

**APPENDIX 3.11-A – NOISE ANALYSIS DATA**



# **NOISE & GROUNDBORNE VIBRATION IMPACT ASSESSMENT**

**FOR THE PROPOSED**

**RINCON DEL RIO  
NEVADA COUNTY, CA**

**AUGUST 2011**

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## LIST OF COMMON TERMS AND ACRONYMS

|                  |  |
|------------------|--|
| ADT              | Average Daily Trips                                |
| ANSI             | Acoustical National Standards Institute, Inc.      |
| Caltrans         | California Department of Transportation            |
| CALVENO          | California Vehicle Reference Noise Emission Levels |
| CEQA             | California Environmental Quality Act               |
| CNEL             | Community Noise Equivalent Level                   |
| dB               | Decibels   |
| dBA              | A-Weighted Decibels                                |
| FAA              | Federal Aviation Administration                    |
| FHWA             | Federal Highway Administration                     |
| FICON            | Federal Interagency Committee on Noise             |
| FTA              | Federal Transit Administration                     |
| Hz               | Hertz  |
| HVAC             | Heating Ventilation & Air Conditioning             |
| in/sec           | Inches per Second                                  |
| L <sub>dn</sub>  | Day-Night Level                                    |
| L <sub>eq</sub>  | Equivalent Sound Level                             |
| L <sub>max</sub> | Maximum Sound Level                                |
| LOS              | Level of Service                                   |
| OPR              | California Office of Planning & Research           |
| Pk-Hr            | Peak Hour  |
| ppv              | Peak Particle Velocity                             |
| SR               | State Route  |
| US EPA           | United States Environmental Protection Agency      |

## INTRODUCTION

This report discusses the existing noise setting, identifies potential noise impacts associated with implementation of the proposed Rincon del Rio Project (project), and recommends mitigation measures to address potential impacts. Specifically, this section analyzes potential noise impacts due to development of the proposed project relative to the existing ambient noise environment and applicable noise criteria. Noise mitigation measures are recommended where the predicted noise levels would exceed applicable noise standards.

## EXISTING SETTING

### ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound is mechanical energy transmitted in the form of a wave because of a disturbance or vibration. Sound levels are described in terms of both amplitude and frequency. Amplitude is defined as the difference between ambient air pressure and the peak pressure of the sound wave. Amplitude is measured in decibels (dB) on a logarithmic scale. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Amplitude is interpreted by the ear as corresponding to different degrees of loudness. Laboratory measurements correlate a 10 dB increase in amplitude with a perceived doubling of loudness and establish a 3 dB change in amplitude as the minimum audible difference perceptible to the average person.

The frequency of a sound is defined as the number of fluctuations of the pressure wave per second. The unit of frequency is the Hertz (Hz). One Hz equals one cycle per second. The human ear is not equally sensitive to sound of different frequencies. For instance, the human ear is more sensitive to sound in the higher portion of this range than in the lower and sound waves below 16 Hz or above 20,000 Hz cannot be heard at all. To approximate the sensitivity of the human ear to changes in frequency, environmental sound is usually measured in what is referred to as "A-weighted decibels" (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA. Common community noise sources and associated noise levels, in dBA, are depicted in **Figure 1**.

Noise can be generated by a number of sources, including mobile sources, such as automobiles, trucks and airplanes, and stationary sources, such as construction sites, machinery, and industrial operations. Noise generated by mobile sources typically attenuates at a rate between 3.0 to 4.5 dBA per doubling of distance. The rate depends on the ground surface and the number or type of objects between the noise source and the receiver. For mobile transportation sources, such as highways, hard and flat surfaces, such as concrete or asphalt, have an attenuation rate of 3.0 dBA per doubling of distance. Soft surfaces, such as uneven or vegetated terrain, have an attenuation rate of about 4.5 dBA per doubling of distance from the source. Noise generated by stationary sources typically attenuates at a rate of approximately 6.0 to 7.5 dBA per doubling of distance from the source.

Sound levels can be reduced by placing barriers between the noise source and the receiver. In general, barriers contribute to decreasing noise levels only when the structure breaks the "line of sight" between the source and the receiver. Buildings, concrete walls, and berms can all act as effective noise barriers. Wooden fences or broad areas of dense foliage can also reduce noise, but are less effective than solid barriers.

**FIGURE 1  
Common Noise Levels**

| Common Outdoor Activities                                  | Noise Level (dBA) | Common Indoor Activities                               |
|--|-------------------|--|
| <u>Jet Fly-over at 300m (1000 ft)</u>                      | <b>110</b>        | <u>Rock Band</u>                                       |
| <u>Gas Lawn Mower at 1 m (3 ft)</u>                        | <b>100</b>        |  |
| <u>Diesel Truck at 15 m (50 ft),<br/>at 80 km (50 mph)</u> | <b>90</b>         | <u>Food Blender at 1 m (3 ft)</u>                      |
| <u>Noisy Urban Area, Daytime</u>                           | <b>80</b>         | <u>Garbage Disposal at 1 m (3 ft)</u>                  |
| <u>Gas Lawn Mower, 30 m (100 ft)</u>                       | <b>70</b>         | <u>Vacuum Cleaner at 3 m (10 ft)</u>                   |
| <u>Commercial Area</u>                                     |                   | <u>Normal Speech at 1 m (3 ft)</u>                     |
| <u>Heavy Traffic at 90 m (300 ft)</u>                      | <b>60</b>         | <u>Large Business Office</u>                           |
| <u>Quiet Urban Daytime</u>                                 | <b>50</b>         | <u>Dishwasher Next Room</u>                            |
| <u>Quiet Urban Nighttime</u>                               | <b>40</b>         | <u>Theater, Large Conference<br/>Room (Background)</u> |
| <u>Quiet Suburban Nighttime</u>                            |                   | <u>Library</u>   |
| <u>Quiet Rural Nighttime</u>                               | <b>30</b>         | <u>Bedroom at Night,</u>                               |
|  |                   | <u>Concert Hall (Background)</u>                       |
|  | <b>20</b>         | <u>Broadcast/Recording Studio</u>                      |
|  | <b>10</b>         |  |
| <u>Lowest Threshold of Human<br/>Hearing</u>               | <b>0</b>          | <u>Lowest Threshold of Human<br/>Hearing</u>           |

Source: Caltrans 2011

## Noise Descriptors

The intensity of environmental noise fluctuates over time, and several descriptors of time-averaged noise levels are used. The three most commonly used descriptors are  $L_{eq}$ ,  $L_{dn}$ , and CNEL. The energy-equivalent noise level,  $L_{eq}$ , is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average noise level,  $L_{dn}$ , is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to  $L_{dn}$  but adds an additional 5-dBA penalty for evening noise (7 p.m. to 10 p.m.). Another descriptor that is commonly discussed is the single-event noise exposure level (SENEL), also referred to as the sound exposure level (SEL). The SENEL/SEL describes a receiver's cumulative noise exposure from a single noise event, which is defined as an acoustical event of short duration, such as a backup beeper, the sound of an airplane traveling overhead, or a train whistle. Noise analyses may also depend on measurements of  $L_{max}$ , the maximum instantaneous noise level during a specific period of time, and  $L_{min}$ , the minimum instantaneous noise level during a specific period. Common noise level descriptors are summarized in **Table 1**.

**TABLE 1**  
**Common Acoustical Descriptors**

| Descriptor  | Definition   |
|---|--|
| Energy Equivalent Noise Level<br>( $L_{eq}$ )       | The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value (in dBA) is calculated.   |
| Minimum Noise Level<br>( $L_{min}$ )                | The minimum instantaneous noise level during a specific period of time.  |
| Maximum Noise Level<br>( $L_{max}$ )                | The maximum instantaneous noise level during a specific period of time.  |
| Day-Night Average Noise Level<br>(DNL or $L_{dn}$ ) | The 24-hour $L_{eq}$ with a 10 dBA "penalty" for noise events that occur during the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours to account for increases sensitivity to noise during these hours. |
| Community Noise Equivalent Level<br>(CNEL)          | The CNEL is similar to the $L_{dn}$ described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated $L_{dn}$ .                           |
| Single Event Level<br>(SEL)                         | The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.   |

## **Sound Propagation & Attenuation**

### *Geometric Spreading*

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level decreases (attenuates) at a rate of approximately 6 decibels (dB) for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately 3 dB for each doubling of distance from a line source, depending on ground surface characteristics. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water,), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation for soft surfaces results in an overall attenuation rate of 4.5 dB per doubling of distance from the source.

### *Atmospheric Effects*

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

### *Shielding by Natural or Human-Made Features*

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in minimum 5 dB of noise reduction. Taller barriers provide increased noise reduction.

Noise reductions afforded by building construction can vary depending on construction materials and techniques. Standard construction practices typically provide approximately 15 dB exterior-to-interior noise reductions for building facades, with windows open, and approximately 20-25 dB, with windows closed. With compliance with current Title 24 energy efficiency standards, which require increased building insulation and inclusion of an interior air ventilation system to allow windows on noise-impacted façades to remain closed, exterior-to-interior noise reductions typically average approximately 25 dB. The absorptive characteristics of interior rooms, such as carpeted floors, draperies and furniture, can result in further reductions in interior noise.

## Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well-being are the basis for land use planning policies preventing exposure to excessive community noise levels.

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged. Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived by humans;
- Outside of the laboratory, a 3-dB change is considered a just-perceivable difference;
- A change in level of at least 5 dB is required before any noticeable change in community response would be expected. An increase of 5 dB is typically considered substantial;
- A 10-dB change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

A limitation of using a single noise-level increase value to evaluate noise impacts, as discussed above, is that it fails to account for pre-development noise conditions. With this in mind, the Federal Interagency Committee on Noise (FICON) developed guidance to be used for the assessment of project-generated increases in noise levels that take into account the ambient noise level. The FICON recommendations are based upon studies that relate aircraft noise levels to the percentage of persons highly annoyed by aircraft noise. Although the FICON recommendations were specifically developed to assess aircraft noise impacts, these recommendations are often used in environmental noise impact assessments involving the use of cumulative noise exposure metrics, such as the average-daily noise level (i.e., CNEL,  $L_{dn}$ ). FICON-recommended noise evaluation criteria are summarized in **Table 2** (FICON 2000).

**TABLE 2**  
**Federal Interagency Committee on Noise**  
**Recommended Criteria for Evaluation of Increases in Ambient Noise Levels**

| Ambient Noise Level Without Project | Increase Required for Significant Impact |
|-------------------------------------|--|
| < 60 dB                             | 5.0 dB, or greater                       |
| 60-65 dB                            | 3.0 dB, or greater                       |
| > 65 dB                             | 1.5 dB, or greater                       |

Source: FICON 2000

As depicted in **Table 2**, an increase in the traffic noise level of 5.0, or greater, would typically be considered to result in increased levels of annoyance where existing ambient noise levels are less than 60 dB. Within areas where the ambient noise level ranges from 60 to 65 dB, increased levels of annoyance would be anticipated at increases of 3 dB, or greater. Increases of 1.5 dB, or greater, could result in increased levels of annoyance in areas where the ambient noise level exceeds 65 dB. The rationale for the FICON-recommended criteria is that as ambient noise levels increase, a smaller increase in noise resulting from a project is sufficient to cause significant increases in annoyance (FICON 2000).

### **Effects of Noise on Human Activities**

The extent to which environmental noise is deemed to result in increased levels of annoyance, activity interference, and sleep disruption varies greatly from individual to individual depending on various factors, including the loudness or suddenness of the noise, the information value of the noise (e.g., aircraft overflights, child crying, fire alarm), and an individual's sleep state and sleep habits. Over time, adaptation to noise events and increased levels of noise may also occur. In terms of land use compatibility, environmental noise is often evaluated in terms of the potential for noise events to result in increased levels of annoyance, sleep disruption, or interference with speech communication, activities, and learning. Noise-related effects on human activities are discussed in more detail, as follows:

#### Speech Communication

For most noise-sensitive land uses, an interior noise level of 45 dB  $L_{eq}$  is typically identified for the protection of speech communication in order to provide for 100-percent intelligibility of speech sounds. Assuming an average 20-dB reduction in sound level between outdoors and indoors (which is an average amount of sound attenuation that assumes windows are closed), this interior noise level would equate to an exterior noise level of 65 dBA  $L_{eq}$ . For outdoor voice communication, an exterior noise level of 60 dBA  $L_{eq}$  allows normal conversation at distances up to 2 meters with 95 percent sentence intelligibility (U.S. EPA 1974.) Based on this information, speech interference begins to become a problem when steady noise levels reach approximately 60 to 65 dBA. Within more noise-sensitive interior environments, such as educational facilities and places of worship, an average-hourly background noise level of 45 dBA  $L_{eq}$  is typically recommended (Caltrans 2002[a].)

#### Annoyance & Sleep Disruption

With regard to potential increases in annoyance, activity interference, and sleep disruption, land use compatibility determinations are typically based on the use of the cumulative noise exposure metrics (i.e., CNEL or  $L_{dn}$ ). Perhaps the most comprehensive and widely accepted evaluation of the relationship between noise exposure and the extent of annoyance was one

originally developed by Theodore J. Schultz in 1978. In 1978 the research findings of Theodore J. Schultz provided support for L<sub>dn</sub> as the descriptor for environmental noise. Research conducted by Schultz identified a correlation between the cumulative noise exposure metric and individuals who were highly annoyed by transportation noise. The Schultz curve, expressing this correlation, became a basis for noise standards. When expressed graphically, this relationship is typically referred to as the Schultz curve. The Schultz curve indicates that approximately 13 percent of the population is highly annoyed at a noise level of 65 dBA L<sub>dn</sub>. It also indicates that the percent of people describing themselves as being highly annoyed accelerates smoothly between 55 and 70 dBA L<sub>dn</sub>. A noise level of 65 dBA L<sub>dn</sub> is a commonly referenced dividing point between lower and higher rates of people describing themselves as being highly annoyed (Caltrans 2002[a].)

