

10.0 NOISE

This chapter includes a summary of applicable regulations related to noise and vibration and a description of ambient-noise conditions. It provides an analysis of potential short-term construction and long-term operational-source noise impacts of the proposed project.

10.1 ENVIRONMENTAL SETTING

10.1.1 SOUND FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound, as described in detail below, is an audible vibration of an elastic medium.

SOUND PROPERTIES

A sound wave is introduced into a medium (e.g., air) by a vibrating object. The vibrating object (e.g., vocal cords, the string and sound board of a guitar, or the diaphragm of a radio speaker) is the source of the disturbance that sets the medium to vibrate and then propagates through the medium. Regardless of the type of source creating the sound wave, the particles of the medium through which the sound moves are vibrating in a back-and-forth motion at a given frequency, tone, or pitch. The frequency of a wave refers to how often the particles vibrate when a wave passes through the medium. The frequency of a wave is measured as the number of complete back-and-forth vibrations of a particle per unit of time. If a particle of air undergoes 1,000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second. A commonly used unit for frequency is Hertz (Hz).

Each particle vibrates as a result of the motion of its nearest neighbor. The first particle of the medium begins vibrating at, for example, 500 Hz, and sets the second particle of the medium into motion at the same frequency (500 Hz). The second particle begins vibrating at 500 Hz and thus sets the third particle into motion at 500 Hz. The process continues throughout the medium; hence each particle vibrates at the same frequency, which is the frequency of the original source. Subsequently, a guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency (500 Hz), which carries a sound signal to the ear of a listener that is detected as a 500-Hz sound wave.

The back-and-forth vibration motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Because a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from high to low and back to high pressure. As the compression (high-pressure) and rarefaction (low-pressure) disturbances move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Thus, the frequency of a sound wave refers not only to the number of back-and-forth vibrations of the particles per unit of time but also to the number of compression or rarefaction disturbances that pass a given point per unit of time. A detector could be used to detect the frequency of these pressure oscillations over a given period of time. The period of the sound wave can be found by measuring the time between successive high-pressure points (corresponding to the compressions) or the time between successive low-pressure points (corresponding to the rarefactions). The frequency is simply the reciprocal of the period; thus an inverse relationship exists so that as frequency increases, the period decreases, and vice versa.

A wave is an energy-transport phenomenon that transports energy along a medium. The amount of energy carried by a wave is related to the amplitude (loudness) of the wave. A high-energy wave is characterized by high amplitude; a low-energy wave is characterized by low amplitude. The amplitude of a wave refers to the maximum amount of displacement of a particle from its rest position. The energy transported by a wave is directly

proportional to the square of the amplitude of the wave. This means that a doubling of the amplitude of a wave is indicative of a quadrupling of the energy transported by the wave.

SOUND AND THE HUMAN EAR

Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). Use of this logarithmic scale reveals that the total sound from two individual sources measured at 65 A-weighted decibels (dBA) (see discussion of the A-weighting scale below) is 68 dBA, not 130 dBA (i.e., doubling the source strength increases the sound pressure by 3 dBA).

