from the southern edge of the gen-tie right-of-way.

In order to document conditions at the receptors in the Stone Land Company Ranch complex, a long-term noise measurement was conducted alongside Nevada Avenue at the ranch between Monday, December 14, 2015 and Tuesday, December 15, 2015. The sound level meter was placed approximately 27 feet from the center of Nevada Avenue to represent the noise exposure at residences in the immediate vicinity of the roadway. The noise measurements documented the existing daily trend in noise levels due to traffic. The day-night average noise level at this site was 67 dBA $L_{dn}$. Typical daytime hourly average noise levels were approximately 57 to 69 dBA $L_{eq}$. Data collected from the long-term noise measurement at Stone Land Company Ranch are graphically displayed on Figure 2.

In order to document conditions at the eight receptors located on the south side of Jayne Avenue, a long-term noise measurement was conducted alongside Jayne Avenue at the receptors between Monday, December 14, 2015 and Tuesday, December 15, 2015. The sound level meter was placed approximately 40 feet from the center of Jayne Avenue to represent the noise exposure at residences in the immediate vicinity of the roadway. The noise measurements documented the existing daily trend in noise levels due to traffic. The day-night average noise level at this site was 75 dBA $L_{dn}$, with the higher daily average values reflecting penalties added for evening and nighttime noise. Typical daytime hourly average noise levels were approximately 65 to 74 dBA

$L_{eq}$. Data collected from the long-term noise measurements at the eight rural dwellings located on the south side of Jayne Avenue are graphically displayed on Figure 3.

## NOISE IMPACT AND MITIGATION MEASURES

### Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive ground-borne vibration levels, or if ambient noise levels at sensitive receptors would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan, Municipal Code, or applicable standards of other agencies.

- A significant impact would be identified if the project would expose persons to excessive vibration levels. Groundborne vibration levels due to project construction activities exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at existing sensitive receptors. A substantial increase would occur if: a) the noise level increase is 5 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level is less than 60 dBA $L_{dn}$/CNEL, or b) the noise level increase is 3 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level is between 60 dBA and 65 dBA $L_{dn}$/CNEL, or c) the noise level increase is 1.5 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level is 65 $L_{dn}$/CNEL or greater.

- A significant noise impact would be identified if construction related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels intermittently exceeding 55 dBA $L_{eq,}$ and the ambient noise levels are exceeded by at least 5 dBA $L_{eq}$, would constitute a significant temporary noise increase at residential land uses in the project vicinity.

**Impact 1:** **Noise from Project Operations.** Noise levels generated by the operation of the project would not exceed the standards established in the Kings County or Fresno County General Plans. **This is a less-than-significant impact.**

<u>Aquamarine Solar Project</u>

Noise sources at the Aquamarine project site would include inverters and transformers necessary to convert the generated power to collection voltage. The inverters and transformers will be placed together on equipment pads at predetermined locations where each inverter/transformer

will serve approximately 2.5 MW of AC power, or the output from approximately 112 full-sized arrays with a total of 9,408 modules. Accordingly, the project will include approximately 100 inverters/transformers. The predicted noise level attributable to one inverter/transformer is a continuous level of 52 dBA measured at a distance of 50 feet from the equipment. The noise level is continuous so the average noise level ($L_{eq}$) and the maximum noise level ($L_{max}$) are the equal (52 dBA). The operation of the 100 inverters/transformers at the project would result in a reference noise level of 72 dBA $L_{max}/L_{eq}$, measured at a distance of 50 feet for the purpose of calculating noise levels at distant receivers.

The Aquamarine Solar project would include one substation, located at the southern end of the site, for the purpose of stepping up voltage levels to 230-kV for transmission on the gen-tie line. Sources of audible noise within a substation include equipment such as transformers, reactors, voltage regulators, circuit breakers and other intermittent noise generators. (The noise generating elements of switching stations are similar to substations.) Among these sources, transformers, reactors, and circuit breakers have the greatest potential for producing noise. The broadband sound from fans, pumps and coolers has the same character as ambient sound and tends to blend with the ambient noise. Reactors are similar to transformers in terms of audible noise and would generate noise levels of about 40 dBA $L_{eq}$ at 200 feet (SLO County 2011, p. AP. 4-114). The highest noise levels would be produced by circuit breakers, which would occur infrequently when breakers are thrown to protect the system during an electrical fault due to line overloads. The resultant noise would be impulsive in character, being loud and short in duration. The maximum impulse noise level from the breakers would be approximately 105 dBA $L_{max}$ at 50 feet (SLO County 2011, p. AP. 4-114).

Kings County General Plan Noise Policy B1.1.1 requires that appropriate noise mitigation measures be included in a proposed project design when the proposed new use will include non-transportation noise sources that would exceed the County's "Non-Transportation Noise Standards" (Table N-8). The daytime noise limits enforced at residential properties are 75 dBA $L_{max}$ and 55 dBA $L_{eq}$. The inverters/transformers would operate only during daytime hours when the SGFs are generating power. Although the solar operations would not generate noise at night, the substation could occasionally generate nighttime noise (if breakers are thrown) when noise limits are 5 dBA more restrictive (i.e., 70 dBA $L_{max}$ and 50 dBA $L_{eq}$).

Noise from "point" sources decreases at a rate of 6 dBA with each doubling of the distance between the noise source and receptor. Based on the worst-case noise level estimate for solar operations of 72 dBA $L_{max}/L_{eq}$ at a distance of 50 feet from the noise source, predicted noise levels at the nearest residential land uses located 1.0 miles from the project site are calculated to be less than 32 dBA $L_{max}/L_{eq}$. Such noise levels would be inaudible above ambient noise levels. Predicted noise levels from solar operations would be less than the 75 dBA $L_{max}$ and 55 dBA $L_{eq}$ noise limits for residential uses. At the on-site substation, the maximum noise of 105 dBA $L_{max}$ would decrease to 75 dBA $L_{max}$ at a distance of 1,600 feet from the source, and further reduced to 69 dBA $L_{max}$ at about 3,000 feet (just over ½ mile). The planned on-site substation would be located at least 2.9 miles from the nearest residences in any direction, where maximum noise levels would fall to 55 dBA $L_{max}$. This would be well under the 75 dBA $L_{max}$ noise limits for residential uses. Therefore, the operational noise from the project would result in a *less-than-significant* impact upon the nearest noise-sensitive receptors.

