4.4 NOISE

This section includes a description of ambient noise conditions, a summary of the applicable noise regulations, and an analysis of potential noise impacts of the proposed project. Mitigation measures are recommended, as necessary, to reduce significant noise impacts. (See Appendix D for noise related information, including a copy of the technical noise study [Bollard 2006]).

4.4.1 ENVIRONMENTAL SETTING

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, unexpected, or unwanted. Sound, as described in more detail below, is mechanical energy transmitted in the form of a wave because of a disturbance or vibration, and as any pressure variation in air that the human ear can detect.

SOUND PROPERTIES

A sound wave is introduced into a medium (air) by a vibrating object. The vibrating object (e.g., vocal chords, the string and sound board of a guitar, or the diaphragm of a radio speaker) is the source of the disturbance that moves 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. 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 cycles per second, called hertz (Hz).

Each particle vibrates as a result of the motion of its nearest neighbor. The first particle of the medium begins vibrating at, say, 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) to avoid a very large and awkward range in numbers. 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 2 individual 65-dBA sources is 68 dBA, not 130 dBA (i.e., doubling the source strength increases the sound pressure by 3 dBA).

Because the human ear is not equally sensitive to all sound frequencies, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. An A-weighted dB (dBA) scale performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. The basis for compensation is the faintest sound audible to the average ear at the frequency of maximum sensitivity. 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 4.4-1.

With respect to how humans perceive and react to changes in noise levels, a 1 dBA increase is imperceptible, a 3 dBA increase is barely perceptible, a 6 dBA increase is clearly noticeable, and a 10 dBA increase is subjectively perceived as approximately twice as loud (Egan 1988), as presented in Table 4.4-1. Table 4.4-1 was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise and to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dBA, as this is the usual range of voice and interior noise levels. For these reasons, a noise level increase of 3 dBA or more is typically considered significant and/or substantial in terms of the degradation of the existing noise environment.

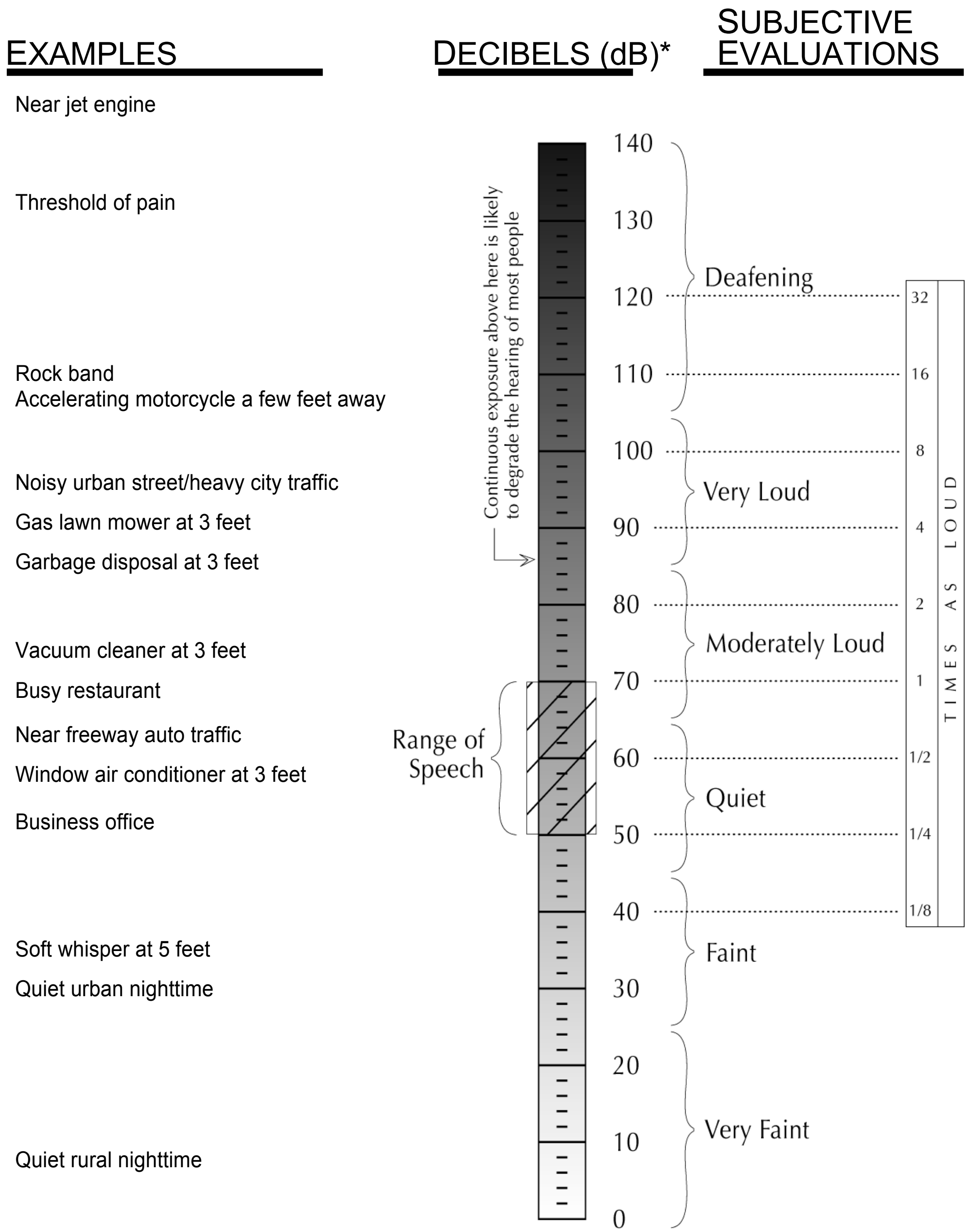
Table 4.4-1
Subjective Reaction to Changes in Noise Levels of Similar Sources

Change in Level, dBA	Subjective Reaction	Factor Change in Acoustical Energy
1	Imperceptible (Except for Tones)	1.3
3	Just Barely Perceptible	2.0
6	Clearly Noticeable	4.0
10	About Twice (or Half) as Loud	10.0

Source: Egan 1988

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 caused by the pattern in which sound travels from the source to receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance (dBA/DD). However, from a line source (e.g., a road), sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. The surface characteristics between the source and the receptor may result in additional sound absorption and/or



* 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: EDAW 2007

Typical Noise Levels **Exhibit 4.4-1**

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, tree, building, wall, or berm (Caltrans 1998).

All buildings provide some exterior-to-interior noise reduction. A building constructed with a wood frame and a stucco or wood sheathing exterior typically provides a minimum exterior-to-interior noise reduction of 25 dBA with its windows closed, whereas a building constructed of a steel or concrete frame, a curtain wall or masonry exterior wall, and fixed plate glass windows of one-quarter-inch thickness typically provides an exterior-to-interior noise reduction of 30–40 dBA with its windows closed (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002).

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 instantaneous noise level during a specific period of time. The L_{max} may also be referred to as the "peak (noise) level."

- **L_{min} (Minimum Noise Level):** The minimum instantaneous noise level during a specific period of time.

- **L_X (Statistical Descriptor):** The noise level exceeded X% of a specific period of time. For example, L_{50} represents the noise level exceeded 50% of the 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}. In noise environments determined by major noise events, such as aircraft overflights, the L_{eq} value is heavily influenced by the magnitude and number of single events that produce the high work levels.

- **L_{dn} (Day-Night Noise Level):** 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, and this generates a higher reported noise level when determining compliance with noise standards. 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):** The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur during the noise-sensitive hours between 7:00 p.m. to 10:00 p.m., which are typically reserved for relaxation, conversation, reading, and television. If using the same 24-hour noise data, the reported CNEL is typically approximately 0.5 dBA higher than the L_{dn}.

- **SENL (Single Event [Impulsive] Noise Level):** The SENL (also defined as Sound Exposure Level [SEL]) describes a receiver's cumulative noise exposure from a single impulsive noise event, which is defined as an acoustical event of short duration and involves a change in sound pressure above some reference value. SENLs typically represent the noise events used to calculate the L_{eq}, L_{dn}, and CNEL.