The Schultz curve and associated research became the basis for many of the noise criteria subsequently established for federal, state, and local entities. Most federal and state of California regulations and policies related to transportation noise sources establish a noise level of 65 dBA CNEL/L<sub>dn</sub> as the basic limit of acceptable noise exposure for residential and other noise-sensitive land uses. For instance, with respect to aircraft noise, both the Federal Aviation Administration (FAA) and the State of California have identified a noise level of 65 dBA L<sub>dn</sub> as the dividing point between normally compatible and normally incompatible residential land use generally applied for determination of land use compatibility. For noise-sensitive land uses exposed to aircraft noise, noise levels in excess of 65 dBA CNEL/L<sub>dn</sub> are typically considered to result in a potentially significant increase in levels of annoyance (Caltrans 2002[a].)

Allowing for an average exterior-to-interior noise reduction of 20 dB, an exterior noise level of 65 dBA CNEL/L<sub>dn</sub> would equate to an interior noise level of 45 dBA CNEL/L<sub>dn</sub>. An interior noise level of 45 dB CNEL/L<sub>dn</sub> is generally considered sufficient to protect against long-term sleep interference (U.S. EPA, 1974.) Within California, the California Building Code establishes a noise level of 45 dBA CNEL as the maximum acceptable interior noise level for residential uses (other than detached single-family dwellings). Use of the 45 dBA CNEL threshold is further supported by recommendations provided in the State of California Office of Planning and Research's *General Plan Guidelines*, which recommend an interior noise level of 45 dB CNEL/L<sub>dn</sub> as the maximum allowable interior noise level sufficient to permit "normal residential activity" (OPR 2003.)

The cumulative noise exposure metric is currently the only noise metric for which there is a substantial body of research data and regulatory guidance defining the relationship between noise exposure, people's reactions, and land use compatibility. However, when evaluating environmental noise impacts involving intermittent noise events, such as aircraft overflights and train passbys, the use of cumulative noise metrics may not provide a thorough understanding of the resultant impact. The general public often finds it difficult to understand the relationship between intermittent noise events and cumulative noise exposure metrics. In such instances, supplemental use of other noise metrics, such as the L<sub>eq</sub> or L<sub>max</sub> descriptor, are sometime used as a means of increasing public understanding regarding the relationship between these metrics and the extent of the resultant noise impact (Caltrans 2002[a].)

## AFFECTED ENVIRONMENT

### **Noise-Sensitive Receptors**

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are

also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

The project site encompasses approximately 215 acres located at the east terminus of Rincon Way, one-half mile east of State Route (SR) 49. A majority of the project site is currently undeveloped, with the exception of an existing onsite residential dwelling, which is located within the southwestern portion of the project site. Nearby noise-sensitive land uses consist predominantly of rural residential land uses generally located at varying distances to the west, north, and east of the project site. Land located to the south of the project site, across Bear River, consists of undeveloped land. Nearby residential land uses are depicted in **Figure 2**.

### Ambient Noise Environment

The noise environment in the proposed project area is defined primarily by vehicular traffic on SR 49. To a lesser extent, occasional aircraft overflights, activities at nearby residential land uses (e.g., landscape maintenance), and vehicle traffic on local roadways, including Rincon Way, also contribute on to ambient noise levels in the project area.

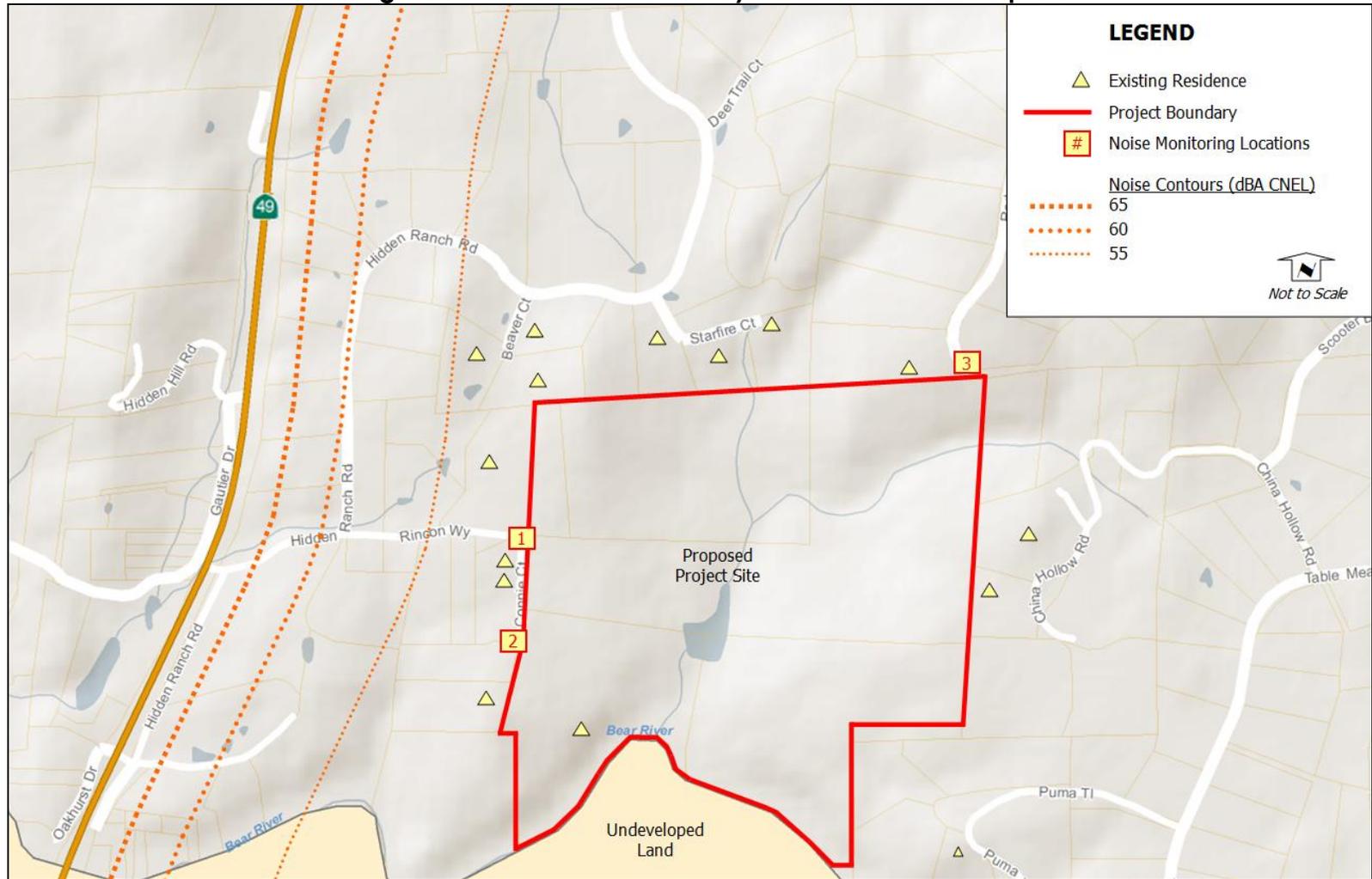
To document existing ambient noise levels in the project area, short-term ambient noise measurements were conducted on June 23, 2011. Noise measurements were conducted using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter positioned at a height of approximately 5 feet above ground level. The meter was calibrated before use and is certified to be in compliance with ANSI specifications. Measured ambient noise levels in the proposed project area are summarized in **Table 3**. Based on the measurements conducted, ambient noise levels range from approximately 43 to 46 dBA  $L_{eq}$ . Maximum intermittent noise levels ranged from approximately 55 dBA  $L_{max}$  to 60 dBA  $L_{max}$ .

**TABLE 3**  
**Summary of Measured Ambient Noise Levels**

| Location |                    | Monitoring Period | Noise Levels (dBA) |           |
|----------|--------------------|-------------------|--------------------|-----------|
|          |                    |                   | $L_{eq}$           | $L_{max}$ |
| 1        | 10450 Rincon Way   | 10:00-10:10       | 44.4               | 62.9      |
|          |                    | 13:00-13:10       | 45.6               | 64.3      |
| 2        | 10450 Rincon Way   | 10:20-10:30       | 43.7               | 57.8      |
|          |                    | 13:20-13:30       | 44.2               | 60.7      |
| 3        | 24912 Connie Court | 11:20-11:33       | 43.2               | 57.4      |
|          |                    | 13:55-14:10       | 42.8               | 58.4      |

*Ambient noise measurements were conducted on June 23, 2011 using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter placed at a height of approximately 5 feet above ground level. Measurement locations correspond to those depicted in **Figure 2**.*

**FIGURE 2**  
**Existing Noise Environment & Nearby Noise-Sensitive Receptors**



Ambient noise measurement locations correspond to those depicted in **Table 3**. Depicts residential dwellings within approximately 500 feet of the project boundary. Predicted noise contours do not take into account shielding from intervening terrain or structures. Site boundary, residence, noise contour, and monitoring locations are approximate.  
 Image Source: Nevada County 2011

## Existing Traffic Noise Levels

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used to determine noise levels associated with existing vehicle traffic on SR 49 and Rincon Way. The FHWA model used California vehicle reference noise emission factors (CALVENO) for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. Traffic data used in the modeling effort was obtained from the traffic analysis prepared for this project and the California Department of Transportation (Flecker 2011).

**Table 4** depicts predicted existing average-daily traffic noise levels (in CNEL/L<sub>dn</sub>) at a distance of 50 feet from the near travel-lane centerline for major roadways within the project area, as well as distances to the predicted 65, 60, and 55 dBA CNEL/L<sub>dn</sub> traffic noise contours. The extent by which nearby land uses are affected by existing traffic noise depends on multiple factors, including their respective proximity to the roadways, shielding provided by intervening terrain and structures, and their individual sensitivity to noise. Predicted existing traffic noise contours for the modeled roadway segments are depicted in **Figure 2**. The project site is not located within the projected 55 dBA CNEL noise contour of SR49 or Rincon Way.

**TABLE 4**  
**Existing Traffic Noise Levels**

| Segment  | Existing ADT | CNEL/L <sub>dn</sub> at 50 Feet from Near-Travel-Lane Centerline | Distance (feet) to Noise Level Contours (dBA CNEL/L <sub>dn</sub> ) from Roadway Centerline |     |       |
|--|--------------|--|---|-----|-------|
|  |              |  | 65  | 60  | 55    |
| SR 49  | 28,000       | 74.38  | 296   | 636 | 1,369 |
| Rincon Way   | 459          | 43.41  | Within Roadway Right-of-Way   |     |       |
| Refer to <b>Appendix A</b> for modeling assumptions and results. |              |  |   |     |       |

## REGULATORY FRAMEWORK

### Noise

#### State

##### *California General Plan Guidelines*

The State of California regulates vehicular and freeway noise affecting classrooms, sets standards for sound transmission and occupational noise control, and identifies noise insulation standards and airport noise/land-use compatibility criteria. The *State of California General Plan Guidelines* (State of California 2003), published by the Governor's Office of Planning and Research (OPR), also provides guidance for the acceptability of projects within specific CNEL/L<sub>dn</sub> contours. The guidelines also present adjustment factors that may be used in order to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

## *California Building Code*

Title 24 of the California Code of Regulations contains standards for allowable interior noise levels associated with exterior noise sources (California Building Code, 1998 edition, Volume 1, Appendix Chapter 12, Section 1208A). The standards apply to new hotels, motels, dormitories, apartment houses, and dwellings other than detached single-family residences. The standards state that the interior noise level attributable to exterior sources shall not exceed 45 dBA CNEL in any habitable room. Proposed residential structures to be located where the CNEL exceeds 60 dBA shall require an acoustical analysis showing that the proposed building design would achieve the prescribed allowable interior noise standard. Worst-case noise levels, either existing or future, shall be used as the basis for determining compliance with these standards.

## Local

### *Nevada County General Plan and Noise Ordinance*

The Noise Element of the *Nevada County General Plan (1996)* establishes maximum allowable exterior noise levels for various land-use categories in terms of the average-hourly ( $L_{eq}$ ) and maximum intermittent ( $L_{max}$ ) noise descriptors. Maximum allowable noise standards are identified for daytime (7 a.m. – 7 p.m.), evening (7 p.m. – 10 p.m.), and nighttime (10 p.m. – 7 a.m.) periods of the day. The County's noise standards, which are typically applied to non-transportation noise sources, are summarized in **Table 2**. These noise standards are also identified in the *Nevada County Land Use Development Code, Chapter 11, Zoning Regulations, Section L-II, 4.1.7, Noise*, (2010). Construction activities are exempt from the County's noise standards.

For transportation noise sources, the County has historically used the average-daily noise descriptor (i.e., CNEL or  $L_{dn}$ ) for determination of land use compatibility. The County's General Plan Noise Element identifies noise criteria to be used for determination of land use compatibility within exterior noise environments, as summarized in **Figure 3**.

In addition to the identification of noise standards, the County's General Plan also identifies goals, objectives, and policies to reduce noise-related impacts and land use compatibility conflicts. Applicable goals and policies relative to the proposed project site within the noise element are listed below in **Table 6**. **Table 6** also summarizes how the proposed project complies with these applicable General Plan goals and policies.