Gen-Tie Line – Kings County Segments

The primary noise sources associated with the operation of the gen-tie line would be noise emitted by maintenance activities and the gen-tie line. Maintenance activities would include annual visual inspections of the transmission lines and access roads. These activities would typically involve the use of light duty trucks, although helicopters may sometimes be used for this purpose. The maintenance and inspection activities would occur infrequently and noise from truck or helicopter pass-bys would be short in duration.

Within Kings County, the nearest sensitive receivers to the gen-tie line are the two residences at the Stone Land Company Ranch. These residences are located 200 feet from the nearest edge of the gen-tie right-of-way on the opposite side of Nevada Avenue. The operation of a helicopter maintenance and inspection would generate maximum noise levels of approximately 80 dBA at 200 feet (USBLM 2013, p. 3.23-11). The nearest conductor arm would be at least 30 feet from the edge of the right-of-way, or 230 feet from the nearest residence. At this distance, the maximum noise level at the nearest residence would be 79 dBA. The applicable Kings County noise standard at the Stone Land Company Ranch is 80 dBA $L_{max}$ (i.e., 75 dBA base standard increased by 5 dBA to encompass the ambient 76 dBA per Kings County Noise Element). Therefore, noise generated by maintenance and inspection of the Kings County segments of the gen-tie line would be *less-than-significant*.

Once energized, the high-voltage conductors of the gen-tie line would be subject to corona discharge. This involves the breakdown of air into charged particles caused by the electrical field at the surface of a conductor, which can result in a crackling or hissing noise and very small amounts of light. Audible noise from corona discharge varies depending on the voltage of the line and is locally intensified by irregularities on the conductor surface such as scratches or water drops. Wet weather conditions often increase corona discharge due to accumulation of raindrops, fog, frost or condensation on the conductor surface which causes surface irregularities and result in small electrical discharges. In addition to noise generation, corona also results in power loss in the transmission line. Therefore, transmission lines are designed to include sufficiently large conductors and smooth-edged hardware, which reduces the potential for corona. For a planned double-circuit 230-kV transmission line in a 100-foot wide right-of-way, maximum noise levels that would be generated by corona discharge during wet conditions would be 37 dBA at the edge of the right-of-way (CPUC 2009, p. 4.10-12). The corona noise generated during dry conditions would be less than 25 dBA and would be barely audible (SLO County 2011). The nearest dwellings to the gen-tie corridor consist of two existing residences along the south side of Nevada Avenue at the Stone Land Company Ranch and would be located 200 feet from the nearest edge of the gen-tie right-of-way. At this distance, the noise from corona discharge would not be audible by the nearest receivers even under wet conditions. All other residential receptors would be located farther away from the transmission lines. Therefore, the potential noise impact due to corona discharge along the Kings County segments of the gen-tie line would be *less-than-significant*.

In summary, the noise generated by gen-tie operations, such as maintenance and inspection, or by corona discharge, would have a *less-than-significant* impact on the potentially affected noise-sensitive receivers.

Gen-Tie Line – Fresno County Segments

Within Fresno County, all sensitive receivers would be located at least 140 feet from the gen-tie right-of-way and 170 feet from the nearest conductor. At this distance, the maximum noise from helicopter pass-bys would be 83 dBA $L_{max}$, and noise from light truck pass-bys would be 67 dBA $L_{max}$. The helicopter noise would exceed the applicable Fresno County 70 dBA $L_{max}$ noise limit at a distance of approximately 625 feet. There are eight residences that are located between 140 and 625 feet from the gen-tie line in Fresno County. If helicopter inspections are required, the noise from helicopter pass-bys would be very brief in duration and therefore would not represent a significant noise impact. In addition, maintenance work performed by public or private utilities in Fresno County is exempt from the County's noise standards (Fresno Ordinance Code Section 8.40.060(G)). In summary, since the routine inspection activities associated with the transmission lines would not violate the applicable Fresno County Code noise control provisions, the potential noise impacts associated with transmission line operation would be *less-than-significant*.

As discussed above, corona discharge along the gen-tie line could produce maximum noise levels of 37 dBA at the edge of the right-of-way under wet conditions. The nearest dwellings to the gen-tie corridor consist of eight dwellings along the south side of Jayne Avenue. These dwellings would be located 140 feet from the nearest edge of the gen-tie right-of-way. At this distance, the noise from corona discharge would not be audible by the nearest receivers even under wet conditions. All other residential receptors would be located farther away from the transmission lines. Therefore, the potential noise impact due to corona discharge along the Fresno County segments of the gen-tie line would be *less-than-significant*.

In summary, the noise generated by gen-tie operations such as maintenance and inspection, or by corona discharge, would have a *less-than-significant* impact on the potentially affected noise-sensitive receivers.

**Mitigation Measures:** **None Required**

**Impact 2**: **Groundborne Vibration.** Vibration levels generated by proposed construction activities would not be excessive at the nearest sensitive receptors. Groundborne noise occurs when groundborne vibration causes the ground surface and structures to radiate audible acoustical energy. It is primarily an issue for underground rail systems. **No impact** would occur as a result of the project.

Aquamarine Solar Project

The construction of the Aquamarine project may generate perceptible vibration in the immediate vicinity of the project site when heavy equipment or impact tools are used. The completion of the solar generating facility will involve three major construction phases, including: site preparation activities, installation of solar arrays and electrical components, and installation of a substation. Groundborne vibration levels would be highest during site preparation activities and when the solar arrays are installed as the project proposes to drive cylindrical steel posts (or H-beams) into the ground using truck-mounted vibratory drivers. The posts will be installed at approximately 10 foot intervals to depths of 4 to 10 feet, with actual depths depending on localized soil conditions and load factors.