- **L_{50} (50 Percentile-exceeded Sound Level):** The L_{50} describes the A-weighted sound level happening at 50 percent or more of the time of the measurement.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level, L_{eq}, which corresponds to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors such as L_{dn} and CNEL, as defined above, and shows very good correlation with community response to noise.

NEGATIVE EFFECTS OF NOISE ON HUMANS

Negative effects of noise exposure include physical damage to the human auditory system, 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. 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 (FTA 2006, 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 (FTA 2006). This is based on a reference value of 1 μ inch/second.

The typical background vibration-velocity level in residential areas is 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 (FTA 2006).

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 (FTA 2006).

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 4.4-2 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 4.4-2
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 μ inch/second and based on the root mean square (RMS) velocity amplitude.
Source: FTA 2006

EXISTING NOISE ENVIRONMENT

The project site is currently vacant and not a source of noise for the project vicinity. The proposed project would involve development of 179 single-family dwelling units on approximately 57 acres. Residential uses are not generally considered substantial noise sources; the primary noise generating aspects of the project would consist of area source noise from landscaping and maintenance activities, air conditioning and mechanical equipment, and project construction.

Existing land uses in the project vicinity consist of mostly rural residences to the east, the nearest of which would be within 50 feet of onsite proposed residences. The Sierra College campus is located approximately one mile southwest of the site, and is also considered noise-sensitive. The project site is bordered to the north by Interstate 80 (I-80) and to the east and south by existing rural residences. The property just west of the project site is currently vacant, however, a large-scale commercial center has been approved for the property (Rocklin Crossings).

The existing ambient noise environment in the immediate project vicinity is dominated by traffic noise from I-80. To quantify existing noise levels in the project vicinity, a noise measurement survey was conducted on the project site. The following section describes the measurement procedure and results.

A 24-hour ambient noise survey was conducted on the project site on January 19, 2006. The 24-hour ambient noise measurement site is shown in Figure 1 of the Environmental Noise Assessment prepared for this project (Bollard 2006) (see Appendix D). LDL Model 820 precision integrating sound level meter was used for the ambient noise level measurement survey. The meter was calibrated before and after use with an LDL Model CA200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

The noise level meter was programmed to record the maximum and average hourly noise levels during the survey. The maximum value, denoted L_{max}, represents the highest noise level measured. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The hourly noise level data was used to calculate the average day/night noise level (L_{dn}). The noise level measurement results are provided in Table 4.4-3.

Table 4.4-3
Summary of Measured 24-Hour Noise Levels

Location	Date	Measured Sound Levels, dBA		
		Day-Night (L_{dn})	Average Range (L_{eq})	Maximum (L_{max})
1 Northern Project Border at Proposed Lot #155	January 19, 2006	76	63–74	83

Source: Monitoring performed Bollard Acoustical Consultants, Inc. 2006.

The ambient noise survey results indicate that the measured daytime ambient noise levels at the project site are well above City of Rocklin noise level standards, as would be expected of areas immediately adjacent to the heavily traveled I-80 corridor.

EXISTING NOISE SOURCES

Non-Transportation (Stationary)

The project site is located near a few rural residential dwellings, which are not substantial noise sources. There are no major stationary sources of noise in the vicinity of the proposed project. Transportation noise sources associated with I-80 would dominate the existing noise environment, as discussed below.

Transportation

The ambient noise environment in the immediate project vicinity is dominated by traffic on I-80.

Existing Noise Levels

To determine the existing traffic noise levels adjacent to the local roadways within the project vicinity, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used with the California Vehicle Noise Emission Levels. The FHWA Model is based upon the Calveno reference noise factors 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 volumes and roadway segment information were obtained from LSA Transportation Engineers (LSA 2006).

Table 4.4-4 shows the predicted existing traffic noise levels in terms of the Day/Night Average Level descriptor (L_{dn}) at a standard distance of 50 feet from the centerlines of the existing project area roadways for existing conditions, as well as distances to existing traffic noise contours. The extent of which existing land uses in the project vicinity are affected by existing traffic noise depends on their respective proximity to the roadways and their individual sensitivity to noise. Appendix D provides the complete inputs and results to the FHWA model for existing conditions.

4.4.2 REGULATORY SETTING

To limit people's exposure to physically and/or psychologically damaging noise levels, the State of California, various county governments, and most municipalities in the State have established standards and ordinances to control noise. The General Plan Noise Element provides standards regarding noise levels for uses relevant to the proposed project. In addition, noise thresholds can be derived from the CEQA guidelines. The following provides a general overview of the existing regulations that would be pertinent to this project.

Table 4.4-4
Summary of Existing (Year 2006) Modeled Roadway Segment Noise Levels

Roadway	Segment	Distance to Contours (feet) [1]			
		70 dBA L_{dn}	65 dBA L_{dn}	60 dBA L_{dn}	55 dBA L_{dn}
Taylor Road	King Road & Horseshoe Bar Road	54.5	116.8	251.3	541.2
Taylor Road	Horseshoe Bar Road & Sierra College Boulevard	n/a	85.6	183.9	396.0
Pacific Street	Sierra College Boulevard & Dominguez Road	n/a	91.8	194.7	417.9
Pacific Street	Dominguez Road & Rocklin Road	54.6	112.5	240.0	515.8
Rocklin Road	Pacific Street & Granite Drive	65.1	135.9	290.7	625.2
Rocklin Road	I-80 & Sierra College Boulevard	n/a	83.5	176.6	378.8
Rocklin Road	Sierra College Boulevard & Barton Road	n/a	54.0	114.0	244.5
Barton Road	Rocklin Road & Brace Road	n/a	n/a	85.2	183.2
Horseshoe Bar Road	I-80 & Brace Road	n/a	59.1	126.8	272.8
Brace Road	I-80 & Barton Road	n/a	n/a	95.9	206.2
Brace Road	I-80 & Sierra College Boulevard	n/a	n/a	86.1	185.1
Sierra College Boulevard	English Colony Way & King Road	n/a	79.7	171.4	369.0
Sierra College Boulevard	King Road & Taylor Road	n/a	85.0	182.6	393.2
Sierra College Boulevard	Taylor Road & I-80	55.5	119.1	256.3	551.9
Sierra College Boulevard	I-80 & Dominguez Road	n/a	98.9	212.7	458.0
Sierra College Boulevard	Dominguez Road & Rocklin Road	n/a	98.9	212.7	458.0
Granite Drive	Dominguez Road & Sierra College Boulevard	n/a	61.9	128.8	275.3
Granite Drive	Dominguez Road & Rocklin Road	n/a	74.1	155.8	333.8
Dominguez Road	Taylor Road & Granite Drive	n/a	n/a	67.9	145.8
King Road	Sierra College Boulevard & Taylor Road	n/a	55.9	119.9	258.0

[1] Distances to traffic noise contours are measured in feet from roadway centerlines.

Source: Data modeled by EDAW 2007 using FHWA-RD-77-108 with inputs from LSA Transportation Engineers 2006.

STATE PLANS, POLICIES, REGULATIONS, AND LAWS

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles and freeway noise affecting classrooms, set standards for sound transmission control and occupational noise control, and identify noise insulation standards. The State has also developed land use compatibility guidelines for community noise environments as discussed below.

Title 24 of the California Code of Regulations establishes standards governing interior noise levels that apply to all new multi-family residential units in California. These standards require that acoustical studies be performed before construction at building locations where the existing L_{dn} exceeds 60 dBA. Such acoustical studies are required to establish mitigation measures that will limit maximum L_{dn} levels to 45 dBA in any habitable room. Although there are no generally applicable interior noise standards pertinent to all uses, many communities in California have adopted an L_{dn} of 45 as an upper limit on interior noise in all residential units.