**TABLE 5  
County of Nevada Exterior Noise Limits**

| Land Use Category         | Zoning District             | Time Period | Noise Level, dBA |                  |
|---------------------------|-----------------------------|-------------|------------------|------------------|
|                           |                             |             | L <sub>eq</sub>  | L <sub>max</sub> |
| Rural                     | A1, TPZ, AE, OS, FR, IDR    | 7 am-7 pm   | 55               | 75               |
|                           |                             | 7 pm-10 pm  | 50               | 65               |
|                           |                             | 10 pm-7 am  | 40               | 55               |
| Residential and Public    | RA, R1, R2, R3, P           | 7 am-7 pm   | 55               | 75               |
|                           |                             | 7 pm-10 pm  | 50               | 65               |
|                           |                             | 10 pm-7 am  | 45               | 60               |
| Commercial and Recreation | C1, C2, C3, CH, CS, OP, REC | 7 am-7 pm   | 70               | 90               |
|                           |                             | 7 pm-7 am   | 65               | 75               |
| Business Park             | BP                          | 7 am-7 pm   | 65               | 85               |
|                           |                             | 7 pm-7 am   | 60               | 70               |
| Industrial                | M1, M2                      | Any time    | 80               | 90               |

**Notes:**

- Compliance with the above standards shall be determined by measuring the noise level based on the mean average of not less than three (3) 20-minute measurements for any given time period. Additional noise measurements may be necessary to ensure that the ambient noise level is adequately determined.
- Where two different zoning districts abut, the standard applicable to the lower or more restrictive district plus 5 dBA shall apply.
- The above standards shall be measured only on property containing a noise-sensitive land use as defined in General Plan Policy 9.8 and may be measured anywhere on the property containing said land use.
- If the measured ambient level exceeds that permitted, the allowable noise exposure standard shall be set at 5 dBA above the ambient.
- Because of the unique nature of sound, the County reserves the right to provide for a more restrictive standard than shown in the Exterior Noise Limits table contained in this policy. The maximum adjustment shall be limited to be not less than the current ambient noise levels and shall not exceed the standards of this policy or as they may be further adjusted by General Plan Policy 9.1b. Imposition of a noise level adjustment shall only be considered if one or more of the following conditions are found to exist:
  - a. Unique characteristics of the noise source:
    - The noise contains a very high or low frequency, is of a pure tone (a steady, audible tone such as a whine, screech, or hum), or contains a wide divergence in frequency spectra between the noise source and ambient level.
    - The noise is impulsive in nature (such as hammering, riveting, or explosions), or contains music or speech.
    - The noise source is of a long duration.
  - b. Unique characteristics of the noise receptor when the ambient noise level is determined to be 5 dBA or more below the Policy 9.1 standard for those projects requiring a General Plan amendment, rezoning, and/or conditional use permit. In such instances, the new standard shall not exceed 10 dBA above the ambient or General Plan Policy 9.1 standard, whichever is more restrictive.
- The above standards shall not apply to those activities associated with the actual construction of a project or to those projects associated with the provision of emergency services or functions.

Source: Nevada County General Plan, 1996; Nevada County Land Use Development Code, 2010.

**FIGURE 3**  
**Nevada County Land Use Compatibility Noise Criteria**

| Land Use Category   | Community Noise Exposure<br>(L <sub>dn</sub> or CNEL, dBA) |    |    |    |    |    | Interpretation  |
|---|--|----|----|----|----|----|---|
|   | 50   | 55 | 60 | 65 | 70 | 75 |   |
| Residential –Low<br>Density Single Family,<br>Duplex, Mobile Homes  |  |    |    |    |    |    | <br><b>Clearly Acceptable</b><br>The activities associated with the specified land use may be carried out with essentially no interference from the noise exposure.   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Residential – Multiple<br>Family                                    |  |    |    |    |    |    | <br><b>Normally Acceptable</b><br>Noise should be considered in proposed land use projects, but under most circumstances conventional construction without and special noise insulation requirements, is satisfactory.  |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Transient Lodging –<br>Motels, Hotels                               |  |    |    |    |    |    | <br><b>Normally Acceptable</b><br>Noise should be considered in proposed land use projects, but under most circumstances conventional construction without and special noise insulation requirements, is satisfactory.  |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Schools, Libraries,<br>Churches, Hospitals,<br>Nursing Homes        |  |    |    |    |    |    | <br><b>Conditionally Acceptable</b><br>New construction or development should be undertaken only after a detailed analysis of noise reduction requirements and needed noise insulation features included in the design. Conventional construction with closed windows and conditioning will normally suffice. |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Auditoriums, Concert<br>Halls, Amphitheaters                        |  |    |    |    |    |    | <br><b>Conditionally Acceptable</b><br>New construction or development should be undertaken only after a detailed analysis of noise reduction requirements and needed noise insulation features included in the design. Conventional construction with closed windows and conditioning will normally suffice. |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Sports Arena, Outdoor<br>Spectator Sports                           |  |    |    |    |    |    | <br><b>Normally Unacceptable</b><br>New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.                       |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Playgrounds,<br>Neighborhood Parks                                  |  |    |    |    |    |    | <br><b>Normally Unacceptable</b><br>New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.                       |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Golf Courses, Riding<br>Stables, Water<br>Recreation,<br>Cemeteries |  |    |    |    |    |    | <br><b>Clearly Unacceptable</b><br>New construction or development should generally not be undertaken   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Office Buildings,<br>Commercial Retail                              |  |    |    |    |    |    | <br><b>Clearly Unacceptable</b><br>New construction or development should generally not be undertaken   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
| Industrial,<br>Manufacturing, Utilities,<br>Agriculture             |  |    |    |    |    |    | <br><b>Clearly Unacceptable</b><br>New construction or development should generally not be undertaken   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |
|   |  |    |    |    |    |    |   |

Source: Nevada County General Plan 1996

**TABLE 6  
Specific Project Consistency with County of Nevada General Plan Noise Policies**

| General Plan Policies   | Project Consistency   |
|---|---|
| <b>Noise Element Goals</b>  |   |
| Noise Goal #9.1: "Provide for the health, safety, and welfare of the people of Nevada County through a set of policies designed to encourage an environment free of unnecessary and annoying noise."  | The proposed project has been evaluated in accordance with County noise standards. Operation of the proposed Project would be subject to County noise standards.  |
| <b>Noise Element Policies</b>   |   |
| Noise Policy #9.1: "The following noise standards, as performance standards and land use compatibility standards shall apply to all discretionary and ministerial projects excluding permitted residential (including tentative maps) land uses."   | The proposed project has been evaluated in accordance with County noise standards. Mitigation measures have been incorporated, where necessary, to require compliance with County noise standards and long-term operation of the proposed project would be subject to County noise standards.   |
| Noise Policy #9.7: "Strongly discourage those General Plan amendments and zone changes that would likely create land use conflicts relative to noise."  | Projected future noise levels within the project area would not exceed County noise standards for land use compatibility, with County noise standards. Mitigation measures have been incorporated, where necessary, to require compliance with County noise standards and long-term operation of the proposed project would be subject to County noise standards. |
| Noise Policy #9.8: "Strongly encourage future noise sensitive land uses, including residences, schools, hospitals, nursing homes, churches, and libraries, to those location of the County where the impact of noise generators is limited so that compliance with standards found in Policy 9.1 will be maintained. This policy shall apply to the approval of all tentative maps for residentially zoned parcels. As an additional guide in evaluating land use compatibility, those standards as found in Figure 1 shall be used." | Refer to Response to Policy 9.7, above.   |
| Noise Policy #9.9: "Limit future noise generating land use to those location of the County where their impacts on noise sensitive land uses will be minimized, consistent with the standards found in Policy 9.1."  | Refer to Response to Policy 9.7, above.   |

*Source: Nevada County General Plan, 1996.*

### **Groundborne Vibration**

There are no federal, state, or local regulatory standards for ground-borne vibration. However, various criteria have been established to assist in the evaluation of vibration impacts. For instance, the California Department of Transportation (Caltrans) has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans-recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance, are summarized in **Table 7** and **Table 8**, respectively. The criteria differentiate between transient and continuous/frequent sources. Transient sources of ground-borne vibration include intermittent events, such as blasting; whereas, continuous and frequent

events would include the operations of equipment, including construction equipment, and vehicle traffic on roadways (Caltrans 2002(b), 2004).

The ground-borne vibration criteria recommended by Caltrans for evaluation of potential structural damage is based on building classifications, which take into account the age and condition of the building. For residential structures and newer buildings, Caltrans considers a minimum peak-particle velocity (ppv) threshold of 0.5 inches per second (in/sec) for transient sources and 0.3 in/sec for continuous/frequent sources to be sufficient to protect against building damage. With the exception of fragile buildings, ruins, and ancient monuments, continuous ground-borne vibration levels below approximately 0.2 in/sec ppv are unlikely to cause structural damage. In terms of human annoyance, continuous vibrations in excess of 0.04 in/sec ppv and transient sources in excess of 0.25 in/sec ppv are identified by Caltrans as being “distinctly perceptible”. Within buildings, short periods of ground vibration in excess of 0.2 in/sec ppv are generally considered to result in increased levels of annoyance (Caltrans 2002(b), 2004).

**TABLE 7**  
**Damage Potential to Buildings at Various Groundborne Vibration Levels**

| Structure and Condition  | Vibration Level<br>(in/sec ppv) |  |
|--|---------------------------------|--|
|  | Transient Sources               | Continuous/Frequent Intermittent Sources |
| Extremely Fragile Historic Buildings, Ruins, Ancient Monuments | 0.12                            | 0.08                                     |
| Fragile Buildings  | 0.2                             | 0.1                                      |
| Historic and Some Old Buildings                                | 0.5                             | 0.25                                     |
| Older Residential Structures                                   | 0.5                             | 0.3                                      |
| New Residential Structures                                     | 1.0                             | 0.5                                      |
| Modern Industrial/Commercial Buildings                         | 2.0                             | 0.5                                      |

*Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.*  
Source: Caltrans 2002(b), 2004

**TABLE 8**  
**Annoyance Potential to People at Various Groundborne Vibration Levels**

| Human Response         | Vibration Level<br>(in/sec ppv) |  |
|------------------------|---------------------------------|--|
|                        | Transient Sources               | Continuous/Frequent Intermittent Sources |
| Barely Perceptible     | 0.04                            | 0.01                                     |
| Distinctly Perceptible | 0.25                            | 0.04                                     |
| Strongly Perceptible   | 0.9                             | 0.10                                     |
| Severe                 | 2.0                             | 0.4                                      |

*Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.*  
Source: Caltrans 2002(b), 2004

## IMPACTS AND MITIGATION MEASURES

### SIGNIFICANCE CRITERIA

Criteria for determining the significance of noise impacts were developed based on information contained in the California Environmental Quality Act Guidelines (CEQA Guidelines, Appendix G). According to the guidelines, a project may have a significant effect on the environment if it would result in the following conditions:

- a) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or of applicable standards of other agencies;
- b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- e) For a project located within an airport land use plan area or, where such a plan has not been adopted, within two miles of a public airport or a public use airport, would the project expose people residing or working in the project area to excessive noise levels?;
- f) 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?;

The nearest airports in the vicinity of the project site include the Auburn Municipal Airport, located approximately 3.75 miles south of the project site, and the Alta Sierra Airport, located approximately 6.2 miles north of the project site. The project site is not located within 2 miles of a public airport or private airstrip, nor would implementation of the proposed project affect airport operations or result in increased exposure of noise-sensitive receptors to aircraft noise. For these reasons, exposure to aircraft noise levels would be considered less than significant and have not been discussed further in this report.

Temporary noise impacts associated with the proposed project would be associated with short-term construction-related activities. Long-term permanent increases in noise levels would occur associated with onsite operational activities, as well as, potential increases in traffic noise levels along area roadways. Potential increases in groundborne vibration levels would be primarily associated with short-term construction-related activities. For purposes of this analysis and where applicable, the Nevada County noise standards were used for evaluation of project-related noise impacts. Thresholds of significance used in this analysis are discussed below:

#### Short-term Construction Noise

As previously discussed and noted in **Table 5**, construction activities are exempt from the County's noise standards. In the absence of applicable County noise standards, short-term construction noise impacts would be considered significant if the proposed project would result in increased levels of nuisance during the more noise-sensitive evening and nighttime hours. For residential land uses, noise-generating construction activities that would result in an increase in ambient noise levels between the hours of 7:00 p.m. and 7:00 a.m. would be considered to result in a potentially significant impact. In addition, sustained short-term construction-generated

noise levels that would exceed the commonly applied interior noise threshold for speech communication (i.e., 60 dBA  $L_{eq}$ ) within nearby existing residential dwellings would also be considered to have a potentially significant impact. Assuming an average exterior-to-interior noise reduction of 20 dB for typical residential construction, an interior noise level threshold of 60 dBA  $L_{eq}$  would equate to an exterior noise threshold of 80 dBA  $L_{eq}$ , which is consistent with the exterior threshold often recommended for construction activities by other governmental agencies, such as the Federal Transit Administration (FTA 2006).

### **Long-term Operational Non-Transportation Noise**

Long-term operational noise impacts would be considered significant if the proposed project would result in non-transportation noise levels that would exceed applicable County noise standards at nearby noise-sensitive land uses. County noise standards are identified in **Table 5**.