Table 4 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. As indicated in Table 4, vibration levels typically produced by a sonic pile driver can reach 0.170 in/sec PPV at a distance of 25 feet. (Note: The relatively small truck-mounted pile drivers that would be used for driving the solar array support posts for the project would produce vibration levels in the "typical" range, compared to larger sonic pile drivers that would be used in heavy construction, which could produce vibration levels as high as indicated in the "upper range" in Table 4.) Vibratory rollers and large bulldozers typically generate vibration levels ranging from of 0.089 to 0.210 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings that are structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened are known to adjoin the project site. Therefore, groundborne vibration levels exceeding 0.3 in/sec PPV at the nearest receptors would have the potential to result in a significant vibration impact.

**TABLE 4 Vibration Source Levels for Construction Equipment**

| **Equipment** | | **PPV at 25 ft. (in/sec)** | **Approximate $L_v$ at 25 ft. (VdB)** |
|---|---|---|---|
| Pile Driver (Impact) | upper range | 1.158 | 112 |
| | typical | 0.644 | 104 |
| Pile Driver (Sonic) | upper range | 0.734 | 105 |
| | typical | 0.170 | 93 |
| Clam shovel drop | | 0.202 | 94 |
| Hydromill (slurry wall) | in soil | 0.008 | 66 |
| | in rock | 0.017 | 75 |
| Vibratory Roller | | 0.210 | 94 |
| Hoe Ram | | 0.089 | 87 |
| Large bulldozer | | 0.089 | 87 |
| Caisson drilling | | 0.089 | 87 |
| Loaded trucks | | 0.076 | 86 |
| Jackhammer | | 0.035 | 79 |
| Small bulldozer | | 0.003 | 58 |

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Vibration impacts are generally confined to the immediate vicinity of the Aquamarine project site. Based on the data contained in Table 4, vibration levels would be less than 0.3 in/sec PPV at a distance of 25 feet. The nearest structures to the project include: 1) the solar arrays at the Westside Solar Project Phase 1 and 2 SGF located 0.6 miles north of the nearest construction activity; and 2) the solar arrays and substation at the Kent South Solar Generating Facility at the northwest corner of Avenal Cutoff Road and 25th Avenue, which would be at least 0.4 miles from the nearest on-site construction activity. The potential for greatest vibration would be during heavy

equipment movement and vibratory pile driving of the support posts for the solar arrays, which would generate vibration levels of 0.210 and 0.170 in/sec PPV, respectively, at 25 feet from the source. These vibration levels at 0.4 miles would decrease to 0.001 in/sec PPV at the nearest structures. These vibration levels would be well below the 0.3 in/sec PPV impact threshold for sound structures and would also be well below the 0.08 in/sec PPV applicable to structurally weakened structures. The majority of construction activity would occur well beyond these distances from the nearest structures. Therefore, groundborne vibration from project construction would have no impact on existing structures in the project vicinity.

People can also be adversely affected by excessive vibration levels. The level at which humans begin to perceive vibration is 0.015 inches per second. Vibrations at 0.2 inches per second are considered bothersome to most people, while continuous exposure to long-term PPV is considered unacceptable at 0.12 inches per second. There are no residential receptors in immediate project vicinity. The existing solar facilities located 0.4 miles to the north may occasionally involve the presence of workers as close as 0.4 miles from the nearest construction activity on the project site. At this distance, the greatest vibration from the nearest construction activity would decrease to 0.001 in/sec PPV. Such low-level vibrations would not be perceptible to workers. Therefore, project construction activities would not expose persons to excessive vibration levels.

In summary, the heaviest construction equipment that would be used for construction at the Aquamarine project site would produce vibration levels that would be far below the vibration levels necessary to cause damage to the nearest off-site building or to be perceptible to the nearest off-site persons. Therefore, the Aquamarine project would not result in the exposure of persons to or generation of excessive groundborne vibration levels. As such, the potential vibration impacts due to construction activities associated with the Aquamarine solar project would be *less-than-significant*.

Gen-Tie Line – Kings County Segments

For gen-tie construction, the heaviest equipment would consist of bulldozers, loaded trucks, and drill rigs (for excavating holes for tower footings), all of which would generate a PPV of 0.089 inches per second at 25 feet. (Non-conventional construction techniques, such as blasting, are not expected to be required.) Construction-related vibration would decrease below the threshold of human perception beyond 350 feet from the nearest receivers. Along the Kings County gen-tie, there are a two residences located within 350 feet of the gen-tie right-of-way. These comprise the two dwellings at the Stone Land Company Ranch on the south side of Nevada Avenue, which are 200 feet from the gen-tie right-of way, and 250 feet from the nearest planned monopole. Other structures at the ranch are at least 340 feet from the gen-tie right-of-way. At a distance of 200 feet, the heaviest equipment would generate a PPV of 0.009 inches per second, which is well below the levels where potential building damage could occur (i.e., 0.3 and 0.08 in/sec), and below the threshold of human perception for vibration (i.e., 0.015 in/sec). Therefore, the potential vibration impacts from equipment used in construction of the Kings County segments of the gen-tie line would be *less-than-significant*.

Gen-Tie Line – Fresno County Segments

Along the Kings County gen-tie, there are eight residences located within 350 feet of the gen-tie right-of-way. These comprise the row of eight dwellings along the south side of Jayne Avenue, which are 140 feet from the gen-tie right-of way, and 250 feet from the nearest planned monopole. Other structures along the Fresno County gen-tie are at least 65 feet from the gen-tie right-of-way and 180 feet from the nearest planned monopole. At a distance of 140 feet, the heaviest equipment would generate a PPV of 0.013 inches per second, which is well below the levels where potential building damage could occur (i.e., 0.3 and 0.08 in/sec), and below the threshold of human perception for vibration (i.e., 0.015 in/sec). At a distance of 65 feet, the nearest non-residential structure would be subject to a PPV of 0.031 inches per second, which is below the levels where potential building damage could occur (i.e., 0.3 and 0.08 in/sec). Therefore, the potential vibration impacts from equipment used in construction of the Fresno County segments of the gen-tie line would be *less-than-significant*.