The State of California General Plan Guidelines (State of California 2003), published by the State Governor's Office of Planning and Research (OPR), provides guidance for the acceptability of projects within specific CNEL/L_{dn} contours. 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 L_{dn} and conditionally acceptable within 55 to 70 dBA L_{dn}. Schools are normally acceptable in areas up to 70 dBA CNEL and normally unacceptable in areas exceeding 70 dBA CNEL. Commercial uses are normally acceptable in areas up to 70 dBA CNEL. Between 67.5 and 77.5 dBA CNEL, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements.

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 pollution. Rocklin has established land use noise compatibility standards, which are presented in the City's General Plan Noise Element, as described below.

Community Ambient Noise Degradation

In addition to the guidelines and standards presented above, another consideration is the degradation of the existing ambient noise environment because of an increase in the ambient noise levels. With respect to noise levels, 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. As a result, for the purpose of the proposed project a minimally perceptible increase of 3 dBA shall represent a significant increase in ambient noise levels.

Local Plans, Policies, Regulations, and Laws

The Rocklin General Plan includes the recommendations for land use compatibility standards as contained in Table 4.4-5, which presents acceptable and unacceptable community noise exposure limits for various land use categories.

The following include the existing policies, laws, and regulations established in the 1991 City of Rocklin General Plan, as applicable to the proposed project.

- **Goal:** To protect residents from health hazards and annoyance associated with excessive noise levels.
  - **Policy 1.** To use adopted noise compatibility guidelines to evaluate compatibility of proposed new development.
  - **Policy 2.** To require noise analysis of proposed development projects as part of the environmental review process and to require mitigation measures that reduce noise impacts to acceptable levels.
  - **Policy 3.** To require noise buffering or insulation in new development along major streets and highways, and along railroad tracks.
  - **Policy 4.** To control noise sources in residential areas by restricting truck traffic to designated truck routes.

- **Policy 5.** To monitor noise generating land uses to assure compliance with acceptable noise levels.

- **Policy 6.** To encourage sound mitigation, including but not limited to sound walls, along existing highways where noise is determined to exceed adopted standards.

Table 4.4-5
City of Rocklin General Plan Land Use Noise Compatibility Guidelines

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

[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.
[4] New construction or development should generally not be undertaken.
Source: City of Rocklin General Plan Noise Element 1991.

Short-Term Stationary Noise Source Standards

For stationary noise sources, the City of Rocklin is currently in the process of adopting the hourly performance standards as presented in the table below. These criteria are most applicable to noise that is relatively short in duration (or impulsive) and as a matter of policy, have been used by the City in the past when evaluating short-term noise sources.

Table 4.4-6
City of Rocklin Hourly Noise Level Performance Standards for Stationary Noise Sources

Noise Level Descriptor	Acceptable Daytime (7 a.m. – 10 p.m.) Noise Levels in dBA	Acceptable Nighttime (10 p.m. – 7 a.m.) Noise Level in dBA
Hourly L_{eq}, dB	55	45

Source: City of Rocklin 2008.

4.4.3 IMPACTS AND MITIGATION MEASURES

METHODOLOGY

To assess potential construction-, area-, and stationary-source noise impacts, sensitive receptors and their relative exposure were identified. Noise (and vibration) levels of specific equipment expected to be used in project construction or operation were determined and resultant noise levels at sensitive receptors were calculated assuming a documented noise (and vibration) attenuation rates.

The FHWA traffic noise prediction model was used to model traffic noise levels along affected roadways, based on the trip distribution estimates obtained from the traffic analysis prepared for this project (LSA 2007), Caltrans, and site reconnaissance data (LSA 2007, Bollard 2006). The project's contribution to the baseline traffic noise levels along area roadways was determined by comparing the predicted noise levels from the centerline of the near travel lane with and without project-generated traffic.

The significance of short-term and long-term noise impacts was determined based on comparisons with applicable standards. Mitigation measures along with their relative effectiveness were provided for significant or potentially significant noise impacts.

THRESHOLDS OF SIGNIFICANCE

In accordance with Appendix G of the CEQA Guidelines, noise impacts are considered significant if implementation of the proposed project under consideration would result in any of the following:

- Exposure of persons to or generation of noise levels in excess of applicable standards, specifically, exterior and interior noise levels of 60 dBA L_{dn} and 45 dBA L_{dn}, respectively, for residential uses exposed to transportation noise sources, and the performance standards identified in Table 4.4-6 for residential uses exposed to stationary-source noise.
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, typically defined as 3 dBA or greater.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport, where the project would expose people residing or working in the area to excessive noise levels.
- For a project within the vicinity of an active, private airstrip, where the project would expose people residing or working in the project area to excessive noise levels.

IMPACTS AND MITIGATION MEASURES

IMPACT 4.4-1 **Construction-Generated Temporary Increases in Ambient Noise Levels.** *Because construction-generated noise levels could potentially expose sensitive receptors to noise levels in excess of the applicable noise standards and/or result in a substantial increase in ambient noise levels, this impact is considered **potentially significant**.*

Construction at the project site would include site grading, clearing, and excavation associated with the site preparation phase; paving; building construction; and the application of architectural coatings, in addition to other miscellaneous activities. The on-site equipment required is not known at this time, but is anticipated to include scrapers, excavators, loaders, backhoes, haul trucks, and other miscellaneous construction equipment.

During the construction phases of the project, noise from construction activities would contribute to the noise environment in the immediate project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 4.4-7, ranging from 80 to 91 dBA at a distance of 50 feet, without noise control (e.g., mufflers). Construction activities would be considered temporary in nature, however, the project would be built out over a period of approximately 2 years.

Table 4.4-7
Typical Construction Equipment Noise Levels

Type of Equipment	Noise Level in dBA at 50 feet	
	Without Feasible Noise Control	With Feasible Noise Control[1]
Dozer or Tractor	80	75
Excavator	88	80
Scraper	88	80
Front End Loader	79	75
Backhoe	85	75
Grader	85	75
Truck	91	75

[1] Feasible noise control includes the use of intake mufflers, exhaust mufflers and engine shrouds operating in accordance with manufacturers specifications.

Source: US Environmental Protection Agency 1971

Noise would also be generated during the construction phase by increased truck traffic on area roadways and on-site grading. A significant project-generated noise source would include truck traffic associated with transport of heavy materials and equipment to and from construction sites and the movement of heavy construction equipment on the project site. This noise increase would be short in duration, but could result in a substantial temporary and intermittent increase in noise levels.

Existing residences are located near the project site, primarily to the east and south. The nearest residence is located at approximately 50 feet east of the project site, as measured at the closest point, on Dias Lane.

Construction activities, though short-term in nature, could result in exterior noise levels at these noise-sensitive receptors of approximately 91 dBA without feasible noise control in place. In addition, based on the equipment noise levels and assuming a noise attenuation rate of 6 dBA per doubling of distance from the source to receptor, exterior noise levels at sensitive receptors within approximately 3,150 feet of the proposed project site could potentially exceed 55 dBA, without feasible noise control.

Therefore, if construction activities were to occur during the more noise-sensitive evening and nighttime hours, or if feasible noise control devices were not properly installed on equipment, the applicable noise standards could potentially be exceeded, resulting in increased annoyance and/or sleep disruption to nearby noise-sensitive receptors. As a result, this impact is considered **significant**.

It is possible that blasting may be required onsite to remove rocks in order to install site improvements. The City has a permit process and permit conditions to minimize noise and safety concerns associated with blasting. Please refer to mitigation below.

Mitigation Measure 4.4-1: Construction-Generated Temporary Increases in Ambient Noise Levels.

1. All construction equipment shall be properly equipped with feasible noise control devices (e.g., mufflers) and properly maintained in good working order.

2. Construction activities shall be limited to the less noise sensitive daytime hours (7:00 a.m. – 7:00 p.m. on weekdays and 8:00 a.m. – 7:00 p.m. on weekends).