### **Long-term Operational Traffic Noise**

Long-term operational noise impacts would be considered significant if the proposed project would result in a substantial increase in ambient noise levels that would exceed the County noise standards for land use compatibility (**Figure 3**). For purposes of this analysis, a substantial increase in noise levels is defined as an increase of 5.0, or greater, where the noise levels, without project implementation, are less than the County's "normally acceptable" noise standard of 60 dBA CNEL/ $L_{dn}$ ; 3 dBA, or greater, where the noise level, without project implementation, ranges from 60 to 65 dBA CNEL/ $L_{dn}$ ; and 1.5 dB, or greater, where the noise level, without project implementation, exceeds 65 dBA CNEL/ $L_{dn}$  (**Table 2**). The rationale for these noise criteria is that as ambient noise levels increase, a smaller increase in noise resulting from a project is sufficient to cause a substantial increase in annoyance. Substantial increase in noise levels that would also exceed applicable noise standards at primarily affected noise-sensitive land uses would be considered to have a significant impact.

### **Exposure to Groundborne Vibration**

Groundborne vibration levels would be considered significant if predicted short-term construction or long-term operational groundborne vibration levels attributable to the proposed project would exceed normally applied groundborne vibration criteria (**Tables 7 and 8**) at nearby existing structures.

### **Land Use Compatibility**

The compatibility of proposed land uses were evaluated in comparison to the County's General Plan noise standards for land use compatibility (**Figure 3**), based on projected future cumulative noise conditions. Accordingly, convalescent care facilities and residential dwellings are considered "normally acceptable" within exterior noise environments up to 60 dBA CNEL/ $L_{dn}$ . The proposed project would be considered to have a potentially significant impact if projected future noise levels at the project site would exceed 60 dBA CNEL/ $L_{dn}$ .

## **METHODOLOGY**

A combination of existing literature, noise level measurements, and application of accepted noise prediction and sound propagation algorithms were used for the prediction of short-term construction and long-term non-transportation and transportation source noise levels, as well as, for the evaluation of groundborne vibration impacts.

### **Short-Term Construction Noise**

Predicted noise levels at nearby noise-sensitive land uses were calculated utilizing typical noise levels and usage rates associated with construction equipment, derived from the U.S. Department of Transportation, Federal Highway Administration's *Roadway Construction Noise Model* (version 1.1). Construction noise levels were predicted assuming an average noise attenuation rate of 6 dB per doubling of distance from the source.

### **Long-term Operational Non-Transportation Noise**

Predicted noise levels associated with non-transportation noise sources were calculated based on representative data obtained from existing literature, as well as, noise measurement data obtained from similar uses. Operational noise levels were calculated at the nearest onsite noise-sensitive receptors and at the property line of the nearest offsite residential land use assuming an average noise-attenuation rate of 6 dB/doubling of distance from the source. To be conservative, no shielding due to intervening terrain or non-source structures was included in the calculation. It is important to note that the County's noise standards are applied only on properties containing a noise-sensitive land use, such as residential dwellings, and may be applied anywhere on the property or at the property boundary. To be conservative, predicted noise levels at existing offsite receptors were calculated based on the distance from the source center to the nearest receptor property line. Modeling assumptions and calculations are included in **Appendix A**.

### **Long-term Traffic Noise & Land Use Compatibility**

Traffic noise levels were calculated using the FHWA roadway noise prediction model (FHWA-RD-77-108) based on California vehicle reference noise emission factors and traffic data obtained from the traffic analysis prepared for this project. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. Predicted noise levels were calculated at a distance of 50 feet from the near-travel-lane centerline, as well as distances to the predicted noise contours. Increases in traffic noise levels attributable to the proposed project were determined based on a comparison of predicted noise levels, with and without project implementation. The compatibility of proposed land uses was evaluated based on projected future onsite transportation noise levels, with project implementation. Predicted onsite noise levels were compared with the County's corresponding noise criteria for determination of land use compatibility (**Figure 3**). Modeling assumptions and calculations are included in **Appendix A**.

### **Groundborne Vibration**

No major existing sources of groundborne vibration have been identified in the proposed project area. Groundborne vibration impacts would be primarily associated with short-term construction activities. Groundborne vibration levels associated with construction-related activities were evaluated utilizing typical groundborne vibration levels rates associated with construction equipment, obtained from the U.S. Department of Transportation, Federal Transit Administration's *Transit Noise and Vibration Impact Assessment Guidelines* (2006). Groundborne vibration impacts related to structural damage and human annoyance were evaluated taking into account the distance from construction activities to nearby land uses and typically applied criteria for structural damage and human annoyance (**Tables 7 and 8**).

## IMPACTS AND MITIGATION MEASURES

**IMPACT 1** *Short-term Exposure to Construction Noise. Construction activities could result in a substantial temporary increase in ambient noise levels at nearby noise-sensitive land uses, which may result in increased levels of annoyance, activity interference, and sleep disruption. This impact is considered **potentially significant**.*

Construction noise associated with future development would be temporary and would vary depending on the nature of the construction activities being performed. Noise generated during construction is typically associated with the operation of off-road equipment, including excavation equipment, material handlers, and portable generators. **Table 9** lists typical uncontrolled noise levels generated by individual pieces of representative construction equipment likely to be used during construction. Noise levels associated with individual construction equipment can reach levels of up to approximately 90 dBA  $L_{max}$  (FTA 2006). Noise from localized point sources, such as construction sites, typically decreases by approximately 6 dBA with each doubling of distance from source to receptor. Given this noise attenuation rate and typical construction equipment noise levels and usage rates, combined noise levels associated with construction activities can reach levels of up to approximately 84 dBA  $L_{eq}$  at 50 feet (EPA 1971). Depending on the location and type of construction activities conducted, construction-generated noise levels at the nearest existing offsite residential land uses, which are located west of the project site, could reach levels of up to approximately 72 dBA  $L_{eq}$ , when construction activities occur near the western boundary of the project site.

Based on the predicted exterior noise level discussed above and assuming an average exterior-to-interior noise reduction of 20 dB, predicted interior noise levels of the nearest existing offsite residential land uses could reach approximately 52 dBA  $L_{eq}$  for short-periods of time, which would not be projected to exceed the commonly applied interior speech communication noise threshold of 60 dBA  $L_{eq}$ . However, with regard to residential land uses, noise levels associated with construction activities occurring during the more noise-sensitive evening and nighttime hours (i.e., 7 p.m. to 7 a.m.) are of increased concern. Because exterior ambient noise levels typically decrease during the nighttime hours as community activities (e.g., commercial activities, vehicle traffic) decrease, construction activities performed during these more noise-sensitive periods of the day could result in increased annoyance and potential sleep disruption for occupants of nearby residential dwellings. It is important to note that construction noise levels are highly variable and would last only as long as construction activities occur. Nonetheless, short-term noise-generating construction activities associated with future development would be considered to have a **potentially significant** impact.

**TABLE 9**  
**Typical Construction Equipment Noise Levels**

| Equipment                       | Typical Noise Level (dBA)<br>at 50 feet from Source |                 |
|---------------------------------|---|-----------------|
|                                 | L <sub>max</sub>                                    | L <sub>eq</sub> |
| Air Compressor                  | 80  | 76              |
| Backhoe/Front End Loader        | 80  | 76              |
| Compactor (Ground)              | 80  | 73              |
| Concrete Mixer Truck            | 85  | 81              |
| Concrete Mixer (Vibratory)      | 80  | 73              |
| Concrete Pump Truck             | 82  | 75              |
| Concrete Saw                    | 90  | 83              |
| Crane                           | 85  | 77              |
| Dozer/Grader/Excavator/Scraper  | 85  | 81              |
| Drill Rig Truck                 | 84  | 77              |
| Generator                       | 82  | 79              |
| Gradall                         | 85  | 81              |
| Hydraulic Break Ram             | 90  | 80              |
| Jack Hammer                     | 85  | 78              |
| Impact Hammer/Hoe Ram (Mounted) | 90  | 83              |
| Pavement Scarifier/Roller       | 85  | 78              |
| Paver                           | 85  | 82              |
| Pneumatic Tools                 | 85  | 82              |
| Pumps                           | 77  | 74              |
| Truck (Dump/Flat Bed)           | 84  | 80              |
| <i>Sources: FHWA 2006</i>       |   |                 |

**Mitigation Measure Noise-1**

The following mitigation measures shall be implemented and specified on all construction contracts:

- a. Construction activities (excluding activities that would result in a safety concern to the public or construction workers) shall be limited to between the hours of 7:00 a.m. and 7:00 p.m. Construction activities shall be prohibited on Sundays and federal holidays.
- b. Construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and shrouds, in accordance with manufacturers' recommendations.
- c. Construction equipment staging areas shall centrally located on the project site or located at the furthest distance possible from nearby residential land uses.

- d. All motorized construction equipment and vehicles shall be turned off when not in use.

Timing/Implementation: Prior to and during construction.

Enforcement/Monitoring: Nevada County.

**Significance After Mitigation**

Implementation of the above mitigation measures would limit construction activities to the less noise-sensitive periods of the day. Use of manufacturer-recommended noise control devices, such as exhaust mufflers and engine shrouds, can reduce individual equipment noise levels by approximately 10 dBA. With implementation of the above mitigation measures, noise-generating construction activities would be considered **less than significant**.

**IMPACT 2** *Increases in Traffic Noise.* Implementation of the proposed project would not result in significant increase in traffic noise levels at nearby noise-sensitive receptors. This impact would be considered **less than significant**.

Implementation of the proposed project would result in increased traffic volumes on some area roadways. The increase in traffic volumes resulting from implementation of the proposed project would, therefore, contribute to predicted increases in traffic noise levels. The FHWA Highway Traffic Noise Prediction Model (FHWA RD77-108), utilizing CALVENO noise emission factors, was used to predict traffic noise levels along primarily affected roadway segments, with and without implementation of the proposed project. Based on information obtained from the traffic analysis prepared for this project, primarily affected roadways would include Rincon Way and nearby segments of SR 49. The Project's contribution to traffic noise levels along these roadways was determined by comparing the predicted noise levels with and without project-generated traffic. Predicted traffic noise levels, with and without development of the proposed project, are summarized in **Table 10**.

**TABLE 10**  
**Predicted Increases in Traffic Noise Levels**  
**Existing Conditions**

| Roadway    | CNEL/L <sub>dn</sub> at 50 Feet from Near-Travel-Lane Centerline <sup>1</sup> |              | Predicted Noise Level Increase | Substantial Noise Level Increase? <sup>2</sup> |
|------------|---|--------------|--------------------------------|--|
|            | Without Project   | With Project |                                |  |
| SR 49      | 74.38   | 74.46        | 0.08                           | No   |
| Rincon Way | 43.41   | 48.34        | 4.93                           | No   |

1. Traffic noise levels were calculated using the FHWA roadway noise prediction model.  
 2. Substantial increases defined as an increase of 5.0, or greater, where noise levels are less than the County's normally acceptable minimum noise level of 60 dBA CNEL/L<sub>dn</sub>; 3 dBA, or greater, where noise levels range from 60 to 65 dBA CNEL; and 1.5 dB, or greater, where the noise level exceeds 65 dBA CNE,L without the proposed project.

As depicted in **Table 10**, the proposed project would result in predicted increases in traffic noise levels of approximately 0.08 dBA along nearby segments of SR 49 and approximately 4.93 dBA along Rincon Way. The proposed project would not result in a substantial increase in traffic noise levels along primarily affected area roadways. As a result, increases in traffic noise levels attributable to the proposed project would be considered **less than significant**.

**IMPACT 3** *Exposure to Non-Transportation Source Noise. Implementation of the proposed project may result in non-transportation noise levels that could exceed applicable noise standards at nearby noise-sensitive land uses. This impact would be considered **potentially significant**.*

Long-term operation of the proposed project would include onsite activities and the operation of stationary equipment that would result in increases in ambient noise levels that could exceed applicable County noise standards at nearby onsite and offsite noise-sensitive receptors. Predicted average-hourly and maximum intermittent noise levels at the nearest onsite and offsite receptors associated with major onsite noise sources are summarized in **Table 11** and **Table 12**, respectively, and discussed in greater detail, as follows:

#### Sewer Lift Stations

The proposed project includes the construction of two onsite sewer lift stations, including one station located along the emergency access road, approximately 120 feet south of the project site's northern property line; and a second station located south of the proposed farm fields, approximately 1,080 feet south of the northern property line. The proposed pump stations are anticipated to include an emergency power generator, control panel, exhaust fans, and booster pump. The booster pump would be located below grade within an underground vault. The remaining equipment would be located above ground and housed within an enclosed structure. Based on data obtained from similar pump stations, operational noise levels associated with pump station equipment can reach combined levels of up to approximately 78 dBA  $L_{eq}$  at 50 feet from the structure, depending on the equipment installed and structural design.

Detailed equipment specifications have not yet been identified for the proposed pump stations. Noise levels were, therefore, predicted based on typical noise levels derived from representative equipment and manufacturer specifications data. Depending on building design, average interior-to-exterior noise reductions typically range from approximately 10 to 25 dBA. Combined equipment noise levels were calculated at the property line of the nearest residential land use, assuming a minimum sound transmission loss of approximately 10 dBA for the pump station building. Modeling was conducted assuming that all equipment, including the emergency generator, would be operating simultaneously. As indicated in **Table 11** and **Table 12** and depending on the hour of day, predicted operational noise levels at the nearest onsite and offsite receptors for both of the proposed pump stations would exceed the County's applicable average-hourly and maximum intermittent noise standards. Actual noise levels would vary depending on final building design, construction materials and techniques, and the equipment installed. Noise generated by the proposed onsite pump stations would be considered **potentially significant**.