**Mitigation Measures:** **None Required**

**Impact 3:** **Project-Generated Traffic Noise.** Project-generated traffic, during construction or operations, would not substantially increase ambient noise levels at sensitive receptors along roadways serving the site. **This is a less-than-significant impact.**

Aquamarine Solar Project

Traffic generated by the Aquamarine project would result in a substantial permanent increase in noise levels at existing sensitive receptors if: a) the noise level increase is 5 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level is less than 60 dBA $L_{dn}$/CNEL; or b) the noise level increase is 3 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level between 60 and 65 dBA $L_{dn}$/CNEL; or c) the noise level increase is 1.5 dBA $L_{dn}$/CNEL or greater, where the pre-project noise level between 65 dBA $L_{dn}$/CNEL or greater.

Traffic volume data were reviewed to calculate project-related traffic noise level increases expected along roadways in the project vicinity. These data included existing average daily traffic (ADT) volumes and worker and truck ADT volumes estimated for both construction and operation of the Aquamarine project.

Average daily traffic volumes generated during the peak construction period were compared to pre-project traffic volumes on the potentially affected roadways to calculate the anticipated noise level increase attributable to the construction of the project. The highest traffic noise increase attributable to project construction traffic on the affected roadways would be less than 0.3 dBA $L_{dn}$/CNEL above existing traffic noise conditions without the project at the most affected roadway – Avenal Cutoff Road.

As noted in "Existing Noise Environment" above, noise measurements taken by *Illingworth & Rodkin, Inc.* alongside Avenal Cutoff Road at the Shannon Ranch indicate that pre-project noise levels at that location are 75 dBA $L_{dn}$. This noise level is considered to represent worst-case ambient noise levels along the affected roadways. The 0.3 dBA $L_{dn}$/CNEL temporary increase in noise levels from project construction traffic is well below the 1.5 dBA increase that would

indicate a significant impact where ambient levels are 65 dBA $L_{dn}$/CNEL or greater, per Kings County's noise standards. Along Laurel Avenue and 22nd Avenue to the east, the five existing rural dwellings that are located from 1.0 to 2.0 miles from the Aquamarine site, and at their nearest points would likewise be subject to temporary noise level increases of 0.3 dBA $L_{dn}$/CNEL. This noise level increase would not be perceptible from the nearest dwellings along 22nd Avenue. Therefore, the construction traffic generated by the Aquamarine project would not result in a substantial temporary increase in ambient noise levels in the project vicinity, and the impact would be *less-than-significant*.

Traffic generation during solar facility operations would be substantially less than the traffic generation during construction, and the resulting noise level increase would be less than 0.1 dBA $L_{dn}$/CNEL at the most affected roadways – Laurel Avenue and Avenal Cutoff Road. The noise levels would be well below the applicable impact thresholds, discussed above and would not be noticeable to the potentially affected sensitive receptors. Therefore, the traffic noise resulting from operation of the Aquamarine project would not result in a substantial permanent increase in ambient noise levels in the project vicinity, and the impact would be *less-than-significant*.

Gen-Tie Line

The following discussion applies equally to the Kings County and Fresno County segments of the gen-tie line.

The construction of the gen-tie line would involve truck trips for hauling equipment and materials to and from the construction sites, and also commute trips by construction workers arriving and departing the construction sites. During the busiest construction phase, when all construction activities would be ongoing, the maximum workforce would be 59 workers, and there would be an average of 15 daily deliveries of equipment and materials. This would result in 108 worker commute trip ends and 30 haul trip ends daily. The worker trips would be concentrated at the beginning and end of work shifts, resulting in 59 AM trips and 59 PM trips. The haul truck trips would occur throughout the day and would average about 4 trips per hour for a 8-hour workday..

The roadway network in the vicinity of the gen-tie line is subject to relatively low traffic volumes typical of the rural setting. Since these roadways currently serve local agricultural operations, dispersed rural residences, and agricultural processing and support facilities, the areas along the roads are currently subject to occasional noise from farm equipment and heavy trucks, as well as light passenger vehicle traffic. The addition of haul truck traffic and commute traffic associated with gen-tie line construction would likely be noticeable in the areas immediately adjacent to the travel routes. The noise associated with this traffic would increase noise levels by less than 1 dBA $L_{dn}$ over ambient noise levels along roadways subject to the construction traffic, which mainly include Nevada Avenue and Jayne Avenue. Although noise from individual truck pass-bys would be noticeable to nearby receptors in the rural noise environment, the noise level increase would be less than the smallest incremental noise threshold considered significant (i.e., 1.5 dBA $L_{dn}$ where ambient noise is over 65 dBA $L_{dn}$) in both of the affected counties. Since the total duration of gen-tie construction would be approximately eight months, the noise from construction traffic would be temporary, and the minor and short-term increase in traffic noise resulting from gen-tie line construction would represent a *less-than-significant* noise impact.

Once completed, the operation of the gen-tie line would generate very little traffic. During annual inspection and maintenance activities, light utility trucks would traverse local roadways to access transmission towers and maintenance roads. The additional traffic noise generated by these occasional maintenance trips would be negligible and would not result in increased average noise levels along the affected roadways. Therefore, the potential traffic noise impacts associated with gen-tie line operation would be *less-than-significant*.

In summary, the traffic generated during project construction and operation would not result in substantial temporary or permanent increases in noise levels in the project vicinity. Therefore, the traffic noise impacts resulting from the project would be *less-than-significant*.

**Mitigation Measures:** **None Required**

**Impact 4:** **Construction Noise.** Noise generated by construction activities at the solar project site and gen-tie line would not exceed the Counties' General Plan standards. Therefore, the solar project and gen-tie line would not result in a substantial increase in ambient noise environment at adjacent sensitive receptors would not be substantially increased over a temporary basis. **This is a less-than-significant impact.**

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise sensitive receptors. Where noise from construction activities exceeds 55 dBA $L_{eq}$, and exceeds the ambient noise environment by 5 dBA $L_{eq}$ or more, the impact would be considered significant.

Construction activities generate considerable amounts of noise, especially during the demolition phase and the construction of project infrastructure when heavy equipment is used. Table 5 presents the typical range of hourly average noise levels generated by different phases of construction measured at a distance of 50 feet. Hourly average noise levels generated by grading and construction equipment associated with the project are calculated to range from 85 dBA $L_{eq}$ to 87 dBA $L_{eq}$ measured at a distance of 50 feet assuming that all equipment proposed for each construction phase are operating simultaneously. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding provided by barriers or structures can provide an additional 5 to 10 dBA noise reduction at distant receptors.