3. An on-site Noise Coordinator (as a function of on-site project management) shall be employed by the applicant, and his or her telephone number along with instructions on how to file a noise complaint shall be posted conspicuously around the project site during all project construction phases. The Noise Coordinator's duties shall include fielding and documenting noise complaints, determining the source of the complaint (e.g., piece of construction equipment), determining whether noise levels at the project boundary are within acceptable limits (i.e., the performance standards in Table 4.4-6), and reporting complaints to the City with documented noise levels at the time of complaint. The Noise Coordinator shall work, to the extent feasible, with the surrounding residents and project contractors to schedule activities to minimize disturbance of residents during the daytime hours.

4. If blasting activities are to occur in conjunction with the improvements, the contractor shall conduct the blasting activities in compliance with state and local regulations. The contractor shall obtain a blasting permit from the City of Rocklin prior to commencing any on-site blasting activities. The permit application shall include a description of the work to be accomplished and a statement of the necessity for blasting, as opposed to other methods, including avoidance of hard rock areas. The permit application shall also specify safety measures to be implemented, such as use of blast blankets. The contractor shall coordinate any blasting activities with the Rocklin Police and Fire Departments to ensure proper site access and traffic control, and to ensure proper public notification, including media, nearby residents and businesses, as determined appropriate by the Rocklin Police Department. Blasting specifications and plans shall include a schedule that outlines the time frame during which blasting will occur in order to limit noise and traffic inconvenience.

Level of Significance after Mitigation

With implementation of the above measure, worst-case noise levels would be reduced to approximately 80 dBA at 50 feet from the source. By limiting construction activities to daytime hours (7:00 a.m. – 7:00 p.m. on weekdays and 8:00 a.m. – 7:00 p.m. on weekends), no sleep disruption or annoyance would result during the noise-sensitive evening or nighttime hours. Finally, the Noise Coordinator would be employed to field noise complaints and, to the extent feasible, work with the surrounding residents and the project's contractor to schedule activities to minimize disturbance of residents during the daytime hours. Blast blankets would minimize noise levels associated with blasting, if this is determined to be required onsite. Successful implementation of the above mitigation measures, in combination with the temporary nature of the construction activities in proximity to occupied residences, would reduce this impact to a **less-than-significant** level.

IMPACT 4.4-2	Traffic-Generated Permanent Increases in Ambient Noise Levels. *The proposed project would not result in a noticeable increase in traffic noise levels at off-site sensitive receptors. Therefore, this impact is considered less than significant.*

The project would generate traffic that would increase noise levels along nearby roadways. To assess noise impacts attributable to the project, traffic noise levels are predicted at a representative distance for both baseline (all approved future projects) with and without project conditions.

The FHWA traffic noise prediction model was used to predict baseline plus project traffic noise levels at a representative distance of 50 feet from the project area roadway centerlines. Table 4.4-8 shows the predicted traffic noise level increases on the local roadway network for baseline conditions with and without the project.

Table 4.4-9 shows the predicted distances to roadway noise contours on the local roadway network for baseline plus project conditions. Appendix D provides the complete inputs and results to the FHWA model for each of the no project and plus project conditions.

Table 4.4-8
Summary of Modeled Baseline Traffic Noise Levels With & Without Project

Roadway	Segment	dBA L_{dn} @ 50 Feet (dBA) [1]		
		Baseline	Baseline + Project	Change
Taylor Road	King Road & Horseshoe Bar Road	69.99	70.01	0.02
Taylor Road	Horseshoe Bar Road & Sierra College Boulevard	68.05	68.07	0.02
Pacific Street	Sierra College Boulevard & Dominguez Road	67.32	67.33	0.01
Pacific Street	Dominguez Road & Rocklin Road	69.47	69.47	0.00
Rocklin Road	Pacific Street & Granite Drive	70.62	70.62	0.00
Rocklin Road	I-80 & Sierra College Boulevard	68.22	68.23	0.01
Rocklin Road	Sierra College Boulevard & Barton Road	65.29	65.33	0.04
Barton Road	Rocklin Road & Brace Road	63.11	63.12	0.01
Horseshoe Bar Road	I-80 & Brace Road	65.53	65.53	0.00
Brace Road	I-80 & Barton Road	63.72	63.75	0.03
Brace Road	I-80 & Sierra College Boulevard	62.98	62.98	0.00
Sierra College Boulevard	English Colony Way & King Road	67.83	67.85	0.02
Sierra College Boulevard	King Road & Taylor Road	68.16	68.22	0.06
Sierra College Boulevard	Taylor Road & I-80	70.27	70.35	0.08
Sierra College Boulevard	I-80 & Dominguez Road	68.07	68.24	0.17
Sierra College Boulevard	Dominguez Road & Rocklin Road	69.34	69.38	0.04
Granite Drive	Dominguez Road & Sierra College Boulevard	64.59	64.60	0.01
Granite Drive	Dominguez Road & Rocklin Road	65.85	65.86	0.01
Dominguez Road	Taylor Road & Granite Drive	61.49	61.49	0.00
King Road	Sierra College Boulevard & Taylor Road	65.14	65.14	0.00

Bold = Significant increase in noise.

[1] Distances to traffic noise contours are measured in feet from the centerlines of the roadways. Traffic noise levels are predicted at a standard distance from the roadway centerlines and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

[2] Baseline + Approved + Project traffic volumes for Interstate 80 were not included in the traffic study.

Source: Data modeled by EDAW 2007 using FHWA-RD-77-108 with inputs from LSA 2007.

Table 4.4-9
Summary of Modeled Distances to Noise Contours for Baseline + Project Conditions

Roadway	Segment	Distance to 60 dBA CNEL Noise Contour (feet) [1]		
		Baseline	Baseline + Project	Difference
Taylor Road	King Road & Horseshoe Bar Road	258.0	258.5	0.5
Taylor Road	Horseshoe Bar Road & Sierra College Boulevard	191.7	192.3	0.6
Pacific Street	Sierra College Boulevard & Dominguez Road	202.4	202.7	0.3
Pacific Street	Dominguez Road & Rocklin Road	280.8	281	0.2
Rocklin Road	Pacific Street & Granite Drive	335.0	355.2	20.2
Rocklin Road	I-80 & Sierra College Boulevard	232.1	232.6	0.5
Rocklin Road	Sierra College Boulevard & Barton Road	137.6	138.3	0.7
Barton Road	Rocklin Road & Brace Road	89.9	90.1	0.2
Horseshoe Bar Road	I-80 & Brace Road	130.2	130.2	0.0
Brace Road	I-80 & Barton Road	98.7	99.2	0.5
Brace Road	I-80 & Sierra College Boulevard	88.1	88.1	0.0
Sierra College Boulevard	English Colony Way & King Road	185.3	185.9	0.6
Sierra College Boulevard	King Road & Taylor Road	194.9	196.7	1.8
Sierra College Boulevard	Taylor Road & I-80	269.4	272.7	3.3
Sierra College Boulevard	I-80 & Dominguez Road	226.9	232.7	5.8
Sierra College Boulevard	Dominguez Road & Rocklin Road	233.3	235.0	1.7
Granite Drive	Dominguez Road & Sierra College Boulevard	133.8	133.9	0.1
Granite Drive	Dominguez Road & Rocklin Road	161.9	162.1	0.2
Dominguez Road	Taylor Road & Granite Drive	70.2	70.2	0.0
King Road	Sierra College Boulevard & Taylor Road	122.6	122.6	0.0

[1] Distances to traffic noise contours are measured in feet from the centerlines of the roadways. Traffic noise levels are predicted at a standard distance from the roadway centerlines and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

Source: EDAW 2007 using FHWA-RD-77-108 with inputs from LSA 2007.

As indicated in Table 4.4-8, the proposed project would not result in traffic noise level increases exceeding 3 dBA on project area roadways, when compared to no project conditions. In addition, the project would not result in the increase of noise levels from a roadway in attainment with the applicable standards (Table 4.4-5) into noncompliance.