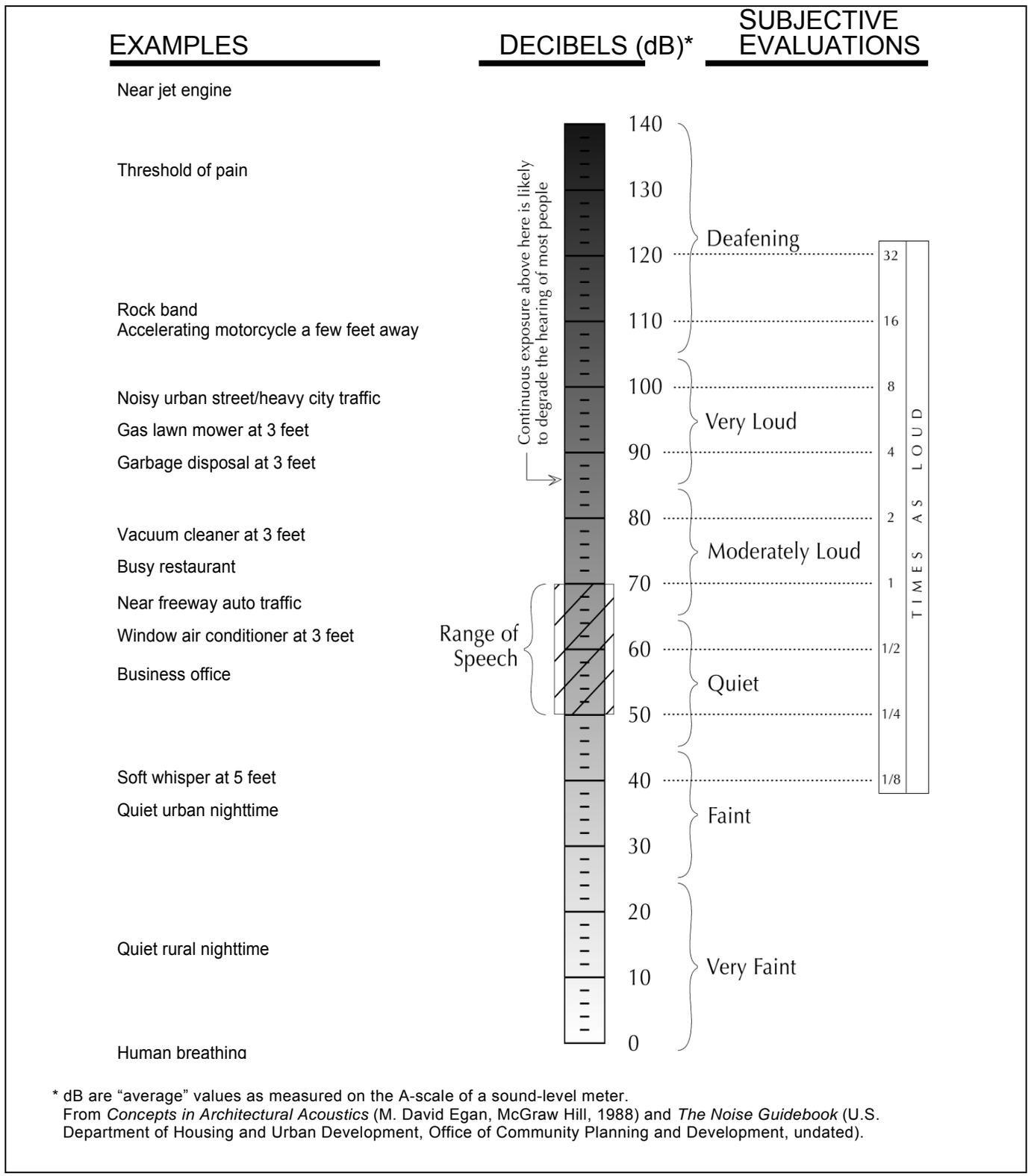
The human ear is sensitive to frequencies from 20 Hz to 20,000 Hz (the audible range) and can detect the vibration amplitudes that are comparable in size to a hydrogen atom (EPA 1974). When damaged by noise, the ear is typically affected at the 4,000-Hz frequency first; therefore, this can be considered the most noise-sensitive frequency. The averaged frequencies of 500 Hz, 1,000 Hz, and 2,000 Hz have traditionally been employed in hearing conservation criteria because of their importance to the hearing of speech sounds (ASA 1997).

Because the human ear is not equally sensitive to all sound frequencies, depending on the amplitude of the sound, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. This is called the weighting scale or function. The A-weighting scale is the most commonly used and is noted as A-weighted dB, dB(A), or dBA. The dBA scale discriminates against frequencies in a manner approximating the sensitivity of the human ear when a source is at 50 dB. The basis for compensation is a comparison of the “loudness” of tones played one at a time with a reference tone producing 50 dB. This dBA scale has been chosen by most authorities for the purpose of regulating environmental noise. Typical indoor and outdoor noise levels are presented in Exhibit 10-1.

With respect to how humans perceive increases in noise levels, for pure tones or some broadband tones, a 1-dBA increase is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly perceptible, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment for this type of source. For more complex sources, that is, where the tones differ substantially between sources such as for the sound of a heavy truck versus a new car or a kitchen blender, the ear perceives differences much more quickly.

SOUND PROPAGATION

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, is dependent on surface characteristics, atmospheric conditions, and the presence of physical barriers. The inverse-square law describes the attenuation when sound travels from a point source such as an air-conditioning unit to the receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance. However, from a line source, such as a long line of traffic on a freeway, sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA per doubling of distance. The surface characteristics between the source and the receptor may result in additional sound absorption and/or reflection. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels. Furthermore, the presence of a barrier between the source and the receptor may also attenuate noise levels. The actual amount of attenuation is dependent upon the size of the barrier and the frequency of the noise. A noise barrier may be any natural or human-made feature such as a hill, building, wall, or berm (Caltrans 1998).