**TABLE 5 Typical Ranges of Noise Levels at 50 Feet from Construction Sites (dBA $L_{eq}$)**

| | Domestic Housing | | Office Building, Hotel, Hospital, School, Public Works | | Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station | | Public Works Roads & Highways, Sewers, and Trenches | |
|---|---|---|---|---|---|---|---|---|
| | I | II | I | II | I | II | I | II |
| Ground Clearing | 83 | 83 | 84 | 84 | 84 | 83 | 84 | 84 |
| Excavation | 88 | 75 | 89 | 79 | 89 | 71 | 88 | 78 |
| Foundations | 81 | 81 | 78 | 78 | 77 | 77 | 88 | 88 |
| Erection | 81 | 65 | 87 | 75 | 84 | 72 | 79 | 78 |
| Finishing | 88 | 72 | 89 | 75 | 89 | 74 | 84 | 84 |

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.
Source: United States Environmental Protection Agency, 1973, Legal Compilation on Noise, Vol. 1, p. 2-104.

Aquamarine Solar Project

Noise from the site preparation phase, installation of the solar arrays, and the installation of inverters, transformers, substation, and interconnection would range from 45 dBA $L_{eq}$ to 47 dBA $L_{eq}$ at the nearest residential land uses located approximately 1.0 mile east of the site, taking into consideration the attenuation with distance from the noise source. These construction-related noise levels would be well below the applicable County noise standards and would be lower than ambient daytime noise levels at the nearest receptors. Therefore, construction activities for the solar facility would not result in a substantial temporary increase ambient noise levels at nearby land uses and the impact would be *less-than-significant*.

Gen-Tie Line – Kings County Segments

The Kings County segments of the gen-tie project are planned to be constructed over a 5-month period in 2019. The general sequence of activities for construction of the gen-tie project would involve the following steps: clearing of right-of-way and staging areas; construction of access roads; installation of tower footings and structures; and conductor stringing. These construction activities would proceed in step-wise fashion from one end of the gen-tie corridor to the other, and as such the duration of construction at any given location would be relatively brief.

The noisiest construction activity would occur during site preparation of tower sites and staging areas, when most construction equipment would be used. This equipment typically includes dozers, graders, compactors, auger drill rigs, and trucks, which produce maximum noise levels ranging from 80 to 85 dBA at 50 feet. The maximum noise level generated by several pieces of equipment operating continuously at a distance of 50 feet would be about 90 dBA. Throughout the gen-tie route, most residential receptors would be located at least 500 feet from construction activity, except at the Stone Land Company Ranch where there are two single-family dwellings located approximately 200 feet south from the edge of the gen-tie right-of-way. At this distance, the

maximum noise level at the nearest residence would be 78 dBA, given that maximum noise levels would decrease at the rate of 6 dBA per doubling of distance from a point source. The applicable Kings County Noise Element standard at the Stone Land Company Ranch is 80 dBA Lmax (i.e., 75 dBA base standard increased by 5 dBA to encompass the ambient 76 dBA per Kings County Noise Element). Therefore, the maximum noise levels of 78 dBA that would occur at the two residential facades at the ranch from operation of conventional construction equipment would not exceed the applicable Kings County noise standard.

Helicopter construction would be used for stringing pilot wires for conductors. The operation of a helicopter for construction would generate maximum noise levels of approximately 80 dBA at 200 feet (USBLM 2013, p. 3.23-11). The stringing of conductor pilot wires by a helicopter would occur along the pole line located near the center of the right-of-way. The nearest conductor arm would be at least 30 feet from the edge of the right-of-way, or 230 feet from the nearest residence at the Stone Land Company Ranch. At this distance, the maximum noise level at the nearest residence would be 79 dBA. As mentioned, the applicable Kings County Noise Element standard at the Stone Land Company Ranch is 80 dBA Lmax (i.e., Kings County base standard of 75 dBA Lmax plus 5 dBA to encompass the 76 dBA Lmax ambient noise level). Therefore, the maximum noise levels of 79 dBA that would occur at the two residential facades at the ranch from helicopter construction would not exceed the applicable Kings County noise standard.

In summary, the maximum noise levels of 79 dBA that would occur at the two residential facades at the Stone Land Company Ranch during construction would not exceed the applicable Kings County noise standard, and the noise impact from gen-tie line construction near the ranch dwellings would be *less-than-significant*.

Gen-Tie Line – Fresno County Segments

At the series of eight dwellings on the south side of Jayne Avenue in Fresno County, the nearest existing dwellings would be 140 feet from the edge of the gen-tie right-of-way, where the maximum noise levels from ground-based equipment would be up to 81 dBA. Noise from helicopter construction would be centered on the conductors, the nearest of which would be 170 feet from the nearest dwellings. At this distance, maximum noise levels from helicopter construction would be 81 dBA. The Fresno County Municipal Code establishes maximum permissible exterior noise levels of 70 dBA during daytime hours of 7 AM to 10 PM. Therefore, construction activity in proximity to the nearest residence could exceed the maximum permissible noise level by 11 dBA if a gen-tie monopole were constructed directly opposite an existing dwelling. However, it is expected that the nearest monopoles would be sited at least 250 feet from the nearest dwelling, where maximum noise levels would be up to 78 dBA. Almost all gen-tie construction would occur at distances of 600 feet or more from the affected residences, where maximum noise levels would be 70 dBA or lower, and within Fresno County noise standards. In addition, construction noise sources are exempt from the Fresno County noise standards, provided the construction activities do not take place before 6 AM or after 9 PM on weekdays, or before 7 AM or after 5 PM on Saturdays or Sundays. It is anticipated that gen-tie construction would occur only within the hours prescribed in the ordinance. However, if nighttime construction is determined to be necessary (e.g., during conductor stringing over State highways or County roads), a variance would be required from Fresno County prior to such

nighttime construction in proximity to any residences. Such a variance would be conditioned to minimize noise and nuisance effects. Since construction of the gen-tie line segments in Fresno County would not violate the noise provisions of the Fresno County Municipal Code, the impact from transmission construction near sensitive noise receptors within the County would be *less-than-significant*.