#### Onsite Agricultural Activities

The proposed project includes farm fields to be used for row crop production and a small orchard area, which are centrally located within the northern portion of the proposed project site. Noise generated by agricultural activities would be primarily associated with the intermittent and seasonal use of small tractors and related farm equipment. Noise levels associated with the operation of farm tractors can reach levels of approximately 92 dBA at 5 feet (NASD 2010). Predicted average-hourly and maximum intermittent noise levels at the nearest onsite and offsite receptors associated with onsite agricultural activities are summarized in **Table 11** and **Table 12**, respectively. Depending on the hour of day, average-hourly and maximum intermittent operational noise levels for onsite agricultural activities could potentially

exceed applicable County noise standards at the nearest onsite and offsite receptors. As a result, noise impacts associated with onsite agricultural activities would be considered potentially **significant**.

#### Automotive & Tractor Repair Barns

The proposed project includes the proposed construction of onsite automotive and tractor repair barns, to be located adjacent to and west of the proposed farm fields. Noise generated by automotive and tractor repair facilities is predominantly associated with the use of small hand-held pneumatic tools (power sanders, grinders, impact wrenches). Other equipment operations such as lifts, compressed air nozzles, air compressors, and welders would generate a lesser degree of noise impact. Operational noise levels can reach approximately 83 dBA  $L_{eq}$  at 50 feet, with intermittent noise events reaching levels of up to approximately 85 dBA  $L_{max}$  at 50 feet. As indicated in **Table 11** and **Table 12** and depending on the hour of day, average-hourly operational noise levels would exceed applicable County noise standards at the nearest receptors. Noise generated during the more noise-sensitive nighttime hours would also be projected to exceed the County's average-hourly noise standards at the nearest offsite receptors. As a result, noise impacts associated with the automotive and tractor repair barns would be considered potentially **significant**.

#### Property Maintenance Activities

Noise-generating activities and noise sources commonly associated with property maintenance activities are typically associated with onsite landscape maintenance, including the operation of leaf blowers, lawn mowers, power sweepers, and vacuum trucks; as well as, occasional waste collection activities. These activities can result in varying noise levels of approximately 70 to 110 dBA  $L_{max}$  at 3 feet. Maintenance-related activities typically occur on an intermittent basis or over a large area, which reduces prolonged exposure at any one receptor. Nonetheless, as indicated in Table 11 and Table 12, predicted noise levels at nearby onsite and offsite receptors could potentially exceed the County's average-hourly and maximum intermittent noise standards. As a result, noise levels generated by onsite landscape maintenance and waste collection activities would be considered potentially significant.

#### Building Equipment

Noise-generating mechanical equipment associated with the proposed onsite structures would be anticipated to include air and water circulation systems (e.g., heating, ventilation, and air conditioning systems, and boilers). Noise generated by mechanical building equipment would occur on an intermittent basis, primarily during the day and evening hours and less frequently at night. In general, noise levels generated by such systems typically average between 55 and 85 dBA at 3 feet from the source (EPA 1971). Mechanical equipment is typically shielded from direct public exposure and usually housed on rooftops, within equipment rooms, or within exterior enclosures. In addition to building mechanical equipment, equipment used for material loading and unloading activities at commercial use structures and lodges could also generate high noise levels. Noise levels commonly associated with material loading and unloading areas typically average approximately to 60 dBA  $L_{eq}$  at 50 feet.

Noise generated by building mechanical equipment intended to serve larger onsite structures, such as the proposed lodges and commercial use structures, would have the highest potential for noise-related impacts. Detailed equipment and building specifications have not yet been identified. Noise levels were, therefore, predicted based on typical noise levels derived from representative equipment and manufacturer specifications data. As depicted in **Table 11** and **Table 12** and depending on the hour of day, operational noise levels at the nearest onsite and offsite receptors could potentially exceed the County's average-hourly noise standards.

Predicted maximum intermittent noise levels would also be projected to exceed the County's nighttime noise standard. Actual noise levels would vary depending on final building design, construction materials and techniques, and the equipment installed. Noise generated by onsite building equipment, including equipment operation within outdoor material loading and unloading areas, would be considered **potentially significant**.

#### Onsite Recreational Uses

Noise generated by onsite recreational uses would be primarily associated with the proposed tennis courts, beach volleyball courts, bocce ball courts, pickle ball courts, and swimming pools. Recreational uses involving multiple participants would typically generate the highest noise levels. Activities resulting in impact noise events, such as tennis and pickle ball courts, can also generate relatively high noise levels that can result in increased levels of annoyance to occupants of nearby residential dwellings.

Predicted average-hourly and maximum intermittent noise levels associated with the proposed onsite recreational activities are summarized in **Table 11** and **Table 12**, respectively. As indicated, operational noise levels associated with the proposed tennis courts, beach volleyball courts, and bocce ball courts would not be projected to exceed the County's noise standards at the nearest onsite or offsite receptor. However, operational noise levels associated with the proposed pickle ball courts and the outdoor swimming pool, which are located adjacent to and north of the Rincon Way, would be projected to exceed the County's average-hourly and maximum intermittent noise standards at nearby receptors, particularly during the more noise-sensitive evening and nighttime hours. As a result, noise generated by these proposed onsite recreational uses would be considered **potentially significant**.

#### **Impact Summary**

Onsite non-transportation noise sources, including the proposed sewer lift stations, agricultural activities, automotive and tractor repair barns, property maintenance activities, building equipment, and recreational uses (i.e., pickle ball courts and outdoor swimming pool), would result in predicted noise levels in excess of County noise standards. Due to decreases in ambient noise levels during the quieter nighttime hours activities occurring during the more noise-sensitive nighttime hours (i.e., 10 p.m. to 7 a.m.) would have a higher potential for increased levels of annoyance and potential sleep disruption to occupants of nearby onsite and offsite residential dwelling units. Noise impacts associated with these onsite sources would be considered to have a **potentially significant** impact.

**TABLE 11**  
**Summary of Predicted Non-Transportation Average-Hourly Noise Levels**  
**at Offsite and Onsite Noise-Sensitive Receptors**

| Source                         | Predicted Exterior Noise Levels at the Property Line of the Nearest Existing Offsite Residence (dBA) <sup>1</sup> |                                   |  |                 |               | Predicted Exterior Noise Levels at the Nearest Proposed Onsite Noise-Sensitive Receptor (dBA) <sup>1,2</sup> |                                   |  |                 |               |
|--------------------------------|---|-----------------------------------|--|-----------------|---------------|--|-----------------------------------|--|-----------------|---------------|
|                                | Distance from Source to Receptor (feet)   | Average Hourly (L <sub>eq</sub> ) | Equals or Exceeds County Noise Standard? |                 |               | Distance from Source to Receptor (feet)  | Average Hourly (L <sub>eq</sub> ) | Equals or Exceeds County Noise Standard? |                 |               |
|                                |   |                                   | Day (55 dB)                              | Evening (50 dB) | Night (40 dB) |  |                                   | Day (55 dB)                              | Evening (50 dB) | Night (40 dB) |
| Sewer Lift Station #1 (North)  | 120   | <b>60</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    | 1300   | <b>40</b>                         | No                                       | No              | <b>Yes</b>    |
| Sewer Lift Station #2 (South)  | 1080  | 41                                | No                                       | No              | <b>Yes</b>    | 195  | <b>56</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Onsite Agricultural Activities | 480   | <b>52</b>                         | No                                       | <b>Yes</b>      | <b>Yes</b>    | 270  | <b>57</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Auto/Tractor Repair Barns      | 540   | 47                                | No                                       | No              | <b>Yes</b>    | 75   | <b>64</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Property Maintenance           | 100   | <b>66</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    | 50   | <b>72</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Building Equipment             | 165   | <b>50</b>                         | No                                       | <b>Yes</b>      | <b>Yes</b>    | 50   | <b>61</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Tennis Courts                  | 150   | 32                                | No                                       | No              | No            | 120  | 33                                | No                                       | No              | No            |
| Beach Volleyball Courts        | 1100  | 10                                | No                                       | No              | No            | 720  | 14                                | No                                       | No              | No            |
| Bocce Ball Courts              | 180   | 24                                | No                                       | No              | No            | 75   | 31                                | No                                       | No              | No            |
| Pickle Ball Courts             | 225   | <b>46</b>                         | No                                       | No              | <b>Yes</b>    | 75   | <b>56</b>                         | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Outdoor Swimming Pool *        | 270   | 37                                | No                                       | No              | No            | 30   | <b>54</b>                         | No                                       | <b>Yes</b>      | <b>Yes</b>    |

1. The County's noise standards are applied only on properties containing a noise-sensitive land use, such as residential dwellings, and may be applied anywhere on the property or at the property boundary. To be conservative, predicted noise levels at existing offsite receptors were calculated based on the distance from the source center to the nearest receptor property line, based on to the proposed site plan and aerial photo interpretation. Predicted noise levels do not include shielding from intervening terrain or non-source structures.

2. Predicted noise levels at onsite receptors are based on distance from source center to the nearest building structure. Predicted noise levels do not include shielding from intervening terrain or non-source structures.

Predicted noise levels that exceed corresponding noise thresholds are depicted in **bold font**. Refer to **Appendix A** for modeling assumptions and results.

**TABLE 12**  
**Summary of Predicted Non-Transportation Maximum Intermittent Noise Levels**  
**at Offsite and Onsite Noise-Sensitive Receptors**

| Source                         | Predicted Exterior Noise Levels at the Property Line of the Nearest Existing Residence (dBA) <sup>1</sup> |   |  |                 |               | Predicted Exterior Noise Levels at the Nearest Onsite Noise-Sensitive Receptor (dBA) <sup>1,2</sup> |   |  |                 |               |
|--------------------------------|---|---|--|-----------------|---------------|---|---|--|-----------------|---------------|
|                                | Distance from Source to Receptor (feet)   | Maximum Noise Level (L <sub>max</sub> ) | Equals or Exceeds County Noise Standard? |                 |               | Distance from Source to Receptor (feet)   | Maximum Noise Level (L <sub>max</sub> ) | Equals or Exceeds County Noise Standard? |                 |               |
|                                |   |   | Day (75 dB)                              | Evening (65 dB) | Night (55 dB) |   |   | Day (75 dB)                              | Evening (65 dB) | Night (55 dB) |
| Sewer Lift Station #1 (North)  | 120   | <b>62</b>                               | No                                       | No              | <b>Yes</b>    | 1300  | 42                                      | No                                       | No              | No            |
| Sewer Lift Station #2 (South)  | 1080  | 43                                      | No                                       | No              | No            | 195   | <b>58</b>                               | No                                       | No              | <b>Yes</b>    |
| Onsite Agricultural Activities | 480   | <b>60</b>                               | No                                       | No              | <b>Yes</b>    | 270   | <b>65</b>                               | No                                       | <b>Yes</b>      | <b>Yes</b>    |
| Auto/Tractor Repair Barns      | 540   | 49                                      | No                                       | No              | No            | 75  | <b>66</b>                               | No                                       | <b>Yes</b>      | <b>Yes</b>    |
| Property Maintenance           | 100   | <b>80</b>                               | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    | 50  | <b>86</b>                               | <b>Yes</b>                               | <b>Yes</b>      | <b>Yes</b>    |
| Building Mechanical Equipment  | 165   | <b>55</b>                               | No                                       | No              | <b>Yes</b>    | 50  | <b>65</b>                               | No                                       | No              | <b>Yes</b>    |
| Tennis Courts                  | 150   | 41                                      | No                                       | No              | No            | 120   | 42                                      | No                                       | No              | No            |
| Beach Volleyball Courts        | 1100  | 24                                      | No                                       | No              | No            | 720   | 27                                      | No                                       | No              | No            |
| Bocce Ball Courts              | 180   | 44                                      | No                                       | No              | No            | 75  | 52                                      | No                                       | No              | No            |
| Pickle Ball Courts             | 225   | 53                                      | No                                       | No              | No            | 75  | <b>63</b>                               | No                                       | No              | <b>Yes</b>    |
| Swimming Pool (Outdoor)        | 270   | 36                                      | No                                       | No              | No            | 30  | <b>55</b>                               | No                                       | No              | <b>Yes</b>    |

1. The County's noise standards are applied only on properties containing a noise-sensitive land use, such as residential dwellings, and may be applied anywhere on the property or at the property boundary. To be conservative, predicted noise levels at existing offsite receptors were calculated based on the distance from the source center to the nearest receptor property line, based on to the proposed site plan and aerial photo interpretation. Predicted noise levels do not include shielding from intervening terrain or non-source structures.

2. Predicted noise levels at onsite receptors are based on distance from source center to the nearest building structure. Predicted noise levels do not include shielding from intervening terrain or non-source structures.

Predicted noise levels that exceed corresponding noise thresholds are depicted in **bold** font. Refer to **Appendix A** for modeling assumptions and results.

## **Mitigation Measure Noise-2**

The following mitigation measures shall be implemented:

### Sewer Lift Stations

- a. Sewer lift stations shall be designed so that operation noise levels at nearby noise-sensitive receptors would not exceed applicable Nevada County noise standards (refer to **Table 5** of this report). Typical design measures may include, but are not limited to, selection of low-noise generating equipment, incorporation of equipment shielding and enclosures, and use of sound-rated doors and vents.

### Onsite Agricultural Activities

- b. Onsite agricultural activities shall be limited to the daytime hours of 7 a.m. to 7 p.m.