* dB are "average" values as measured on the A-scale of a sound-level meter.
 From *Concepts in Architectural Acoustics* (M. David Egan, McGraw Hill, 1988) and *The Noise Guidebook* (U.S. Department of Housing and Urban Development, Office of Community Planning and Development, undated).

Source: Data provided by EDAW in 2006

Typical Noise Levels

Exhibit 10-1

NOISE DESCRIPTORS

The selection of a proper noise descriptor for a specific source is dependent upon the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998, Lipscomb and Taylor 1978).

- ▶ *L_{max}* (*maximum noise level*): The maximum noise level during a specific period of time. The *L_{max}* may also be referred to as the “highest (noise) level.”
- ▶ *L_{min}* (*minimum noise level*): The minimum noise level during a specific period of time.
- ▶ *L_X* (*statistical descriptor*): The noise level exceeded X% of a specific period of time.
- ▶ *L_{eq}* (*equivalent noise level*): 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 is calculated, which is then converted back to dBA to determine the *L_{eq}*.
- ▶ *L_{dn}* (*day-night noise level*): The 24-hour *L_{eq}* with a 10-dBA “penalty” for the noise-sensitive hours between 10 p.m. and 7 a.m. The *L_{dn}* attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.
- ▶ *CNEL* (*community noise equivalent level*): A noise level similar to the *L_{dn}* described above, but with an additional 5-dBA “penalty” for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If the same 24-hour noise data are used, the *CNEL* is typically approximately 0.5 dBA higher than the *L_{dn}*.
- ▶ *SEL* (*single-event [impulsive] noise level*): A receiver’s cumulative noise exposure from a single impulsive-noise event, which is defined as an acoustical event of short duration and which involves a change in sound pressure above some reference value.

NEGATIVE EFFECTS OF NOISE ON HUMANS

Negative effects of noise exposure include physical damage to the human auditory system, speech interference, sleep interference, activity interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. However, gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 1998).

VIBRATION

Vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structureborne noise. Sources of groundborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, groundborne vibrations may be described by amplitude and frequency.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean squared (RMS), as in RMS vibration velocity. The PPV and RMS velocity are normally described in inches per second (in/sec). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (FHWA 1995, Caltrans 2002).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FHWA 1995). This is based on a reference value of 1 microinch per second ($\mu\text{in}/\text{sec}$).

The background vibration-velocity level in residential areas is usually approximately 50 VdB. Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FHWA 1995).

Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities can generate groundborne vibrations, which can pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FHWA 1995).

Construction vibrations can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 10-1 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 10-1 Human Response to Different Levels of Groundborne Noise and Vibration	
Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.
Note: VdB = vibration decibels referenced to 1 microinch per second ($\mu\text{in}/\text{sec}$) and based on the root mean square (RMS) velocity amplitude. Source: FHWA 1995	

10.1.2 EXISTING SENSITIVE RECEPTORS

Noise- and vibration-sensitive land uses generally include those uses where exposure would result in adverse effects (e.g., annoyance and structural damage), as well as uses 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. Other sensitive land uses include

hospitals, convalescent facilities, parks, hotels, churches, libraries, and other uses where low interior noise levels are essential, including any uses where people sleep at night. With respect to the project area, there is no residential zoning in the vicinity and the nearest sensitive receptor is more than 2 miles away.

10.1.3 EXISTING NOISE SOURCES

The project area is located in the undeveloped North Fork American River canyon in Placer County, approximately 3 miles northeast of the city of Auburn. The area surrounding the project area is open space and zoned as Water Influence, Water Influence with a Mineral Reserve combining district, and Farm with Building Site (20 acre minimum) and Mineral Reserve combining districts. Existing noise sources are occasional traffic from Foresthill Road, water falling over Clementine Dam, and recreational users on Lake Clementine and throughout the Auburn State Recreation Area (SRA).

10.2 REGULATORY SETTING

10.2.1 FEDERAL PLANS, POLICIES, REGULATIONS, AND LAWS

No federal plans, policies, regulations, or laws related to noise are applicable to the proposed project. However, the Federal Transit Administration (FTA) has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses to address the human response to groundborne vibration (Federal Transit Administration 1995):

- ▶ 65 VdB (referenced to 1 μ m/sec and based on the RMS velocity amplitude) for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, laboratory facilities);
- ▶ 80 VdB for residential uses and buildings where people normally sleep; and
- ▶ 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, offices).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics (CHABA) at the request of the U.S. Environmental Protection Agency (EPA) (Federal Transit Administration 1995). For fragile structures, CHABA recommends a maximum limit of 0.25 in/sec PPV (Federal Transit Administration 1995).