As mentioned, gen-tie construction activities would move along the gen-tie line and would only take place near any individual receptor for a relatively brief period. Given that maximum construction noise levels would not violate the noise provisions applicable in either county where the gen-tie lines would be constructed, and that construction activity duration at any given location along the gen-tie line would be short, the noise impacts associated with gen-tie construction would be *less-than-significant*.

**Mitigation Measures:** **None Required**

**Impact 5:** **Noise and Land Use Compatibility (Aircraft).** The proposed project would be located in a compatible noise environment with respect to noise generated by aircraft. **No impact** would occur as a result of the project**.**

Aquamarine Solar Project

The Aquamarine project site is located 14 to 17 miles from the nearest public use airports and is not located within an airport land use plan area. The nearest public or public use airports include the Hanford, Corcoran, and Coalinga municipal airports, and the Harris Ranch airfield, all of which are located 17 miles or more from the project site. There are three private airstrips within a 5-mile radius of the site, nearest three of which are all located approximately 2.0 miles away from the nearest site boundaries to the west, northeast, and southeast. Based on the project site's distance from the nearest airports or airstrips, and the limited operations associated with the nearest airstrips, the project would not expose people residing or working in the project area to excessive noise levels from those airports or airstrips.

The Aquamarine project site is located 5.5 miles south of the airfield at Naval Air Station Lemoore (NASL) and is included in the study area for the NAS Lemoore Joint Land Use Study (JLUSPC 2011). The project site is located within the NASL flight pattern and is mapped as land subject to noise levels lower than 75 dBA CNEL as mapped in the NAS Lemoore Joint Land Use Study. The eastern one-fourth of the project site is exposed to noise levels just over 70 dBA CNEL, while the western three-fourths of the site is exposed to noise levels of less than 65 dBA CNEL (JLUSPC 2011, p. 2-11). The Kings County General Plan noise standard for the noise-sensitive outdoor areas of commercial or industrial developments is 65 dBA CNEL (Kings County 2010). However, the Aquamarine solar project is not considered a noise-sensitive land use and will have no permanent employees stationed on-site that would utilize outdoor use areas. Land uses that are not noise sensitive and have no outdoor use areas are considered compatible with exterior noise levels of up to 76 dBA CNEL. Prolonged exposure to noise levels exceeding 76 dBA CNEL are considered hazardous to health as determined by the Environmental Protection Agency (EPA). Aircraft overflights would expose construction workers, who would be on the site temporarily, and the operational workers, who would visit the site periodically, to

maximum noise levels of just over 70 dBA CNEL while working near the east end of the project (assuming that the workers were on the site for at least 24-hours, which is unlikely), which is well below the 76 dBA CNEL threshold. Therefore, the project would not expose workers on the project site to excessive noise levels from flight operations at NAS Lemoore. Therefore, the project would be subject to a *less-than-significant* impact with respect to aircraft noise received at the Aquamarine project.

Gen-Tie Line – Kings County Segments

The nearest municipal airports to the Kings County segments of gen-tie line include the Hanford, Corcoran, and Coalinga airports, all of which are located between 15 and 20 miles from the gen-tie corridor at their nearest points. In addition, the airfield at NAS Lemoore is located 10 miles from the gen-tie corridor. The flight operations associated with these airports are too far from the gen-tie corridor to result in excessive noise levels to workers on the gen-tie line. Therefore, workers on the gen-tie project would not be exposed to excessive noise levels from flight operations associated with public or public use airports, as well as NAS Lemoore, and the impact would be less-than-significant.

There are five private airstrips within about 5 miles of the gen-tie line. The nearest airstrip is at Stone Land Company Ranch on Nevada Avenue, where the north end of the runway is about 1,500 feet from the gen-tie right-of-way. Occasional takeoffs and landings at these private airstrips would generate noise at the nearby portions of these gen-tie corridors. However, the noise levels from small private aircraft would not be excessive, and construction workers would be present in the vicinity relatively briefly during gen-tie line construction, and rarely during inspection and maintenance activities once the gen-tie lines are completed. These workers would not be exposed to excessive noise levels from flight operations associated with private airstrips. The remaining four airstrips are located from 3 to 5 miles from the gen-tie line. At these distances, flight operations associated with the airstrips would not result in excessive noise levels at the nearest segments of the transmission corridors. Therefore, workers on the gen-tie line would not be exposed to excessive noise levels from flight operations associated with private airstrips, and the impact would be less-than-significant.

In summary, the workers on the Kings County segments of the gen-tie line would not be exposed to excessive noise levels from flight operations associated with public or public use airports, NAS Lemoore, or private airstrips in the vicinity. Therefore, the potential noise impacts from flight operations to workers on the Kings County portion of the gen-tie line would be *less-than-significant*.

Gen-Tie Line – Fresno County Segments

The nearest municipal airports to the Fresno County segments of gen-tie line include the Hanford, Corcoran, and Coalinga airports, all of which are located between 10 and 25 miles from the gen-tie corridor at their nearest points. In addition, the airfield at NAS Lemoore is located 11 miles from the gen-tie corridor. The flight operations associated with these airports are too far from the gen-tie corridor to result in excessive noise levels to workers on the gen-tie line. Therefore, workers on the gen-tie project would not be exposed to excessive noise levels from

flight operations associated with public or public use airports, as well as NAS Lemoore, and the impact would be less-than-significant.

There is one private airstrip within 5 miles of the Fresno County gen-tie line. The nearest airstrip is at Stone Land Company Ranch on Nevada Avenue, which is located 1.8 miles east of the gen-tie line. Occasional takeoffs and landings at this private airstrip would generate noise at the nearby portions of these gen-tie corridors. However, the noise levels from small private aircraft would not be excessive, and construction workers would be present in the vicinity relatively briefly during gen-tie line construction, and rarely during inspection and maintenance activities once the gen-tie lines are completed. These workers would not be exposed to excessive noise levels from flight operations associated with this private airstrip, and the impact would be less-than-significant.

In summary, the workers on the Fresno County segments of the gen-tie line would not be exposed to excessive noise levels from flight operations associated with public or public use airports, NAS Lemoore, or private airstrips in the vicinity. Therefore, the potential noise impacts from flight operations to workers on the Fresno County portion of the gen-tie line would be *less-than-significant*.