Project implementation would result in slight extension of the distance to the 60 dBA CNEL roadway noise contours along some affected roadway segments. Some of the affected roadway segments have existing sensitive receptors (e.g., residences) located along them, such as Sierra College Boulevard and Rocklin Road. However, it is not anticipated that the 60 dBA contour would be extended such that any sensitive receptors would experience roadway noise levels above 60 dBA that were not already exposed to such noise levels without the project (see Table 4.4-9). In other words, no existing receptors would be exposed to a noticeable (i.e., 3 dBA or greater) increase in traffic noise levels as a result of the proposed project. Thus, the proposed project would not result in a substantial, permanent increase in traffic noise levels at off-site sensitive receptors. Therefore, this impact is considered **less than significant**.

Mitigation Measure 4.4-2: Traffic-Generated Permanent Increases in Ambient Noise Levels.

No mitigation is necessary.

IMPACT 4.4-3	Land Use Compatibility with Off-Site Traffic Noise Levels. *Because the project could expose proposed noise sensitive uses to noise in exceedance of City standards, this impact is considered **significant**.*

The FHWA Traffic Noise Prediction Model was used by Bollard Acoustical Consultants to predict future traffic noise levels at the proposed residential uses (Bollard 2006). The focus of this modeling was on noise emanating from I-80. The model is based upon the CALVENO noise emission factors 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.

On January 18, 2006, Bollard Acoustical Consultants, Inc. conducted noise level measurements and concurrent counts of I-80 traffic at the project site. The purpose of the short-term traffic noise level measurements was to determine the accuracy of the FHWA model in describing the existing noise environment on the project site, accounting for shielding from existing intervening structures, actual travel speeds, and roadway grade. Noise measurement results were compared to the FHWA model results by entering the observed traffic volume, speed and distance as inputs to the FHWA model. Instrumentation used for the measurement was a LDL Model 820 precision integrating sound level meter which was calibrated in the field before use with an LDL CA-200 acoustical calibrator. The noise measurement sites were selected to represent the back yards/first floor building facades and second floor building facades of the proposed residential lots adjacent to I-80.

Based upon the calibration results, the FHWA Model was found to over-predict traffic noise levels at the ground floor measurement location and under-predict traffic noise levels at the second floor measurement location. To conservatively assess future traffic noise levels at the project site, no correction was made to the FHWA Model for predicted future traffic noise levels at ground floor locations and a +2 dBA offset was applied to the predicted future traffic noise levels at second floor locations.

Predicted Exterior Traffic Noise Level Impacts on Proposed Sensitive Receptors

To determine future traffic noise levels from I-80 on the project site, Bollard Acoustical Consultants, Inc. once again employed the FHWA model. The future traffic volume for I-80 was obtained from the *Traffic Operations Analysis* conducted by Omni-Means for the Sierra College Boulevard/I-80 Interchange Improvement Project (January 8, 2003). Table 4.4-10 shows the results of the traffic noise modeling.

Based upon the analysis, the predicted exterior noise levels would exceed the City of Rocklin 60 dBA L_{dn} exterior noise level criterion at the northernmost tier of lots nearest I-80, such as lots 144 through 165 (refer to Exhibit 3-1 for the location of lots). Bollard Acoustical Consultants, Inc. used the FHWA noise barrier performance analysis methodology to determine the insertion loss and resulting noise level provided by different barrier heights at lots affected by I-80 traffic noise, as a noise barrier located along the northern boundary of the site is proposed as a part of the project. Table 4.4-11 shows the results of the barrier analysis.

Based upon the Table 4.4-11 data, exterior traffic noise levels are predicted to exceed the applicable 60 dBA L_{dn} exterior noise level standard at locations nearest the northern project boundary (i.e., Lot 155). In addition, the Table 4.4-10 data indicate that predicted interior noise levels at the first and second floor locations of Lot 155 would exceed the City of Rocklin 45 dBA L_{dn} interior noise level standard (as noted, homes would typically provide a minimum exterior-to-interior noise reduction of 25 dBA with its windows closed). Some proposed residential units are predicted to be exposed to exterior noise levels ranging from 68–78 dBA L_{dn}. As a result, this impact is considered **significant**.

Table 4.4-10
Predicted Future I-80 Traffic Noise Levels (Unmitigated)

Location	Distance (Feet)[1]	Predicted Noise Level (dBA L_{dn})	Distance to Noise Contours (Feet)[1]	
			60 dBA L_{dn}	65 dBA L_{dn}
Lot 144	660	68	2,433	1,130
Lot 155 – First Floor Location	225	76		
Lot 155 – Second Floor Location	225	78		
Lot 179	760	68		

[1] Distances are from the roadway centerline. Locations were selected to represent the back yards/first floor building facades and second floor building facades of the proposed residential lots adjacent to Interstate 80, where future noise levels would be highest and additional lots that together represent the northern portion of the project site. Refer to Appendix D for more information.

For model results an input parameters, see Appendix D of the Environmental Noise Assessment prepared for this project. The lot numbers in the table above are current, whereas lot numbers reflected in the appendix in some instances are outdated.

Source: Data modeled by Bollard 2006

Table 4.4-11
Predicted Traffic Noise Levels at Representative Residential Lots With Varying Barrier Heights at the Property Lines (with and without Mitigation)

Barrier Location	Traffic Noise Level Without Barrier, dBA L_{dn}	Barrier Height	Traffic Noise Level With Barrier, dBA L_{dn}
Property Line of Lot 144	68	8' 9' 10'	61 60 59
Property Line of Lot 155	76	8' 9' 10' 11' 12'	68 67 65 65 64
Property Line of Lot 179	68	7' 8' 9'	61 60 59

For model results and input parameters, see Appendix D of the Environmental Noise Assessment prepared for this project. The lot numbers in the table above are current, whereas lot numbers reflected in the appendix in some instances are outdated.

Source: Data modeled by Bollard, Inc. 2006

Predicted Traffic Noise Level Impacts at Interior Areas of Proposed Sensitive Receptors

Following barrier construction, worst case exterior traffic noise levels at the residences nearest to I-80 are predicted to be 65 dBA L_{dn} or less at first floor facades. Second floor facades would not be affected by the recommended noise barrier and are typically exposed to traffic noise levels approximately 2 dBA higher than first floor facades because of the loss of excess ground attenuation. Therefore, the second floor facades of residences nearest to I-80 would be exposed to future traffic noise levels of 78 dBA L_{dn}. Building facade noise level reductions of 20 dBA and 33 dBA would be required to reduce interior traffic noise levels to a state of compliance with the City of Rocklin's 45 dBA L_{dn} interior noise level standard at first and second floor building facades, respectively. Standard residential construction (wood siding or one-coat stucco siding, Sound Transmission Class [STC] rating-27 windows, door weatherstripping, exterior wall insulation, composition plywood roof, etc.), results in an exterior to interior noise reduction of about 25 dBA with windows closed, and approximately 15 dBA with windows open.

Based upon a 25 dBA building facade noise reduction provided by standard residential construction, interior traffic noise levels at first floor receivers are predicted to satisfy the City of Rocklin 45 dBA L_{dn} interior noise level standard, but that standard would be exceeded at elevated second floor locations with standard construction. Therefore, noise impacts associated with interior noise levels at the first tier of proposed residences nearest I-80 along the northern project boundary would be **significant**.

Mitigation Measure 4.4-3: Land Use Compatibility with Off-Site Traffic Noise Levels.