10.2.2 STATE PLANS, POLICIES, REGULATIONS, AND LAWS

The *State of California General Plan Guidelines*, published by the Governor's Office of Planning and Research (2003), provides guidance for the acceptability of projects within specific CNEL/ L_{dn} contours. Table 10-2 presents acceptable and unacceptable community-noise-exposure limits for various land-use categories. Generally, residential uses are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA CNEL/ L_{dn} . Residential uses are normally unacceptable in areas exceeding 70 dBA CNEL/ L_{dn} and conditionally acceptable within 55–70 dBA CNEL/ L_{dn} . Schools are normally acceptable in areas up to 70 dBA CNEL/ L_{dn} and normally unacceptable in areas exceeding 70 dBA CNEL/ L_{dn} . Recreation uses are normally acceptable in areas up to 75 dBA CNEL/ L_{dn} . The guidelines also present adjustment factors that may be used 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 issues.

With respect to vibration, the California Department of Transportation (Caltrans) recommends a more conservative threshold of 0.2 in/sec PPV for normal residential buildings and 0.08 in/sec PPV for old or historically significant structures (Caltrans 2002) to protect fragile, historic, and residential structures. These standards are more stringent than the federal standard established by CHABA, presented above.

**Table 10-2
State of California Noise Compatibility Guidelines by Land Use Category**

Land Use Category	Community Noise Exposure (CNEL/L _{dn} , dBA)			
	Normally Acceptable ¹	Conditionally Acceptable ²	Normally Unacceptable ³	Clearly Unacceptable ⁴
Residential—Low-Density Single-Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential—Multiple-Family	<65	60–70	70–75	75+
Transient Lodging, Motel, Hotel	<65	60–70	70–80	80+
School, Library, Church, Hospital, Nursing Home	<70	60–70	70–80	80+
Auditorium, Concert Hall, Amphitheater		<70	65+	
Sports Arenas, Outdoor Spectator Sports		<75	70+	
Playground, Neighborhood Park	<70		67.5–75	72.5+
Golf Courses, Stable, Water Recreation, Cemetery	<75		70–80	80+
Office Building, Business Commercial and Professional	<70	67.5–77.5	75+	
Industrial, Manufacturing, Utilities, Agriculture	<75	70–80	75+	

¹ Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

² New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

³ 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. Outdoor areas must be shielded.

⁴ New construction or development should generally not be undertaken.

Source: Governor's Office of Planning and Research 2003

10.2.3 LOCAL PLANS, POLICIES, REGULATIONS, AND LAWS

PLACER COUNTY GENERAL PLAN

The following are the relevant policies identified by the *Placer County General Plan* (Placer County 1994) for noise.

- ▶ **Policy 9.A.2.** The County shall require that noise created by new non-transportation noise sources be mitigated so as not to exceed the noise level standards of [Table 10-3] as measured immediately within the property line of lands designated for noise-sensitive uses.
- ▶ **Policy 9.A.9.** Noise created by new transportation noise sources, including roadway improvement projects, shall be mitigated so as not to exceed the levels specified in [Table 10-3] at outdoor activity areas or interior spaces of existing noise-sensitive land uses.
- ▶ **Policy 9.A.12.** Where noise mitigation measures are required to achieve the standards of [Tables 10-3 and 10-4], the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered as a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

**Table 10-3
Allowable CNEL/L_{dn} Noise Levels Within Specified Zone Districts¹
Applicable to New Projects Affected by or Including Nontransportation Noise Sources**

Zone District of Receptor	CNEL/L _{dn} (dBA) at Property Line of Receiving Use	Interior Spaces (dBA) ²
Residential Adjacent to Industrial ³	60	45
Other Residential ⁴	50	45
Office/Professional	70	45
Transient Lodging	65	45
Neighborhood Commercial	70	45
General Commercial	70	45
Heavy Commercial	75	45
Limited Industrial	75	45
Highway Service	75	45
Shopping Center	70	45
Industrial	---	45
Industrial Park	75	45
Industrial Reserve	---	---
Airport	---	45
Unclassified	---	---
Farm	(see footnote 6)	---
Agriculture Exclusive	(see footnote 6)	---
Forestry	---	---
Timberland Preserve	---	---
Recreation & Forestry	70	---
Open Space	---	---
Mineral Reserve	---	---

Notes:

- Except where noted otherwise, noise exposures will be those which occur at the property line of the receiving use.
- Where existing transportation noise levels exceed the standards of this table, the allowable CNEL/L_{dn} shall be raised to the same level as that of the ambient level.
- If the noise source generated by, or affecting, the uses shown above consists primarily of speech or music, or if the noise source is impulsive in nature, the noise standards shown above shall be decreased by 5 dB.
- Where a use permit has established noise level standards for an existing use, those standards shall supersede the levels specified in Table [10-3] and Table [10-4]. Similarly, where an existing use which is not subject to a use permit causes noise in excess of the allowable levels in Tables [10-3] and [10-4], said excess noise shall be considered the allowable level. If a new development is proposed which will be affected by noise from such an existing use, it will ordinarily be assumed that the noise levels already existing or those levels allowed by the existing use permit, whichever are greater, are those levels actually produced by the existing use.
- Existing industry located in industrial zones will be given the benefit of the doubt in being allowed to emit increased noise consistent with the state of the art⁵ at the time of expansion. In no case will expansion of an existing industrial operation be cause to decrease allowable noise emission limits. Increased emissions above those normally allowable should be limited to a one-time 5 dB increase at the discretion of the decision-making body.
- The noise level standards applicable to land uses containing incidental residential uses, such as caretaker dwellings at industrial facilities

**Table 10-3
Allowable CNEL/L_{dn} Noise Levels Within Specified Zone Districts¹
Applicable to New Projects Affected by or Including Nontransportation Noise Sources**

Zone District of Receptor	CNEL/L _{dn} (dBA) at Property Line of Receiving Use	Interior Spaces (dBA) ²
<p>and homes on agriculturally zoned land, shall be the standards applicable to the zone district, not those applicable to residential uses.</p> <ul style="list-style-type: none"> • Where no noise level standards have been provided for a specific zone district, it is assumed that the interior and/or exterior spaces of these uses are effectively insensitive to noise. <p>¹ Overriding policy on interpretation of allowable noise levels: Industrial-zoned properties are confined to unique areas of the County, and are irreplaceable. Industries which provide primary wage-earner jobs in the County, if forced to relocate, will likely be forced to leave the County. For this reason, industries operating upon industrial zoned properties must be afforded reasonable opportunity to exercise the rights/privileges conferred upon them by their zoning. Whenever the allowable noise levels herein fall subject to interpretation relative to industrial activities, the benefit of the doubt shall be afforded to the industrial use. Where an industrial use is subject to infrequent and unplanned upset or breakdown of operations resulting in increased noise emissions, where such upsets and breakdowns are reasonable considering the type of industry, and where the industrial use exercises due diligence in preventing as well as correcting such upsets and breakdowns, noise generated during such upsets and breakdowns shall not be included in calculations to determine conformance with allowable noise levels.</p> <p>² Interior spaces are defined as any locations where some degree of noise-sensitivity exists. Examples include all habitable rooms of residences, and areas where communication and speech intelligibility are essential, such as classrooms and offices.</p> <p>³ Noise from industrial operations may be difficult to mitigate in a cost-effective manner. In recognition of this fact, the exterior noise standards for residential zone districts immediately adjacent to industrial, limited industrial, industrial park, and industrial reserve zone districts have been increased by 10 dB as compared to residential districts adjacent to other land uses. For purposes of the Noise Element, residential zone districts are defined to include the following zoning classifications: AR, R-1, R-2, R-3, FR, RP, TR-1, TR-2, TR-3, and TR-4.</p> <p>⁴ Where a residential zone district is located within an -SP combining district, the exterior noise level standards are applied at the outer boundary of the -SP district. If an existing industrial operation within an -SP district is expanded or modified, the noise level standards at the outer boundary of the -SP district may be increased as described above in these standards. Where a new residential use is proposed in an -SP zone, an Administrative Review Permit is required, which may require mitigation measures at the residence for noise levels existing and/or allowed by use permit as described under "NOTES," above, in these standards.</p> <p>⁵ State of the art should include the use of modern equipment with lower noise emissions, site design, and plant orientation to mitigate offsite noise impacts, and similar methodology.</p> <p>⁶ Normally, agricultural uses are noise insensitive and will be treated in this way. However, conflicts with agricultural noise emissions can occur where single-family residences exist within agricultural zone districts. Therefore, where effects of agricultural noise upon residences located in these agricultural zones is a concern, an CNEL/L_{dn} of 70 dBA will be considered acceptable outdoor exposure at a residence.</p>		
Source: Placer County 1994		

PLACER COUNTY NOISE ORDINANCE

The Placer County Noise Ordinance (Article 9.36 of the Placer County Code), which was approved in December 2003 and became effective March 2004, defines sound level performance standards for sensitive receptors. The ordinance states that it is unlawful for any person at any location to create any sound, or to allow the creation of any sound, on property owned, leased, occupied, or otherwise controlled by such a person that causes the exterior sound level, when measured at the property line of any affected sensitive receptor, to exceed the ambient sound level by 5 dBA or exceed the sound level standards listed in the table reproduced here as Table 10-5, whichever is greater.