### Auto/Tractor Repair Barns

- c. Use of the auto/tractor repair barns shall be subject to the following conditions:
  1. Noise-generating activities/equipment repair shall be prohibited within outdoor areas.
  2. Use of the auto/tractor repair barns shall be limited to the daytime hours of 7 a.m. to 7 p.m.
  3. All doors and windows shall be closed when noise-generating activities are conducted.
  4. Signage specifying the above conditions shall be posted at building entrances.
- d. Stationary equipment (i.e., air compressors, generators, etc.) shall be designed and installed so that operational noise levels at nearby noise-sensitive land uses would not exceed applicable Nevada County noise standards of 55 dBA  $L_{eq}$  during the daytime hours of 7 a.m. to 7 p.m., in accordance with Nevada County noise standards (refer to **Table 5** of this report). Typical design measures may include, but are not limited to, the selection of low-noise generating equipment, incorporation of equipment shielding, and locating equipment indoors and/or within enclosures.
- e. Main building entrances/overhead doors shall be shielded from direct line-of-sight of proposed onsite dwelling units located within 250 feet of the repair barns.

### Property Maintenance

- f. Landscape maintenance activities shall be limited to the daytime hours of 7 a.m. to 7 p.m.
- g. Building equipment and material loading/unloading areas shall be designed so that operation noise levels at nearby noise-sensitive receptors would not exceed applicable Nevada County noise standards (refer to **Table 5** of this report). Typical design measures may include, but are not limited to, selection of low-noise generating equipment, incorporation of equipment shielding and enclosures, use of sound-rated doors and vents, and incorporation of sound barriers/building parapets to interrupt line-of-sight between the source and nearby receptors.

### Building Mechanical Equipment

- h. Building equipment shall be designed and installed so that operational noise levels at nearby noise-sensitive land uses would not exceed applicable Nevada County noise standards (refer to **Table 5** of this report). Typical design measures may include, but are not limited to, selection of low-noise generating equipment, incorporation of equipment shielding, and locating equipment indoors and/or within enclosures. Building parapets

should be incorporated, where necessary, to shield roof-mounted equipment from direct line-of-sight of nearby noise-sensitive receptors.

#### Recreational Uses

- i. Use of recreational areas shall be prohibited during the more noise-sensitive nighttime hours of 10 p.m. to 7 a.m.
- j. Pickle ball courts shall be located no closer than 250 feet of existing adjacent residential properties or onsite residential units; or, shielding (e.g., noise curtains/blankets or barriers) shall be installed at the court perimeter sufficient to shield noise-sensitive receptors located within 250 feet of the courts. Noise curtains or barriers shall be installed/constructed to a minimum height of 6 feet above ground level with no visible air gaps between construction materials or at the base of the structure.
- k. Swimming pool equipment (e.g., pumps, heaters, and blower units) shall be designed and installed so that equipment operational noise levels at nearby noise-sensitive land uses would not exceed applicable Nevada County noise standards (refer to **Table 5** of this report). Typical design measures may include, but are not limited to, selection of low-noise generating equipment, incorporation of equipment shielding, and locating equipment indoors and/or within enclosures.

#### Proposed Dwelling Units

- l. Proposed dwelling units shall comply with applicable California Code of Regulations Title 24 noise insulation standards for allowable interior noise levels of 45 dBA CNEL in habitable rooms.
- m. Proposed onsite dwelling units shall be equipped with fresh air supply systems or air conditioning systems to allow window to remain closed during inclement weather conditions so that acceptable interior noise levels can be maintained.
- n. Outdoor activity areas or residential dwellings located within 175 feet of pickle ball courts and outdoor swimming pool, 350 feet of proposed onsite agricultural farming/orchard areas, and within 250 feet of the proposed auto/tractor repair barns shall be shielded from direct line-of-sight of these noise sources, to be measured at a height of 5 feet above ground level. These distances represent the area of potential impact within which noise levels from these sources are projected to potentially exceed the County's noise standards.
- o. Onsite dwelling units located within 175 feet of pickle ball courts and outdoor swimming pool, 350 feet of proposed onsite agricultural farming/orchard areas, and within 250 feet of the proposed auto/tractor repair barns shall be provided written notification of potential exposure to nuisances noise associated with the operation of these nearby uses prior to purchase/occupancy. These distances represent the area of potential impact within which noise levels from these sources are projected to potentially exceed the County's noise standards.

*Timing/Implementation: Prior to construction and during operation.*

*Enforcement/Monitoring: Nevada County.*

## Significance After Mitigation

With mitigation, acoustical analyses would be required for major noise-generating sources, including the proposed sewer pump stations, automotive and tractor repair barns, and building equipment, to ensure that facilities are designed in compliance with County noise standards. Additional measures have been included to reduce the potential for increased levels of annoyance and sleep disruption to nearby noise-sensitive receptors, including restrictions on the hours of operation for onsite recreational uses, maintenance activities, and agricultural activities. Proposed residential dwelling units would also be required to comply with California Title 24 noise insulation standards of 45 dBA CNEL for habitable rooms. Additional mitigation was included that would require the outdoor activity areas of primarily impacted onsite dwelling units to be shielded from direct line-of-sight of nearby noise sources and that advance notification be provided to occupants of these residences to inform them of potential exposure to nuisance noise from these nearby sources. This would include residential dwelling units located near the proposed pickle ball courts, outdoor swimming pool, farm fields and orchards, and auto/tractor repair barns. With mitigation, operational noise levels would be reduced to a **less than significant** level.

**IMPACT 4:** *Exposure to Groundborne Vibration. Ground-borne vibration levels associated with construction activities would not be projected to exceed applicable groundborne vibration criterion at nearby land uses. This impact would be less than significant.*

Ground vibration spreads through the ground and diminishes in strength with distance. The effects of ground vibration can vary from no perceptible effects at the lowest levels, low rumbling sounds and detectable vibrations at moderate levels, and slight damage to nearby structures at the highest levels. At the highest levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely result in structural damage. For most structures, a peak particle velocity (ppv) threshold of 0.5 inches per second (in/sec) is sufficient to avoid structure damage, with the exception of fragile historic structures or ruins. For the protection of fragile, historic, and residential structures, the California Department of Transportation recommends a more conservative threshold of 0.2 inches per second ppv. This same threshold would represent the level at which vibrations would be potentially annoying to people in buildings (FTA 2006, Caltrans 2002).

Long-term operational activities associated with the proposed project would not involve the use of any equipment or processes that would result in potentially significant levels of ground vibration. Increases in groundborne vibration levels attributable to the proposed project would be primarily associated with short-term construction-related activities. Groundborne vibration levels associated with construction equipment are summarized in **Table 13**.

Construction activities associated with the proposed project would not be anticipated to require the use of pile drivers. Based on the vibration levels presented in **Table 11**, ground vibration generated by typical offroad construction equipment, such as tractors, trucks, and tractors, would be less than 0.09 inches per second ppv at 25 feet and would not pose a significant risk to nearby structures or occupants. As a result, this impact would be considered **less than significant**.

**TABLE 13**  
**Representative Construction Equipment Vibration Levels**

| Equipment        | Peak Particle Velocity<br>at 25 Feet (in/sec ppv) |
|------------------|---|
| Large Tractors   | 0.089   |
| Caisson Drilling | 0.089   |
| Loaded Trucks    | 0.076   |
| Jackhammer       | 0.035   |
| Small Tractors   | 0.003   |

Source: Caltrans 2004, FTA 2006

**IMPACT 5:** *Compatibility of Proposed Land Uses with Projected Future Noise Levels. Projected on-site noise levels at proposed on-site land uses would not exceed the County's "normally acceptable" noise exposure standards for land use compatibility. As a result, this impact is considered **less than significant**.*

The compatibility of proposed land uses are evaluated based on a comparison of predicted future cumulative traffic noise levels at the site to the County's General Plan exterior noise standards (**Figure 3**). According to the County's General Plan noise standards for land use compatibility, residential land uses and convalescent care facilities are considered "normally acceptable" within exterior noise environments up to 60 dBA CNEL/L<sub>dn</sub>.

As noted earlier in this report, noise levels within the project area are predominantly influenced by vehicle traffic noise emanating from Highway 49. To a lesser extent, noise generated by vehicle traffic on Rincon Way would also contribute to the projected future noise environment. Predicted future cumulative transportation noise levels for these sources, with implementation of the proposed project, were calculated using the FHWA Highway Traffic Noise Prediction Model (FHWA RD77-108), based on CALVENO noise emission factors and traffic data obtained from the traffic analysis prepared for this project. Based on the modeling conducted, the projected future 60 dBA noise contour for Highway 49 would extend approximately 831 feet from the roadway centerline. The projected future 60 dBA noise contour for Rincon Way would not extend beyond the roadway right of way. The project site would not be located with the projected 60 dBA CNEL/L<sub>dn</sub> contours of these roadways. Predicted future onsite noise levels would not be projected to exceed the County's "normally acceptable" noise standard of 60 dBA CNEL/L<sub>dn</sub> at proposed onsite land uses. As a result, this impact would be considered **less than significant**.

## CUMULATIVE SETTING

The geographic extent of the cumulative setting for noise consists of the project area and the surrounding areas within the County. Cumulative development conditions would result in increased cumulative roadway noise levels, and would also result in increased noise associated with future development. As noted earlier in this report, ambient noise levels in the project area are influenced primarily by traffic noise emanating from area roadways, particularly Highway 49 and Rincon Way. No major stationary sources of noise have been identified in the project area. The primary factor for cumulative noise impact analysis is, therefore, the consideration of future traffic noise levels.

## CUMULATIVE IMPACTS & MITIGATION MEASURES

**IMPACT 6:** *Contribution to Cumulative Noise Levels. Implementation of the proposed project would not result in a substantial contribution to cumulative noise levels and would be considered **less than significant**.*

The project's contribution to the cumulative traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic. Predicted increases in future cumulative traffic noise levels along primarily affected roadways are depicted in **Table 14**. As depicted, implementation of the proposed project would result in predicted increases of 0.06 dBA along nearby segments of Highway 49 and approximately to 4.21 dBA along Rincon Way. The proposed project would not result in a substantial increase in traffic noise levels along primarily affected area roadways. Given that the proposed project would not result in a significant contribution to traffic noise levels, this impact would be considered **less than significant**.

**TABLE 14**  
**Predicted Increases in Traffic Noise Levels**  
**Future Cumulative Conditions**

| Roadway    | CNEL/L <sub>dn</sub> at 50 Feet from Near-Travel-Lane Centerline <sup>1</sup> |              | Predicted Increase | Substantial Increase? <sup>2</sup> |
|------------|---|--------------|--------------------|------------------------------------|
|            | Without Project   | With Project |                    |                                    |
| Highway 49 | 76.06   | 76.12        | 0.06               | No                                 |
| Rincon Way | 44.52   | 48.73        | 4.21               | No                                 |

1. Traffic noise levels were calculated using the FHWA roadway noise prediction model.  
 2. Substantial increases defined as an increase of 5.0, or greater, where noise levels are less than the County's normally acceptable minimum noise level of 60 dBA CNEL/L<sub>dn</sub>; 3 dBA, or greater, where noise levels range from 60 to 65 dBA CNEL; and 1.5 dB, or greater, where the noise level exceeds 65 dBA CNE,L without the proposed project. In comparison to.

## REFERENCES

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**APPENDIX A  
NOISE MODELING**

**TRAFFIC NOISE MODELING**

**SR49**

TRAFFIC DISTRIBUTION PERCENTAGES  
DAY EVENING NIGHT

---      -----      -----  
AUTOS    75.40    12.00    9.00  
M-TRUCKS    1.80    0.30    0.20  
H-TRUCKS    1.00    0.20    0.10  
\*Caltrans 2010

EXISTING

ADT: 28000    SPEED: 65    ACTIVE HALF WIDTH (FT): 24  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 74.38  
\*\* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \*\*  
70 CNEL    65 CNEL    60 CNEL    55 CNEL  
-----  
139.1    296.1    636.1    1369.3

EXISTING PLUS PROJECT

ADT: 28581    SPEED: 65    ACTIVE HALF WIDTH (FT): 24  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 74.46  
\*\* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \*\*  
70 CNEL    65 CNEL    60 CNEL    55 CNEL  
-----  
140.9    300.1    644.8    1388.2

CUMULATIVE

ADT: 41260    SPEED: 65    ACTIVE HALF WIDTH (FT): 24  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 76.06  
\*\* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \*\*  
70 CNEL    65 CNEL    60 CNEL    55 CNEL  
-----  
179.0    382.9    823.4    1773.0

CUMULATIVE PLUS PROJECT

ADT: 41793    SPEED: 65    ACTIVE HALF WIDTH (FT): 24  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 76.12  
\*\* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \*\*  
70 CNEL    65 CNEL    60 CNEL    55 CNEL  
-----  
180.5    386.1    830.5    1788.3

**RINCON DRIVE**

TRAFFIC DISTRIBUTION PERCENTAGES  
DAY EVENING NIGHT

---      -----      -----  
AUTOS    84.00    15.00    0.76  
M-TRUCKS    0.10    0.10    0.01  
H-TRUCKS    0.01    0.01    0.01

EXISTING

ADT: 459    SPEED: 25    ACTIVE HALF WIDTH (FT): 6  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 43.41  
\*\* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \*\*  
70 CNEL    65 CNEL    60 CNEL    55 CNEL  
-----  
0.0    0.0    0.0    0.0

EXISTING PLUS PROJECT

ADT: 1428    SPEED: 25    ACTIVE HALF WIDTH (FT): 6  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 48.34  
\* \* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \* \*  
70 CNEL   65 CNEL   60 CNEL   55 CNEL

-----  
0.0    0.0    0.0    0.0

CUMULATIVE

ADT: 593    SPEED: 25    ACTIVE HALF WIDTH (FT): 6  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 44.52  
\* \* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \* \*  
70 CNEL   65 CNEL   60 CNEL   55 CNEL