**Mitigation Measures:** **None Required**

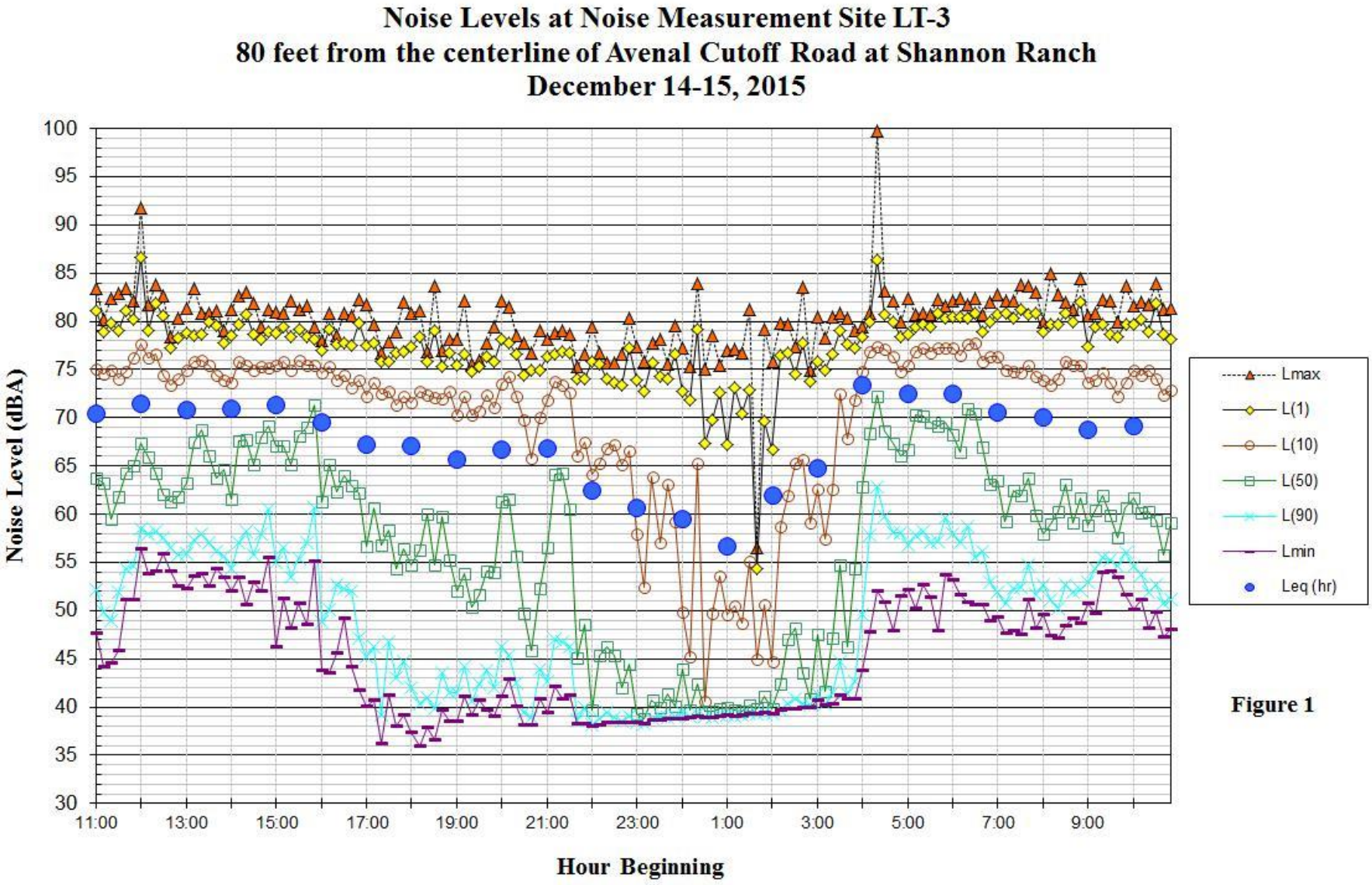

Noise Levels at Noise Measurement Site LT-3
80 feet from the centerline of Avenal Cutoff Road at Shannon Ranch
December 14-15, 2015
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
11:00
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

**Figure 1**

**Noise Levels at Noise Measurement Site LT-2**
**27 feet from the centerline of Nevada Avenue across from Stone Land Offices**
**December 14-15, 2015**