Table 10-4 Maximum Allowable Noise Exposure Transportation Noise Sources			
Land Use	Outdoor Activity Areas ^a		Interior Spaces (dBA)
	CNEL/L _{dn} (dBA)	CNEL/L _{dn}	L _{eq} ^b
Residential	60 ^c	45	---
Transient Lodging	60 ^c	45	---
Hospitals, Nursing Homes	60 ^c	45	---
Theaters, Auditoriums, Music Halls	---	---	35
Churches, Meeting Halls	60 ^c	---	40
Office Buildings	---	---	45
Schools, Libraries, Museums	---	---	45
Playgrounds, Neighborhood Parks	70	---	---

^a Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.

^b As determined for a typical worst-case hour during periods of use.

^c Where it is not possible to reduce noise in outdoor activity areas to 60 dB CNEL/L_{dn} or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB CNEL/L_{dn} may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Source: Placer County 1994

Table 10-5 Sound Level Standards (On-site)		
Sound Level Descriptor (dBA)	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
L _{eq} (1-hour)	55	45
L _{max}	70	65

Source: Placer County 2004

Each of the sound level standards specified in Table 10-5 shall be reduced by 5 dBA for simple tone noises, consisting of speech and music. However, in no case shall the sound level standard be lower than the ambient sound level plus 5 dBA. If the intruding sound source is continuous and cannot be reasonably discontinued or stopped for a time period whereby ambient sound level can be measured, the sound level measured while the source is in operation shall be compared directly to the sound level standards of Table 10-5.

Section 9.36.030, “Exemptions,” of the noise ordinance states that sound or noise emanating from the following sources and activities is exempt from the provisions of Title 9.36:

- ▶ Construction between 6 a.m. and 8 p.m., Monday through Friday, and between 8 a.m. and 8 p.m. Saturday and Sunday, provided that all construction equipment is fitted with factory-installed muffler devices and maintained in good working order.

10.3 IMPACTS

10.3.1 ANALYSIS METHODOLOGY

Land use types and major noise sources in the vicinity of the project area were identified based on existing documentation (e.g., Placer County Zoning Code) and site reconnaissance data. To assess potential short-term construction noise impacts, sensitive receptors and their relative exposure (considering topographic barriers and distance) were identified. Noise levels of specific construction equipment were determined and resultant noise levels at those receptors were calculated.

Potential long-term (operational) traffic, area-, and stationary- source noise impacts were qualitatively assessed based on the number of vehicle trips and other potential operational noise sources introduced to the project area.

Groundborne vibration impacts were qualitatively assessed based on existing documentation (e.g., vibration levels produced by specific construction equipment) and the distance of sensitive receptors from the given source.

Predicted noise levels were compared with applicable standards for determination of significance. Mitigation measures were developed for significant and potentially significant noise impacts.

10.3.2 THRESHOLDS OF SIGNIFICANCE

Based on applicable Placer County (County) noise regulations, the Placer County California Environmental Quality Act Guidelines (CEQA) Checklist, and the State CEQA Guidelines, the proposed project would result in a potentially significant noise impact if it would:

- ▶ result in short-term construction-generated noise levels that exceed the applicable County noise standards (Table 10-3 and Table 10-4), or substantially increase ambient noise at nearby existing noise-sensitive receptors during the more noise-sensitive hours of the day (8 p.m.–6 a.m. Monday through Friday and 8 p.m.–8 a.m. Saturday and Sunday);
- ▶ result in short- or long-term (operational) traffic-generated noise levels that exceed the applicable County noise standards (Table 10-4), or substantially increase ambient noise at nearby existing noise-sensitive receptors;
- ▶ result in long-term (operational) stationary- or area- source noise levels that exceed applicable County noise standards (Table 10-3 and Table 10-4), or substantially increase ambient noise at nearby existing noise-sensitive receptors; or
- ▶ expose persons to or generation of excessive groundborne vibration or noise levels that exceed Caltrans's recommended standards with respect to the prevention of structural building damage (0.2 in/sec PPV and 0.08 in/sec PPV, respectively, for normal and historical buildings) or FTA's maximum-acceptable vibration standard with respect to human response (80 VdB for residential uses) at nearby existing or proposed vibration-sensitive land uses.