1. Noise Barrier

a. A noise barrier ranging in height from 9 to 11 feet shall be constructed along the property line to achieve conditionally-acceptable future traffic noise levels of 60–65 dBA L_{dn} for residences within the 60 dBA noise contour on the project site.

b. Barriers shall be constructed of concrete or masonry block, or precast concrete. Barriers on top of earthen berms are also acceptable. Other prefabricated barriers may be used; however, they shall be reviewed by an acoustical consultant.

c. The recommended noise barrier shall traverse across the northern end of Buttonbush Lane, to be opened later to allow future access to other developments to the north, should such developments be approved. It would not be feasible to achieve the required noise attenuation for this project without closing this gap with some additional noise barrier, as the opening would create a substantial acoustic “leak” into the development. However, additional noise mitigation measures are assumed to be necessary for any future development located to the north, including the likely construction of a noise wall along I-80. The opening at Wedgeleaf Drive with the recommended noise barrier design wrap, would not result in a noticeable acoustical leak because of the distance and angle of construction to I-80. A combined Emergency and Pedestrian Access opening is to be located behind Building G of the adjacent approved retail center (Rocklin Crossings). With the combination of distance from the Emergency and Pedestrian Access opening to the nearest homes and the additional shielding provided by the retail center, the traffic noise levels associated with I-80 will comply with the City’s exterior noise standard at outdoor activity areas of proposed sensitive receptors.

2. Sound Insulation

a. To achieve compliance with the 45 dBA L_{dn} interior noise level standard at elevated second floor facades, an exterior-to-interior noise reduction of 33 dBA would be required. Building facade and window assembly upgrades would be required of this project. It is likely that window ratings will need to be upgraded to a combination of STC-35 and STC-38 rated windows, depending on the ratio of exposed windows with a full or partial view of I-80 to solid building facades. An analysis of project construction plans should be conducted when such plans are available to ensure that sufficient sound insulation has been incorporated into the project design. In addition, the project applicant shall implement the following measures.

- All residential buildings shall be constructed with mechanical ventilation systems which would allow occupants to keep windows and doors closed to achieve acoustical isolation from I-80 traffic noise. The systems shall allow for the introduction of fresh outside air, without the requirement of open windows.

- All attic vents in the residential buildings on lots along the northern boundary of the site shall be acoustically baffled. The baffles shall introduce at least one 90 degree obstruction to the flow of air through the vent. The baffle shall be lined with an acoustically absorbent material.

- The project applicant shall be required to submit an analysis that verifies compliance with the City of Rocklin 45 dBA L_{dn} interior noise level standard for the residential buildings within the 60 dBA noise contour of I-80 (distance to be determined after mitigation has been implemented [i.e., accounting for the actual attenuation achieved from the noise barrier constructed along the northern project boundary]). The analysis shall be based upon actual building plans and shall be conducted before the issuance of building permits for these units. The analysis shall be conducted by a qualified acoustical consultant.

Level of Significance after Mitigation

According to the City's Noise Compatibility Guidelines (Table 4.4-5), exterior noise levels between 60 and 70 dBA L_{dn}/CNEL are "conditionally acceptable" for residential uses as long as necessary noise insulation features are included in the design. With implementation of the above mitigation measures, the necessary noise insulation features would be integrated into the project design and the exterior noise levels at residences would be reduced to between 60 and 65 dBA L_{dn}/CNEL. Therefore, the project would comply with the noise compatibility guidelines and noise impacts associated with the proposed project would be reduced to a **less-than-significant** level.

IMPACT 4.4-4 Exposure of Sensitive Receptors to Excessive Stationary- or Area-Source Noise Levels. *The mechanical equipment and truck deliveries associated with adjacent proposed commercial uses would generate substantial noise levels, which could affect the proposed residential uses of the Rocklin 60 project. However, the Rocklin Crossings project would be required to reduce noise levels for the adjacent residences to acceptable levels. Therefore, this impact would be considered **less than significant**.*

The proposed residential uses are not typically considered major stationary- or area-sources of noise. Noise emanating from the proposed project would be dominated by noise associated with landscaping and maintenance equipment (e.g., motorized lawn and garden equipment). Such activities would be temporary in nature and would typically be limited to the daytime hours. Other noise sources from residential uses, which would influence the noise environment of the project to a lesser extent would include people talking, amplified music, dogs barking, garbage collection, and mechanical equipment (e.g., HVAC systems). HVAC equipment noise would mostly be generated by small fan-type units located adjacent to the structures and would be contained in a metal enclosure, as opposed to large commercial roof-mounted condensers, given that the proposed uses are residential. Stationary- and area-source noise sources associated with the proposed project would be temporary and/or minor and, thus, **less than significant**.

The parcel adjacent to the project site is approved for development of a large shopping center (Rocklin Crossings). The noise sources and levels typically associated with commercial land uses and associated noise impacts are discussed separately below.

Noise from the Rocklin Crossings Commercial Development

A separate noise analysis was prepared for the Rocklin Crossings commercial development (Bollard Acoustical Consultants, August 2007), in which noise impacts of that commercial project upon the Rocklin 60 residential development were identified. The following discussion is from that analysis.

A combination of use of existing literature, and application of accepted noise prediction and sound propagation algorithms, were used to predict noise levels resulting from the Rocklin Crossings retail center project. Specific noise sources evaluated in this section include truck circulation and unloading activities, and mechanical equipment. Potential noise impacts of each of these major noise sources are described below.

Truck Delivery Noise

For the adjacent approved large-scale commercial project known as Rocklin Crossings, Wal-Mart and Home Depot are anticipated as two major tenants. The identity of the remaining tenants, as well as the location and size of the remaining tenant buildings to be constructed on this adjacent site has not yet been determined. The home improvement store, large retail/grocery store, and the remaining smaller commercial buildings along the Rocklin Crossings eastern site boundary adjacent to the Rocklin 60 project site would all have truck loading dock facilities in the rear of the buildings. In order to utilize the loading dock facilities, trucks would arrive, stop, couple and decouple trailers, back into loading docks, be unloaded, and depart the site. Trucks would bring enclosed trailers with food (some refrigerated) and merchandise for each of the commercial buildings, and flatbeds carrying lumber to the home improvement store. According to Rocklin Crossings project representatives, worst case daily truck activity at these stores could involve as many as 15 semi-trailer trucks per day and approximately 3 semi dual-trailer flatbed trucks per day for delivery of materials at the home improvement store. In addition, 6 semi-trailer trucks delivering dry grocery goods and general merchandise per day and 3 refrigerated semi-trailer truck deliveries per day would occur at the proposed Wal-Mart. Approximately 15 smaller 2-axle vender trucks would also make deliveries to these stores each day. For the noise analysis prepared to support the Rocklin Crossings Draft EIR, it was assumed that up to 27 truck deliveries and 15 small truck deliveries could occur in a given day (Bollard Acoustical Consultants, Inc. 2007).

Based on an evaluation of the Rocklin Crossings site plan, delivery trucks would likely enter from the south and traverse north behind the proposed stores of the site. After delivery, trucks would exit to the south. Delivery trucks would be closest to noise-sensitive receivers on the Rocklin 60 site during passages directly behind the stores. Truck trips along the eastern boundary of the Rocklin Crossings site would be approximately 70 feet from the center of the nearest residential backyards proposed as a part of the Rocklin 60 project. Truck trips en route to the loading dock areas are expected to be relatively brief, and are estimated to produce an average Sound Exposure Level (SEL) of approximately 87 dBA at a distance of 50 feet. Smaller truck trips would produce an average SEL of approximately 80 db at 50 feet. Relative to the louder and greater number of heavy truck deliveries, the noise generation of the smaller (2-axle) trucks is not anticipated to appreciably affect overall truck pass-by noise levels. The typical L_{max} level due to a truck pass-by has been measured to be approximately 75 dBA at a distance of 50 feet. Because the SEL represents a single impulsive noise event over a short duration (0.5 second), it is typically higher than the L_{max} level, which represents the maximum instantaneous noise level during a specific period of time.

Noise generating activities associated with loading dock operations at the proposed large retail/grocery store would likely include heavy trucks stopping (air brakes), backing into the loading docks (back-up alarms), and pulling out of the loading docks (revving engines).

Two below-grade truck loading docks are proposed for the Wal-Mart Supercenter, each with 3 individual side-by-side loading bays. The bay doors would be equipped with sealed gaskets to minimize noise generation from off-loading trailers.

If the heavy truck engines idle and/or trailer refrigeration units cycle on and off while the trucks are being unloaded, this would generate additional sources of noise at the loading dock location. Once the trucks have backed into the loading dock, they are unloaded from the inside of the store using a fork lift or hand cart. Most noise from these unloading activities would be contained within the building and truck trailer.