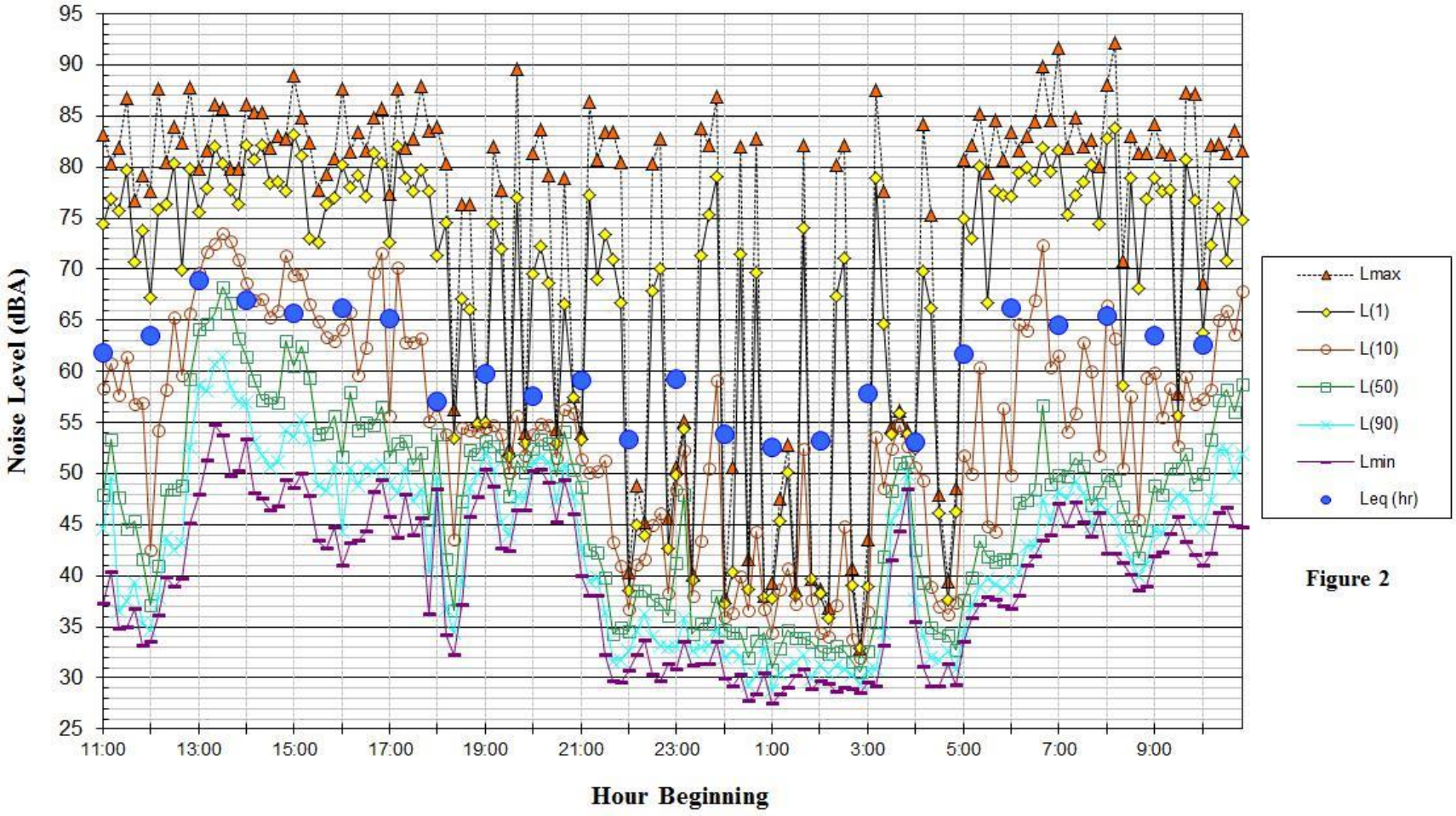



**Figure 2**

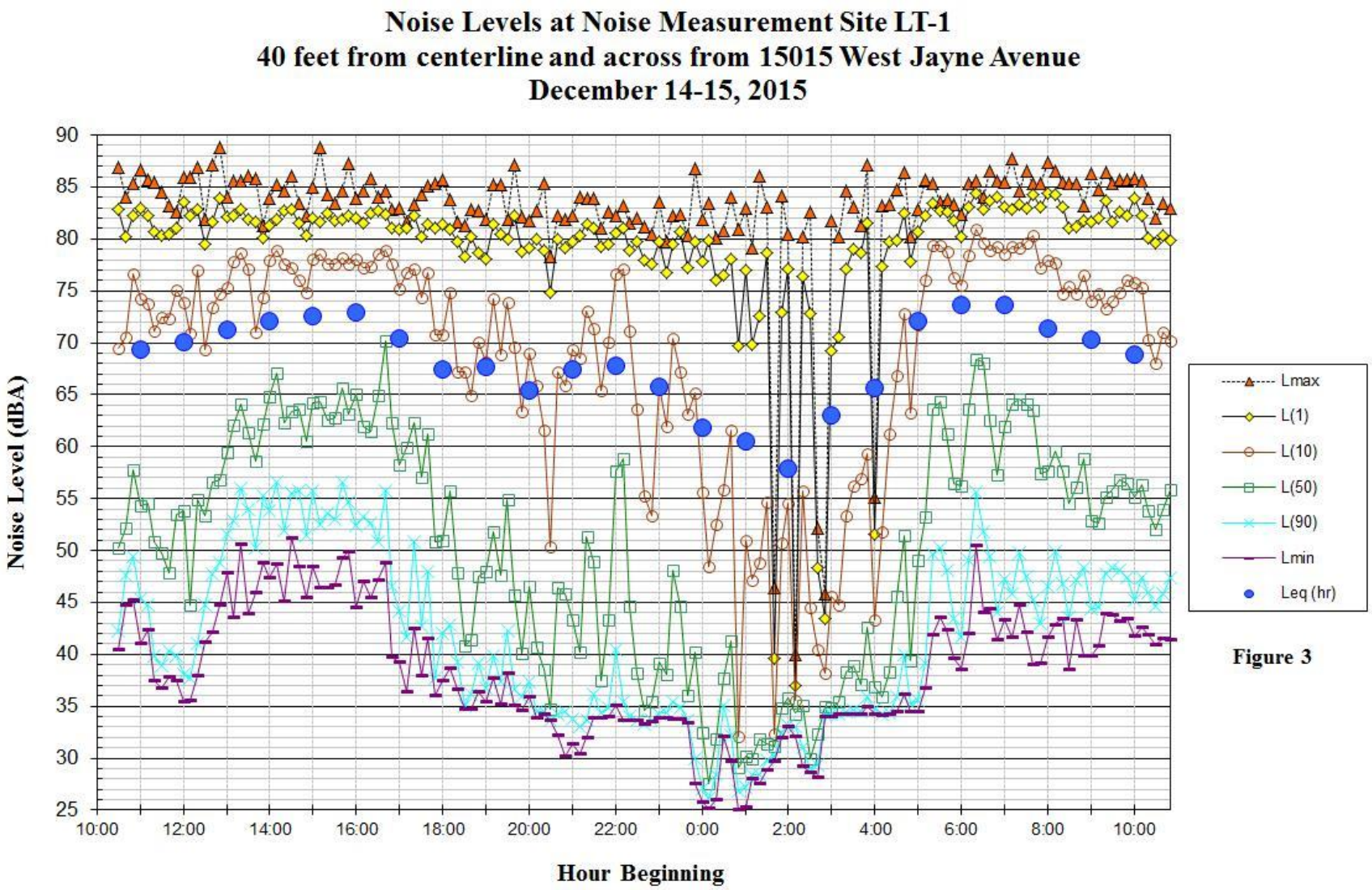

Noise Levels at Noise Measurement Site LT-1
40 feet from centerline and across from 15015 West Jayne Avenue
December 14-15, 2015
Noise Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

**Figure 3**