10.3.2 IMPACT ANALYSIS

IMPACT 10-1	Noise – Short-Term Construction-Generated Noise Levels. <i>Short-term exterior noise levels at the closest existing noise-sensitive receptor could exceed 47 dBA without feasible noise controls, which would exceed the applicable County nighttime standard of 45 dBA. However, construction activities would occur only during daytime hours. Resulting exterior noise levels at the closest noise-sensitive receptor would not exceed the County daytime noise standard of 55 dBA, nor would they reflect a substantial increase in ambient noise.</i>
Significance	<i>Less Than Significant</i>
Mitigation Proposed	<i>None Warranted</i>
Residual Significance	<i>Less Than Significant</i>

Activities associated with construction of 14.2 miles of trail would include site preparation (e.g., excavation, grading, and clearing), staging, and other miscellaneous activities. The trail would be constructed by hand and/or with a small Sweco trail dozer or equivalent. Hand construction of the trail would require one or more crews (approximately 12 members) of the California Conservation Corps or others, and the use of hand tools and chain saws. The use of a trail dozer would significantly reduce the amount of manual labor needed for the exaction of soil and large rocks. The trail dozer would not be used in any areas where it would be incapable of excavating to the dimensional requirements of the *North Fork American River Trail, Trail Plan* (Placer County 2003a). The trail dozer would have a narrow track and blade width, minimizing impacts on natural resources, but its diesel-powered engine would generate noise. Other equipment used for trail construction would include a mini excavator, haul trucks, and other types of machinery (e.g., graders) that would fit the size constraints of the trail corridor. Larger equipment such as grader, excavators, and dozers would be used for construction of the proposed staging areas.

According to EPA, and as indicated in Table 10-5, noise levels from individual equipment can range from 80 to 91 dBA at 50 feet. The simultaneous operation of on-site construction equipment associated with the project, as identified above, could result in combined intermittent noise levels up to approximately 93 dBA at 50 feet from the site (Appendix E). Based on these equipment noise levels and a typical noise-attenuation rate of 6 dBA per doubling of distance, exterior noise levels at the closest existing noise-sensitive receptor (located approximately 2 miles from the project site) could exceed 47 dBA without feasible noise controls. Thus, if construction activities were to occur during the more noise-sensitive hours or if construction equipment were not properly equipped with noise control devices, construction-generated noise levels could exceed the applicable County nighttime standard of 45 dBA and substantially increase ambient noise at existing nearby sensitive receptors. However, as stated in Chapter 3.0, “Project Description,” construction activities would only occur 7 hours per day. Construction activities would be restricted to the daytime hours of 6 a.m. and 8 p.m. Monday through Friday, and between 8 a.m. and 8 p.m. Saturday and Sunday. During such hours of the day, noise emanating from construction activities is exempt from the provisions of the Placer County Noise Ordinance. In addition, short-term construction-generated exterior noise levels at the closest noise-sensitive receptor would not be anticipated to exceed the applicable County daytime noise standard of 55 dBA. Thus, short-term construction-generated noise levels would not exceed the applicable County noise standards or substantially increase ambient noise at nearby existing noise-sensitive receptors during the more noise-sensitive hours of the day. As a result, this impact is considered less than significant.

**Table 10-5
Typical Construction Equipment Noise Levels**

Type of Equipment	Noise Level in dBA at 50 feet ¹	
	Without Feasible Noise Control	With Feasible Noise Control ²
Dozer or Tractor	85	75
Excavator	88	80
Truck	91	75

Note: dBA = A-weighted decibels
¹ Estimates correspond to a distance of 50 feet from the noisiest piece of equipment and 200 feet from the other equipment.
² Feasible noise control includes the use of intake mufflers, exhaust mufflers and engine shrouds in accordance with manufacturers specifications.
Source: U.S. Environmental Protection Agency 1971

IMPACT 10-2 **Noise – Increases in Long-Term (Operational) Stationary- and Area-Source Noise Levels.** *Area-source noise may result from trail landscape maintenance activities. However, exterior noise levels at the closest existing noise-sensitive receptor (2 miles away) would not exceed 20 dBA. Such noise levels would not exceed any of the applicable County daytime or nighttime noise standards, nor would ambient noise levels substantially increase at nearby existing noise-sensitive receptors.*

Significance *Less Than Significant*

Mitigation Proposed *None Warranted*

Residual Significance *Less Than Significant*

Use of the proposed trail would not result in the use of any new stationary sources of noise in the project area. However, area-source noise may result from trail landscape maintenance activities. According to EPA, such activities could result in noise levels reaching approximately 90 dBA at 3 feet from the source, depending on the exact equipment type and size (U.S. Environmental Protection Agency 1971). Based on these equipment noise levels and a typical noise-attenuation rate of 6 dBA per doubling of distance, exterior noise levels at the closest existing noise-sensitive receptor (2 miles) would not exceed 20 dBA, which would not exceed any of the applicable County daytime or nighttime noise standards. Thus, long-term stationary- and area-source noise levels would not exceed applicable County noise standards or substantially increase ambient noise at nearby existing noise-sensitive receptors. As a result, this impact is considered less than significant.