Not all trucks are unloaded at loading docks, as beverage, bread, potato chip, and other venders often utilize hand carts to unload their products through rear doors (as opposed to depressed dock areas). Flatbed lumber trailers would be unloaded using forklifts in the area behind the home improvement store. Noise from these operations also contributes to the overall truck delivery noise environment.

Due to the fairly intensive truck unloading operations that would occur adjacent to the eastern site boundary, it is not feasible to assess the noise of different operations (i.e., lumber unloading, loading docks, truck pass-bys, refrigeration trucks, etc.) independently. As a result, the noise generation of each of these sources was combined to arrive at a cumulative assessment of truck delivery noise. The results of this assessment indicate that a typical busy hour of overall truck activity along the eastern site boundary would generate median (L_{50}) and maximum (L_{max}) noise levels of 60 dBA and 80 dBA, respectively, at a reference distance of 50 feet from the effective noise center of the truck unloading activities. When refrigeration trucks are present, the median noise levels would be approximately 5 dBA higher, or 65 dBA L_{50}. Maximum noise levels associated with refrigeration trucks were not found to be higher than maximum noise levels for non-refrigeration trucks.

Assuming the overall noise levels cited above and a 6-dBA decrease in noise levels for each doubling of distance from the source of noise, the noise levels at the closest proposed residences would be 60 dBA L_{50} at 50 feet. At 100 feet, the noise level would be 54 dBA L_{50}. At 200 feet, the noise level would be 48 dBA L_{50}.

The distances from the approximate noise center of the truck delivery areas to the nearest proposed residences in the Rocklin 60 residential development vary. For example, proposed Lot 38 is closer to the noise sources on the Rocklin Crossings site than proposed lots 46-47, 66-67, and 92-93. Table 4.4-12 shows the approximate distances from the effective noise centers of the truck delivery areas to the nearest proposed residences at the Rocklin 60 project site, and the corresponding noise levels associated with the combined truck delivery operations.

The Rocklin Crossings project proposes a noise barrier to account for noise generated on that adjacent project site. Based on the predicted average and maximum noise levels associated with truck deliveries, a noise barrier analysis was performed for the Rocklin Crossings project. The barrier analysis took into account the relative elevations of the commercial truck activity and the proposed elevations of residences at the Rocklin 60 project site.

Table 4.4-12
Predicted Truck Delivery Noise Levels at Nearest Proposed Residences

Lots(s)	Distance (feet)	Predicted L_{50} Without/With Refrigeration Trucks (dBA)	Predicted L_{max} (dBA)
38	70	57/62	77
46–47, 66–67, 92–93, 117–118	120	52/57	72
144–146	70	57/62	77

Notes: The lot numbers in the table above are current, whereas lot numbers reflected in the appendix in some instances are outdated.
[1] Lot locations are shown in Figure 1 of the Environmental Noise Assessment prepared for this project (Bollard Acoustical Consultants, Inc.2006) (Appendix D).
[2] Distances shown are from approximately the noise center of truck activity areas to the backyards of the nearest residences.
[3] Predicted L_{50} values based on a reference level of 60 dBA at 50 feet.
[4] Predicted L_{max} values based on a reference level of 80 dBA at 50 feet.
Source: Bollard Acoustical Consultants, Inc. 2006

The proposed residential area would be at a lower elevation than the commercial site, thereby improving the efficiency of the noise barrier constructed at the commercial site. The results of the barrier analysis are summarized in Table 4.4-13 (Bollard Acoustical Consultants, Inc. 2007).

The results of the noise barrier analysis indicate that, without refrigeration trucks present, noise barriers ranging in height from 6 to 9 feet along the eastern site boundary could be utilized to reduce truck unloading activity noise to below the City's land use noise compatibility standards for single-family residential development (cited earlier) (Bollard Acoustical Consultants, Inc. 2007). With the use of refrigeration trucks, additional noise controls would be necessary to ensure the City's noise standards are not exceeded. The barrier heights identified in Table 4.4-13 with the use of refrigeration trucks assume that no additional noise controls are implemented. However, with the implementation of the additional noise control measures that would be required of the Rocklin Crossings project, as discussed below, a perimeter noise barrier height of greater than nine feet would not be necessary. Because noise from the adjacent approved project's truck deliveries would be reduced to below the applicable standards with the implementation of required noise mitigation measures, the impact would be considered **less than significant**.

Table 4.4-13 Barrier Heights Required to Satisfy Exterior Noise Standards at Nearest Residences		
Lots(s)	Noise Barrier Height (feet) to Achieve:	
	45 dBA L_{50} Without / With Refrigeration Trucks	65 / 75 dBA L_{max}
38	7 / 16	7 / 6
46–47	6 / 11	6 / 0
66–67	6 / 11	6 / 0
92–93	6 / 11	6 / 0
117–118	6 / 13	6 / 0
144–145	9 / 16	9 / 6

Notes:

[1] Cumulative commercial noise levels do not include refrigerated trailer unit noise.

The lot numbers in the table above are current, whereas lot numbers reflected in the appendix in some instances are outdated.

Source: Bollard Acoustical Consultants, Inc. 2006

Mechanical Equipment Noise

The HVAC system for the adjacent approved Rocklin Crossings project would consist of packaged rooftop air conditioning systems. The units would be relatively evenly distributed across the roof of the building, starting about 30 feet in from the edges of the roof. These HVAC units, which typically stand about 4–5 feet tall, would be shielded from view by the project building parapets. Such rooftop HVAC units typically generate noise levels of approximately 50 dBA L_{50} at a reference distance of 100 feet from the building, including shielding by the building. During nighttime hours, the air conditioning requirements of the facilities would decrease significantly, with reference levels being reduced to less than 45 dBA L_{50}.

Given the distance between the rooftop HVAC units and the closest proposed residences in the Rocklin 60 project, and the shielding provided by the rooftop parapet, noise from mechanical equipment would not exceed applicable standards. However, deviation from the design outlined above would produce different noise levels. For the purposes of this analysis, it is assumed the design as proposed would be implemented and that all mechanical equipment would be shielded from view or enclosed, thus breaking the line of sight from the equipment to off-site receptors.

To estimate the noise produced by food cold storage refrigeration equipment proposed as a part of the adjacent Rocklin Crossings project, noise measurements were conducted at a similar large grocery store. At a distance of 50 feet from the food cold storage equipment, a noise level of 66 dBA L_{50} was recorded. Food cold storage equipment is proposed to be located on the roof of the large retail/grocery store on the Rocklin Crossings site, approximately 300 feet west of the closest proposed residences. At this distance, the food cold storage equipment is predicted to generate noise levels of 50 dBA L_{50}, not including shielding by the rooftop and parapet. After consideration of this shielding, cold storage equipment noise levels are predicted to be below the recommended 45 dBA L_{50} nighttime noise standards.

Other Noise Sources

Other noise sources at the back of Rocklin Crossings buildings near the Rocklin 60 site could include cardboard baling and trash compaction machinery, and garbage collection. These activities are anticipated to generate lower levels of noise than the truck delivery activities, and the noise barrier recommended for those operations would provide similar noise reduction from these ancillary noise sources as experienced by proposed residences on the project site.

Parking lot noise would also be minor relative to trucking activities, and the majority of parking lots on the Rocklin Crossings site are to be located on the western portion of the site, near I-80 and Sierra College Blvd, and away from Rocklin 60 proposed residences. Nonetheless, there is a smaller parking area and rows of parking along the eastern portion of the Rocklin Crossings project boundary.