-----  
0.0    0.0    0.0    0.0

CUMULATIVE PLUS PROJECT

ADT: 1562    SPEED: 25    ACTIVE HALF WIDTH (FT): 6  
SITE CHARACTERISTICS: SOFT    GRADE (PERCENT): .5  
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE = 48.73  
\* \* DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL \* \*  
70 CNEL   65 CNEL   60 CNEL   55 CNEL

-----  
0.0    0.0    0.0    0.0

| PREDICTED AVERAGE-HOURLY NOISE LEVELS (CONTROLLED)  |   |        |                            |      |   |   |          |          |  |  |          |          |
|---|---|--------|----------------------------|------|---|---|----------|----------|--|--|----------|----------|
|   | DISTANCE FROM SOURCE CENTER TO RECEPTOR/RES.P.L. (FEET) |        | REPRESENTATIVE NOISE LEVEL |      | PREDICTED NOISE LEVEL AT OFFSITE RECEPTOR (DBA LEQ) | NEVADA COUNTY NOISE STANDARDS                             |          |          | PREDICTED NOISE LEVEL AT ONSITE RECEPTOR (DBA LEQ) | NEVADA COUNTY NOISE STANDARDS                            |          |          |
|   | OFFSITE   | ONSITE | DBA LEQ                    | FEET |   | 7AM-7PM   | 7PM-10PM | 10PM-7AM |  | 7AM-7PM  | 7PM-10PM | 10PM-7AM |
|   |   |        |                            |      |   | EXCEEDS CORRESPONDING NOISE STANDARD AT OFFSITE RECEPTOR? |          |          |  | EXCEEDS CORRESPONDING NOISE STANDARD AT ONSITE RECEPTOR? |          |          |
| SEWER LIFT STATION - NORTH  | 120   | 1300   | 78                         | 50   | 60  | YES   | YES      | YES      | 40   | NO   | NO       | YES      |
| SEWER LIFT STATION - SOUTH  | 1080  | 195    | 78                         | 50   | 41  | NO  | NO       | YES      | 56   | YES  | YES      | YES      |
| AGRICULTURAL ACTIVITIES   | 480   | 270    | 92                         | 5    | 52  | NO  | YES      | YES      | 57   | YES  | YES      | YES      |
| AUTO/TRACTOR REPAIR BARNs**   | 540   | 75     | 83                         | 50   | 47  | NO  | NO       | YES      | 64   | YES  | YES      | YES      |
| PROPERTY MAINTENANCE  | 100   | 50     | 72                         | 50   | 66  | YES   | YES      | YES      | 72   | YES  | YES      | YES      |
| BUILDING MECHANICAL EQUIPMENT (COMM)***   | 165   | 50     | 85                         | 3    | 50  | NO  | YES      | YES      | 61   | YES  | YES      | YES      |
| RECREATIONAL USES   |   |        |                            |      |   |   |          |          |  |  |          |          |
| TENNIS COURTS   | 150   | 120    | 51                         | 16   | 32  | NO  | NO       | NO       | 33   | NO   | NO       | NO       |
| VOLLEYBALL COURTS   | 1100  | 720    | 57                         | 5    | 10  | NO  | NO       | NO       | 14   | NO   | NO       | NO       |
| BOCCE BALL COURTS   | 180   | 75     | 55                         | 5    | 24  | NO  | NO       | NO       | 31   | NO   | NO       | NO       |
| PICKLE BALL COURTS  | 225   | 75     | 53                         | 105  | 46  | NO  | NO       | YES      | 56   | YES  | YES      | YES      |
| OUTDOOR POOL EQUIPMENT*   | 270   | 30     | 68                         | 3    | 29  | NO  | NO       | NO       | 48   | NO   | NO       | YES      |
| OUTDOOR POOL USE  | 270   | 30     | 52                         | 30   | 33  | NO  | NO       | NO       | 52   | NO   | YES      | YES      |
| *Assumes 2 3hp multi-phase/speed pumps operating at 3,000 RPM (Intelliflo 3050) and gas heater (Pentair Commercial MaxETherm400) operating simultaneously.        |   |        |                            |      |   |   |          |          |  |  |          |          |
| **Assumes minimum 15 dB interior-to-exterior noise reduction due to shielding, with windows and doors partially opened and in line-of-sight of nearest residence. |   |        |                            |      |   |   |          |          |  |  |          |          |
| ***Assumes compressor, pneumatic tools, and welder/torch operating simultaneously.  |   |        |                            |      |   |   |          |          |  |  |          |          |

| PREDICTED MAXIMUM INTERMITTENT NOISE LEVELS   |   |        |                            |      |  |                               |          |          |   |                               |          |          |
|---|---|--------|----------------------------|------|--|-------------------------------|----------|----------|---|-------------------------------|----------|----------|
|   | DISTANCE FROM SOURCE CENTER TO RECEPTOR/RES.P.L. (FEET) |        | REPRESENTATIVE NOISE LEVEL |      | PREDICTED NOISE LEVEL AT OFFSITE RECEPTOR (DBA LMAX) | NEVADA COUNTY NOISE STANDARDS |          |          | PREDICTED NOISE LEVEL AT ONSITE RECEPTOR (DBA LMAX) | NEVADA COUNTY NOISE STANDARDS |          |          |
|   | OFFSITE   | ONSITE | DBA LMAX                   | FEET |  | 7AM-7PM                       | 7PM-10PM | 10PM-7AM |   | 7AM-7PM                       | 7PM-10PM | 10PM-7AM |
|   |   |        |                            |      |  | 75                            | 65       | 55       |   | 75                            | 65       | 55       |
|   |   |        |                            |      |  | EXCEEDS?                      | EXCEEDS? | EXCEEDS? |   | EXCEEDS?                      | EXCEEDS? | EXCEEDS? |
| SEWER LIFT STATIONS - NORTH   | 120   | 1300   | 80                         | 50   | 62   | NO                            | NO       | YES      | 42  | NO                            | NO       | NO       |
| SEWER LIFT STATIONS - SOUTH   | 1080  | 195    | 80                         | 50   | 43   | NO                            | NO       | NO       | 58  | NO                            | NO       | YES      |
| AGRICULTURAL ACTIVITIES*  | 480   | 270    | 80                         | 50   | 60   | NO                            | NO       | YES      | 65  | NO                            | YES      | YES      |
| AUTO/TRACTOR REPAIR BARNs**   | 540   | 75     | 85                         | 50   | 49   | NO                            | NO       | NO       | 66  | NO                            | YES      | YES      |
| PROPERTY MAINTENANCE  | 100   | 50     | 110                        | 3    | 80   | YES                           | YES      | YES      | 86  | YES                           | YES      | YES      |
| BUILDING MECHANICAL EQUIPMENT (COMM)  | 165   | 50     | 65                         | 50   | 55   | NO                            | NO       | YES      | 65  | NO                            | YES      | YES      |
| RECREATIONAL USES   |   |        |                            |      |  |                               |          |          |   |                               |          |          |
| TENNIS COURTS   | 150   | 120    | 60                         | 16   | 41   | NO                            | NO       | NO       | 42  | NO                            | NO       | NO       |
| VOLLEYBALL COURTS   | 1100  | 720    | 75                         | 3    | 24   | NO                            | NO       | NO       | 27  | NO                            | NO       | NO       |
| BOCCE BALL COURTS   | 180   | 75     | 80                         | 3    | 44   | NO                            | NO       | NO       | 52  | NO                            | NO       | NO       |
| PICKLE BALL COURTS  | 225   | 75     | 60                         | 105  | 53   | NO                            | NO       | NO       | 63  | NO                            | NO       | YES      |
| OUTDOOR POOL***   | 270   | 30     | 55                         | 30   | 36   | NO                            | NO       | NO       | 55  | NO                            | NO       | YES      |
| *Based on distance from source center.  |   |        |                            |      |  |                               |          |          |   |                               |          |          |
| **Assumes minimum 15 dB interior-to-exterior noise reduction due to shielding, with windows and doors partially opened and in line-of-sight of nearest residence. |   |        |                            |      |  |                               |          |          |   |                               |          |          |
| ***Based on maximum intermittent noise levels during use (non-equipment).   |   |        |                            |      |  |                               |          |          |   |                               |          |          |

**ACOUSTICAL  
CONSTRAINTS EVALUATION**

**GRASS VALLEY CONTINUING CARE PROPERTY  
NEVADA COUNTY, CALIFORNIA**

August 17, 2007

LSA

**ACOUSTICAL  
CONSTRAINTS EVALUATION**

**GRASS VALLEY CONTINUING CARE PROPERTY  
NEVADA COUNTY, CALIFORNIA**

Submitted to:

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**LSA**

August 17, 2007

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## 1.0 DESCRIPTION

This preliminary acoustical constraints analysis has been prepared to provide the acoustical environmental background conditions for the proposed development parcels located in Nevada County north of Auburn. This report begins with an introduction to several key concepts and terms that are used in evaluating noise. It then outlines the EPA, State, and County regulations governing noise in Nevada County, summarizing key standards that are applied to proposed development. This report includes a description of current noise sources that affect the project site and the noise conditions that are experienced in the project site vicinity. It concludes with a discussion of the project constraints analysis with regard to noise impacts.

### 1.1 CHARACTERISTICS OF SOUND

Noise is generally defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: *pitch* and *loudness*. Pitch is the number of complete vibrations or cycles per second of a wave that results in the range of tone from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment, and it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effects on adjacent sensitive land uses.

**Measurement of Sound.** Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale, representing points on a sharply rising curve. Table 1 contains a list of typical acoustical terms and definitions. Table 2 shows representative outdoor and indoor noise levels in units of dBA.

A decibel (dB) is a unit of measurement which indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense. Each 10-dB increase in sound level is perceived as approximately a doubling of loudness.

**Table 1: Definitions of Acoustical Terms**

| Term  | Definitions   |
|---|---|
| Decibel, dB                                 | A unit of level that denotes the ratio between two quantities proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.   |
| Frequency, Hz                               | Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).   |
| A-Weighted Sound Level, dBA                 | The sound level obtained by use of A-weighting. 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. All sound levels in this report are A-weighted, unless reported otherwise. |
| $L_{01}$ , $L_{10}$ , $L_{50}$ , $L_{90}$   | The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level for 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period.  |
| Equivalent Continuous Noise Level, $L_{eq}$ | The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time varying sound.   |
| Community Noise Equivalent Level, CNEL      | The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of five decibels to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.  |
| Day/Night Noise Level, $L_{dn}$             | The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.  |
| $L_{max}$ , $L_{min}$                       | The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.  |
| Ambient Noise Level                         | The all encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.   |
| Intrusive                                   | The noise that 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, 1991.

**Table 2: Typical A-Weighted Sound Levels**

| Noise Source                                       | A-Weighted Sound Level in Decibels | Noise Environments   |
|--|------------------------------------|----------------------|
| Near Jet Engine                                    | 140                                | Deafening            |
| Civil Defense Siren                                | 130                                | Threshold of pain    |
| Hard Rock Band                                     | 120                                | Threshold of feeling |
| Accelerating Motorcycle at a Few Feet Away         | 110                                | Very loud            |
| Pile Driver; Noisy Urban Street/Heavy City Traffic | 100                                | Very loud            |
| Ambulance Siren; Food Blender                      | 95                                 | Very loud            |
| Garbage Disposal                                   | 90                                 | Very loud            |
| Freight Cars; Living Room Music                    | 85                                 | Loud                 |
| Pneumatic Drill; Vacuum Cleaner                    | 80                                 | Loud                 |
| Busy Restaurant                                    | 75                                 | Moderately loud      |
| Near Freeway Auto Traffic                          | 70                                 | Moderately loud      |
| Average Office                                     | 60                                 | Moderate             |
| Suburban Street                                    | 55                                 | Moderate             |
| Light Traffic; Soft Radio Music in Apartment       | 50                                 | Quiet                |
| Large Transformer                                  | 45                                 | Quiet                |
| Average Residence Without Stereo Playing           | 40                                 | Faint                |
| Soft Whisper                                       | 30                                 | Faint                |
| Rustling Leaves                                    | 20                                 | Very faint           |
| Human Breathing                                    | 10                                 | Very faint           |

Source: Compiled by LSA Associates, Inc., 2007.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise sensitive receptor of concern.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level ( $L_{eq}$ ) is the total sound energy of time varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the  $L_{eq}$ , the community noise equivalent level (CNEL), and the day-night average level ( $L_{dn}$ ) based on A-weighted decibels (dBA). CNEL is the time varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly  $L_{eq}$  for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours).  $L_{dn}$  is similar to the CNEL scale, but without the adjustment for events occurring during the evening relaxation hours. CNEL and  $L_{dn}$  are within one dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours. Typical A-weighted sound levels from various sources are described in Table 2.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level ( $L_{max}$ ), which is the highest exponential time averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by  $L_{max}$  for short-term noise impacts.  $L_{max}$  reflects peak operating conditions, and addresses the annoying aspects of intermittent noise.

Noise standards in terms of percentile exceedance levels,  $L_n$ , are often used together with the  $L_{max}$  for noise enforcement purposes. When specified, the percentile exceedance levels are not to be exceeded by an offending sound over a stated time period. For example, the  $L_{10}$  noise level represents the level exceeded ten percent of the time during a stated period. The  $L_{50}$  noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The  $L_{90}$  noise level represents the noise level exceeded 90 percent of the time and is considered the lowest noise level experienced during a monitoring period. It is normally referred to as the background noise level. For a relatively steady noise, the measured  $L_{eq}$  and  $L_{50}$  are approximately the same.

Noise impacts can be described in three categories. The first is audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3.0 dBA or greater, since, as described earlier, this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1.0 and 3.0 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise level of less than 1.0 dB that are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

**Psychological and Physiological Effects of Noise.** Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, and thereby affecting blood pressure, functions of the ear, and the nervous system. In comparison,

extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling.