IMPACT 10-3 **Noise – Increases in Short- and Long-Term Traffic-Generated Noise Levels.** *Construction, use, and maintenance of the proposed trail would not result in a noticeable change in the traffic noise contours of area roadways. In addition, noise increases associated with construction traffic would be temporary and would occur during the less noise-sensitive daytime hours. Thus, short- and long-term traffic-generated noise levels would not exceed applicable Placer County noise standards or substantially increase ambient noise at nearby existing noise-sensitive receptors.*

Significance *Less Than Significant*

Mitigation Proposed *None Warranted*

Residual Significance *Less Than Significant*

As described in Chapter 3.0, “Project Description,” construction of the proposed trail would require approximately 12 on-site employees at any given time. Assuming two total trips per day per employee, project construction would only result in a maximum of approximately 24 one-way daily trips. In the long term, the proposed trail could result in additional vehicle trips on local roadways because the trail could result in an increase in visitors to the Auburn SRA; however, a majority of such vehicle trips would be anticipated to be generated by current visitors (see Chapter 8.0, “Transportation and Circulation,” for more detail). Typically, roadway traffic volumes have to double before the associated increase in noise levels (3 dBA [CNEL/L_{dn}]) is noticeable. Therefore, the addition of these daily trips on the local roadway system to existing volumes (e.g., approximately 6,650 average daily trips on Foresthill Road) would be minor. Consequently, construction, use, and maintenance of the proposed trail would not result in a noticeable change in the traffic noise contours of area roadways. In addition, such increases associated with construction traffic would be temporary and would occur during the less noise-sensitive daytime hours. Thus, short- and long-term traffic-generated noise levels would not exceed applicable County noise standards, nor would ambient noise levels substantially increase at nearby existing noise-sensitive receptors. As a result, this impact is considered less than significant.

IMPACT 10-4	Noise – Exposure of Persons to or Generation of Excessive Groundborne Vibration or Noise Levels. <i>Vibration levels associated with on-site construction equipment would not exceed Caltrans’s recommended standard for the prevention of structural damage and FTA’s maximum-acceptable vibration standard with respect to human annoyance for residential uses. In addition, long-term use and maintenance of the proposed trail would not include any vibration sources. Thus, the proposed project would not result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.</i>
Significance	<i>Less Than Significant</i>
Mitigation Proposed	<i>None Warranted</i>
Residual Significance	<i>Less Than Significant</i>

Construction activities have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and operations involved. Vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. Table 10-6 displays vibration levels for typical construction equipment.

As discussed above, on-site construction equipment would include a Sweco trail dozer, trucks, excavators, and graders. According to FTA and as shown in Table 10-6, vibration levels associated with the use of trucks are 0.076 in/sec PPV and 86 VdB (referenced to 1 µin/sec and based on the RMS velocity amplitude) at 25 feet. Using FTA’s recommended procedure for applying a propagation adjustment to these reference levels, predicted worst-case vibration levels of approximately 0.000009 in/sec PPV and 33.5 VdB at the closest existing noise-sensitive receptor (2 miles away) could occur from use of trucks. These vibration levels would not exceed Caltrans’s recommended standard of 0.2 in/sec PPV (Caltrans 2002) with respect to the prevention of structural damage for normal buildings and FTA’s maximum-acceptable vibration standard of 80 VdB (Federal Transit Administration 1995) with respect to human annoyance for residential uses. In addition, the long-term operation of the proposed project (i.e., use and maintenance of the proposed trail) would not include any vibration sources. Thus, short-term construction and long-term operation would not result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. As a result, this impact is considered less than significant.

**Table 10-6
Typical Construction-Equipment Vibration Levels**

Equipment		PPV at 25 feet (in/sec) ¹	Approximate Lv at 25 feet ²
Pile Driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile Driver (sonic)	Upper range	0.734	105
	Typical	0.170	93
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Trucks		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58
<p>Notes: in/sec = inches per second; Lv = velocity level in decibels (VdB) referenced to 1 microinch per second (μin/sec) and based on the root mean square (RMS) velocity amplitude; PPV = peak particle velocity Source: Federal Transit Administration 1995</p>			

10.4 MITIGATION MEASURES

No mitigation measures are required.