Assuming all of the approximately 200 spaces in the parking area located at the northeastern portion of the Rocklin Crossings project site are filled and emptied in one hour, a total of 400 parking lot events would occur in that area during a very busy hour. The approximate center of activity of the parking area would be 65 feet from the residential property line to the east and approximately 70 feet from the nearest backyard locations of the proposed Rocklin 60 residential development. A typical SEL due to automobile arrivals/departures, including car doors slamming and people conversing is approximately 70 dB and maximum parking lot noise levels are typically 63 dB, at a distance of 50 feet. At the nearest residential outdoor activity areas, the predicted median hourly and maximum noise levels were computed to be 49 dB L50 and 51 dB L_{max}. Interior levels within the nearest proposed Rocklin 60 residences would be at least 15 dB lower, or approximately 33 dB L50 and 36 dB L_{max}. The predicted levels, which include a -9 dB offset to account for the recommended property line noise barrier for truck delivery noise, would not exceed the City's noise level standards. Because the parking lot activities would not expose offsite residents to noise levels in excess of applicable standards, this impact would be considered less than significant.

In addition to routine use of the parking lots on the adjacent Rocklin Crossings project site, there will be noise associated with cleaning the parking lots. Parking lot sweeper noise varies and is dependent upon the actual sweeper truck equipment, as well as the truck operator. Rocklin Crossings proposes buildings and a noise barrier between the primary areas where parking lot sweeping noise would be generated and the Rocklin 60 residences. This is predicted to provide significant shielding of sweeper truck noise. Also, the noise generated by the sweeper truck equipment would be substantially lower than the noise generated from heavy truck deliveries. Therefore, the sweeper truck equipment noise would be considered a relatively negligible noise source on the site and it would not expose offsite residents to excessive noise levels. This impact would be considered less than significant.

The adjacent proposed Rocklin Crossings project would also involve the use of property maintenance equipment (e.g., leaf blowers, lawn mowers, and trimmers). According to the EPA, noise attributable to such equipment could result in noise levels of approximately 80 to 90 dBA at 3 feet from the source, depending on the exact type and size of the maintenance equipment (EPA 1971). Thus, property maintenance activities occurring at the Rocklin Crossings project site could result in noise levels of approximately 65 dBA at 50 feet from the proposed project limits. Landscape maintenance would be primarily occur on the western portion of the Rocklin Crossings site, away from Rocklin 60 residences. As in the case of other stationary- and area-sources of noise, the sound wall proposed as a part of the Rocklin Crossings project and intervening structures would reduce these noise levels to levels acceptable according to locally applicable standards.

The City of Rocklin is the lead agency for consideration of the Rocklin Crossings project, as well as the proposed project considered herein. The Rocklin Crossings project requires noise mitigation specifically designed to achieve an acceptable noise environment for proposed Rocklin 60 residences. The noise analysis conducted to support the Rocklin Crossings EIR uses information specific to the Rocklin 60 project site plan for analysis of impacts and mitigation design. Noise mitigation fitting the description below would be needed to sufficiently attenuate off-site stationary- and area-source noise levels from the proposed Rocklin Crossings project, as experienced at the proposed residences:

- A solid noise barrier constructed at the locations shown on Figure 1 of the Environmental Noise Assessment prepared for this project (Bollard 2006) (Please refer to Appendix D of this EIR for the full Environmental Noise Assessment).
- The barrier should be constructed of masonry block, pre-cast concrete panels, or other massive materials.
- The recommended noise barrier height along the entire eastern boundary of the project site shall be sufficient to ensure that the proposed commercial project is consistent with the City's exterior and interior noise levels of 60 dBA L_{dn} and 45 dBA L_{dn}, respectively, for residential uses exposed to noise sources.

- Solid noise barriers shall extend along the cold food unloading area of the large retail/grocery store loading dock to further shield refrigeration trucks while being unloaded. Refrigeration trucks shall be required to park within those shielded loading dock areas while on site.

- All rooftop mechanical equipment shall be completely screened from view of existing or proposed residences by the proposed building parapet.

- Before occupancy, documentation shall be provided by the project applicant demonstrating that the noise barrier achieves the reduction in noise levels necessary to comply with the standards set forth in Table 4.4-6 at the off-site residential lots bordering the project site. This verification shall be in the form of an acoustical analysis performed by an acoustical engineer, and funding for this analysis shall be provided by the applicant.

These recommendations are based on the site plans shown in Figure 1 of the Environmental Noise Assessment (Bollard 2007), and on the assumptions contained herein. Deviation from these site plans or assumptions could cause actual noise levels to vary. Implementation of the above-described measures is predicted to fully mitigate noise impacts, and noise levels associated with off-site activities at the Rocklin Crossings commercial project would be within acceptable limits as experienced at the proposed Rocklin 60 residential project. Therefore, this impact would be considered **less-than-significant**.

Mitigation Measure 4.4-4: Exposure of Sensitive Receptors to Excessive Stationary- or Area-Source Noise Levels.

No mitigation is necessary.

IMPACT 4.4-5 Exposure of Sensitive Uses to Excessive Vibration Levels. *The proposed project would generate vibration levels that could cause annoyance for existing adjacent residential uses. However, such instances of construction vibration would be temporary and intermittent in nature and no long-term sources of vibration would occur as a result of the project. Therefore, the impact is considered* ***less than significant****.*

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 4.4-14 displays vibration levels for typical construction equipment.

As discussed above, on-site construction equipment could include dozers and trucks. According to Federal Transit Administration (FTA), vibration levels associated with the use of a large bulldozer is 0.089 inches per second (in/sec) peak particle velocity (PPV) and 87 vibration decibels (VdBA) referenced to 1 microinch per second (µin/sec) and based on the root mean square (RMS) velocity amplitude] 25 feet, as shown in Table 4.4-13. Using FTA's recommended procedure for applying a propagation adjustment to these reference levels, predicted worst-case vibration levels of approximately 0.03 in/sec PPV and 81 VdBA at the closest proposed off-site sensitive receptor (approximately 50 feet from the eastern boundary of the project site) could occur from use of a large bulldozer. These vibration levels would not exceed Caltrans's recommended standard of 0.2 in/sec PPV (California Department of Transportation 2002) with respect to the prevention of structural damage for normal buildings. However, vibration levels could exceed the FTA's maximum-acceptable vibration standard of 80 VdBA (Federal Transmit Administration 2006) with respect to human annoyance for residential uses. Although operation of heavy duty construction equipment could expose persons to excessive groundborne vibration or groundborne noise levels, the instances of such vibration and groundborne noise would be intermittent and very short in duration. The long-term operation of the proposed project would not include any vibration sources. As a result, this impact is considered **less than significant**.

Table 4.4-14 Typical Construction-Equipment Vibration Levels		
Equipment	PPV at 25 feet (in/sec)[1]	Approximate L_v at 25 feet[2]
Large Bulldozer[3]	0.089	87
Caisson Drilling	0.089	87
Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

[1] Where PPV is the peak particle velocity

[2] Where Lv is the velocity level in decibels (VdBA) referenced to 1 μ inch/second and based on the root mean square (RMS) velocity amplitude.

[3] Bulldozer types range in size and operating weight from less than 10 tons to greater than 100 tons. Depending on the model of bulldozer used during construction of the proposed project, associated vibration levels could fall between those from a large or small bulldozer. For the purposes of this analysis, a bulldozer would be considered large if it has an operating weight greater than 45 tons.

Source: Federal Transit Administration 2006

Mitigation Measure 4.4-5: Exposure of Sensitive Uses to Excessive Vibration Levels.

No mitigation is necessary.

IMPACT 4.4-6 Exposure of Sensitive Uses to Excessive Aircraft-Generated Noise Levels. *The project would not result in exposure of sensitive receptors to excessive aircraft noise, and thus,* **no impact** *would occur.*

The project is not located within 2 miles of an airport land use plan or a public airport, or in the vicinity of an active private airport. The Holsclaw's short take-off and landing (STOL) Airstrip, located parallel to I-80 to the northeast, is the nearest airport, but is inactive. The project would not expose people residing in the project area to excessive aircraft-generated noise levels. There is **no impact**.

Mitigation Measure 4.4-6: Exposure of Sensitive Uses to Excessive Aircraft-Generated Noise Levels.

No mitigation is necessary.