**Noise Regulatory Framework.** The following section summarizes the regulatory framework related to noise, including federal, State, and County of Nevada plans, policies and standards.

*U.S. Environmental Protection Agency (EPA).* In 1972 Congress enacted the Noise Control Act. This act authorized the EPA to publish descriptive data on the effects of noise and establish levels of sound “requisite to protect the public welfare with an adequate margin of safety.” These levels are separated into health (hearing loss levels) and welfare (annoyance levels), as shown in Table 3. The EPA cautions that these identified levels are not standards because they do not take into account the cost or feasibility of the levels.

For protection against hearing loss, 96 percent of the population would be protected if sound levels are less than or equal to an  $L_{eq(24)}$  of 70 dB. The “(24)” signifies an  $L_{eq}$  duration of 24 hours. The EPA activity and interference guidelines are designed to ensure reliable speech communication at about 5 feet in the outdoor environment. For outdoor and indoor environments, interference with activity and annoyance should not occur if levels are below 55 dBA and 45 dBA, respectively.

The noise effects associated with an outdoor  $L_{dn}$  of 55 dB are summarized in Table 4. At 55 dB  $L_{dn}$ , 95 percent sentence clarity (intelligibility) may be expected at 3.5 meters, and no community reaction. However, 1 percent of the population may complain about noise at this level and 17 percent may indicate annoyance.

*State of California.* The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the “State Noise Insulation Standard,” it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. State regulations include requirements for the

**Table 3: Summary of EPA Noise Levels**

| Effect                                      | Level                   | Area  |
|---|-------------------------|---|
| Hearing loss                                | $L_{eq(24)} \leq 70$ dB | All areas.  |
| Outdoor activity interference and annoyance | $L_{dn} \leq 55$ dB     | Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use. |
|   | $L_{eq(24)} \leq 55$ dB | Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.   |
| Indoor activity interference and annoyance  | $L_{eq} \leq 45$ dB     | Indoor residential areas.   |
|   | $L_{eq(24)} \leq 45$ dB | Other indoor areas with human activities such as schools, etc.  |

Source: U.S. Environmental Protection Agency, 1974. “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.” March.

**Table 4: Summary of Human Effects in Areas Exposed to 55 dBA  $L_{dn}$**

| Type of Effects            | Magnitude of Effect  |
|----------------------------|--|
| Speech – Indoors           | 100 percent sentence intelligibility (average) with a 5 dB margin of safety.   |
| Speech – Outdoors          | 100 percent sentence intelligibility (average) at 0.35 meters (1.15 feet).<br>99 percent sentence intelligibility (average) at 1.0 meters (3.3 feet).<br>95 percent sentence intelligibility (average) at 3.5 meters (11.5 feet) |
| Average Community Reaction | None evident; 7 dB below level of significant complaints and threats of legal action and at least 16 dB below “vigorous action.”   |
| Complaints                 | 1 percent dependent on attitude and other non-level related factors.   |
| Annoyance                  | 17 percent dependent on attitude and other non-level related factors.  |
| Attitude Towards Area      | Noise essentially the least important of various factors.  |

Source: U.S. Environmental Protection Agency, 1974. “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.” March.

construction of new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor ceiling assemblies must block or absorb sound. For limiting noise from exterior noise sources, the noise insulation standards set an interior standard of 45 dBA CNEL in any habitable room with all doors and windows closed. In addition, the standards require preparation of an acoustical analysis demonstrating the manner in which dwelling units have been designed to meet this interior standard, where such units are proposed in an area with exterior noise levels greater than 60 dBA CNEL.

The State has also established land use compatibility guidelines for determining acceptable noise levels for specified land uses. These guidelines, shown in Table 5, include transportation noise sources.

**Table 5: Land Use Compatibility for Exterior Community Noise**

| Land Use Category  | Noise Range ( $L_{dn}$ or CNEL), dB |       |       |     |
|--|-------------------------------------|-------|-------|-----|
|  | I                                   | II    | III   | IV  |
| Passively used open spaces                                   | 50                                  | 50-55 | 55-70 | 70+ |
| Auditoriums, concert halls, amphitheaters                    | 45-50                               | 50-65 | 65-70 | 70+ |
| Residential: low-density single-family, duplex, mobile homes | 50-55                               | 55-70 | 70-75 | 75+ |
| Residential: multifamily                                     | 50-60                               | 60-70 | 70-75 | 75+ |
| Transient lodging: motels, hotels                            | 50-60                               | 60-70 | 70-80 | 80+ |
| Schools, libraries, churches, hospitals, nursing homes       | 50-60                               | 60-70 | 70-80 | 80+ |
| Actively used open spaces: playgrounds, neighborhood parks   | 50-67                               | —     | 67-73 | 73+ |
| Golf courses, riding stables, water recreation, cemeteries   | 50-70                               | —     | 70-80 | 80+ |
| Office buildings, business commercial and professional       | 50-67                               | 67-75 | 75+   | —   |
| Industrial, manufacturing, utilities, agriculture            | 50-70                               | 70-75 | 75+   | —   |

Source: Office of Noise Control, California Department of Health 1976.

**Table 6: Exterior Noise Limits**

| Land Use Category         | Zoning Districts            | Time Period  | Noise level, dBA |           |
|---------------------------|-----------------------------|--------------|------------------|-----------|
|                           |                             |              | $L_{eq}$         | $L_{max}$ |
| Rural                     | A1, AE, FR, TPZ, OS, IDR    | 7 am - 7 pm  | 55               | 75        |
|                           |                             | 7 pm - 10 pm | 50               | 65        |
|                           |                             | 10 pm - 7 am | 40               | 55        |
| Residential and Public    | RA, R1, R2, R3, P           | 7 am - 7 pm  | 55               | 75        |
|                           |                             | 7 pm - 10 pm | 50               | 65        |
|                           |                             | 10 pm - 7 am | 40               | 55        |
| Commercial and Recreation | C1, C2, C3, CH, CS, OP, REC | 7 am - 7 pm  | 70               | 90        |
|                           |                             | 7 pm - 7 am  | 65               | 75        |
| Business Park             | BP                          | 7 am - 7 pm  | 65               | 85        |
|                           |                             | 7 pm - 7 am  | 60               | 70        |
| Industrial                | M1, M2                      | Anytime      | 80               | 90        |

Source: Nevada, County of. 1996. *Nevada County General Plan, Volume I, Chapter 9: Noise.*

The County has adopted and modified the State's land use compatibility guidelines, as discussed below.

*Nevada County.* The project site lies within the unincorporated boundaries of Nevada County. The County of Nevada addresses noise in the Nevada County General Plan.<sup>1</sup> The County's policies that are applicable to the proposed project are outlined below.

**Policy 9.1** The following noise standards, as performance standards and land use compatibility standards, shall apply to all discretionary and ministerial projects excluding permitted residential (including tentative maps) land uses.

**Noise Range I—Normally Acceptable:** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

**Noise Range II—Conditionally Acceptable:** New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

**Noise Range III—Normally Unacceptable:** New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

**Noise Range IV—Clearly Unacceptable:** New construction or development should generally not be undertaken.

- a. Compliance with the above standards shall be determined by measuring the noise level based on the mean average of not less than three (3) 20 minute measurements for any given time period. Additional noise measurements may be necessary to ensure that the ambient noise level is adequately determined.
- b. Where two different zoning districts abut, the standard applicable to the lower, or more restrictive, district plus 5 dBA shall apply.
- c. The above standards shall be measured only on property containing a noise sensitive land use as defined in Policy 9.8 and may be measured anywhere on the property containing said land use. However, this measurement standard may be amended to provide for measurement at the boundary of a recorded noise easement or as determined in a recorded letter of agreement between all effected property owners and approved by the County.
- d. If the measured ambient level exceeds that permitted, then the allowable noise exposure standard shall be set at 5 dBA above the ambient.
- e. Because of the unique nature of sound, the County reserves the right to provide for a more restrictive standard than shown in the Exterior Noise Limits table contained in this policy. The maximum adjustment shall be limited to be not less than the current ambient noise levels and shall not exceed the standards of this policy or as they may be further adjusted by Policy 9.1b.. Imposition of a noise level adjustment shall only be considered if one or more of the following conditions are found to exist:
  1. Unique characteristics of the noise source:
    - (a). The noise contains a very high or low frequency, is of a pure tone (a steady, audible tone such as a whine, screech, or hum), or contains a wide divergence in frequency spectra between the noise source and ambient level.
    - (b). The noise is impulsive in nature (such as hammering, riveting, or explosions), or contains music or speech.
    - (c). The noise source is of a long duration.
  2. Unique characteristics of the noise receptor when the ambient noise level is determined to be 5 dBA or more below the Policy 9.1 standard for those projects requiring a General Plan amendment, rezoning, and/or conditional use permit. In such instances, the new standard shall not exceed 10 dBA above the ambient or the Policy 9.1 standard, whichever is more restrictive.
- f. The above standards shall not apply to those activities associated with the actual construction of a project or to those projects associated with the provision of emergency services or functions.
- g. The standards of this policy shall be enforced through compliance inspections and/or complaints.
- h. Recognizing that this chapter must work toward the solution to existing noise problems, those land uses that are inconsistent with the above standards and are therefore non-conforming in nature, shall comply with said standards as these land uses are upgraded or intensified or after abandonment through the use permit or site plan

<sup>1</sup> Nevada, County of, 1996. *Nevada County General Plan.*

process. Said standards shall apply only to that portion of the land use requiring approval. In any event, the use or portion subject to a land use permit must meet the standards in the Exterior Noise Limits table in this policy and cumulatively the noise generated from the entire site must be equal to or less than the pre-land use permit ambient noise level. All such projects will require a comprehensive noise analysis per Policy 9.10 and the Nevada County Noise Element Manual.

**Policy 9.8** Strongly encourage future noise sensitive land uses, including residences, schools, hospitals, nursing homes, churches, and libraries, to those location of the County where the impact of noise generators is limited so that compliance with standards found in Policy 9.1 will be maintained. This policy shall apply to the approval of all tentative maps for residentially zoned parcels. As an additional guide in evaluating land use compatibility, those standards as found in Figure 1 [*Reference the County's General Plan*] shall be used.

**Policy 9.9** Limit future noise generating land use to those location of the County where their impacts on noise sensitive land uses will be minimized, consistent with the standards found in Policy 9.1.

**Policy 9.10** Require the preparation of a comprehensive noise study for all land use projects determined to have a potential to create noise levels inconsistent with those standards found in Policy 9.1, and in accordance with the methodology identified in the Noise Element Manual contained in General Plan Volume 2, Section 3 - Noise Analysis Appendix A.

**Policy 9.11** Provide for adequate design controls to assist in mitigating on-site the significant adverse impacts of future noise generating land uses through increased setbacks, landscaping, earthen berms, and solid fencing.

**Policy 9.12** Strictly enforce the noise insulation standards for new construction as required by Title 24 of the California Administrative Code.

## 1.2 EXISTING NOISE ENVIRONMENT

The project site is located in a rural area. The existing site primarily consists of undeveloped open space and is bordered to the east and south by undeveloped open space and by rural low-density residential land uses to the north and west. The project site is currently designated by the County as Planned Development (PD) land use. The following section describes the existing noise environment and identifies primary noise sources in the project vicinity.

**Existing Ambient Noise Levels.** An LSA noise technician conducted short-term (20 minute) ambient noise monitoring on the project site on July 31, 2007 between the hours of 11:00 a.m. and 1:00 p.m. The purpose of this noise monitoring was to document the existing noise environment and capture the noise levels associated with operations and activities in the project vicinity. Ambient noise level measurements ranged from 45.8 dBA to 47.1 dBA  $L_{eq}$ . Recorded maximum noise levels ranged from 64.4 dBA to 72.8 dBA  $L_{max}$ ; while minimum noise levels were measured at 35.9 dBA to 36.3 dBA  $L_{min}$ . Audible noise sources noted at the time of these measurements included residential construction activities on a neighboring property site, birds, and occasional distant small engine aircraft.

**Existing Traffic Noise Levels.** Highway traffic is the only major source of vehicular traffic noise in most rural settings. State Route 49 is located approximately 2,250 feet east of the western property boundary of the proposed project. At this distance, and due to existing terrain features, traffic noise levels from SR 49 are not audible on the project property. Other roadways in the project vicinity do not carry high traffic volumes that would significantly affect the ambient noise levels on the project site.

**Existing Aircraft Noise Levels.** Beale Air Force Base is located approximately 13 miles west/northwest of the project site. Lincoln Regional Airport is located approximately 15 miles

west/southwest of the project site. The project site does not lie within the 55 dBA noise contours of any airport nor is it located within an airport land use plan. As noted earlier, although occasional small engine aircraft related noise is audible on the project site, it does not significantly affect the ambient noise levels on the project site.

### **1.3 PROJECT CONSTRAINTS ANALYSIS**

Based on the measured ambient noise levels and on the State's and County's acceptable land use development criteria, the existing noise environment would be acceptable for the following land uses:

- Rural;
- Residential: low density single-family, duplex, mobile homes, multifamily;
- Transient lodging: motels, hotels;
- Public: schools, libraries, churches, hospitals, nursing homes;
- Commercial;
- Recreation: actively used open spaces, play grounds, neighborhood parks;
- Business Park: office buildings, business commercial and professional; and
- Industrial: light industrial, manufacturing, utilities, agriculture.

Proposed development projects would need to comply with the County's policies for noise generating land uses. Project noise impacts and potential mitigation measures could be evaluated in a separate technical acoustic analysis as more details of the project become available.

