G. NOISE

The following discussion describes the general characteristics of sound and the categories of audible noise; and the regulatory framework related to noise issues at the City, State, and federal levels. Potential noise impacts associated with implementation of the Wildfire Hazard Reduction and Resource Management Plan (Plan) are evaluated and mitigation measures are recommended where appropriate.

1. Setting

This section begins with an introduction to several key concepts and terms that are used in evaluating noise. It then explains the various agencies that regulate the noise environment surrounding and including the Study Area, which is under the jurisdiction of the East Bay Regional Park District (EBRPD), and summarizes key standards that are applied to proposed Plan implementation actions. The section concludes with a description of the existing noise environment.

a. Characteristics of Sound. To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is the number of complete vibrations or cycles per second of a wave that results in the range of tone from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment, and it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. A specific pitch can be an annoyance, while loudness can affect our ability to hear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. Table IV.G-1 lists the "Definitions of Acoustical Terms."

Noise is generally defined as unwanted sound, and consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, or sleep. Several noise measurement scales exist that are used to describe noise in a particular location. A decibel (dB) is a unit of measurement which indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense and 30 dB is 1,000 times more intense. Each 10 dB increase in sound level is perceived as approximately a doubling of loudness. Sound intensity is normally measured through the A-weighted sound level (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Table IV.G-2 shows representative outdoor and indoor noise levels in units of dBA.

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

Table IV.G-1: Definitions of Acoustical Terms

Term	Definition
Decibel, dB	A unit of measure that denotes the ratio between two quantities proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless noted otherwise.
L_{02}, L_{08}, L_{50}, L_{90}	The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level at 2 percent, 8 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 decibels to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurement and Noise Control, 1991.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise-sensitive receptor of concern. There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and community noise equivalent level (CNEL) or the day-night average level (L_{dn}) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within one dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours.

Table IV.G-2: Typical A-Weighted Sound Levels

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

Source: Compiled by LSA Associates, Inc., 2008.

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

b. Characteristics of Groundborne Vibration. Vibrating objects in contact with the ground radiate vibration waves through various soil and rock strata to the foundations of nearby buildings. As the vibration propagates from the foundation throughout the remainder of the building, the vibration of floors and walls may cause perceptible vibration from the rattling of windows or a rumbling noise. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. When assessing annoyance from groundborne noise, vibration is typically expressed as root mean square (rms) velocity in units of decibels of 1 micro-inch per second. To distinguish vibration levels from noise levels, the unit is written as "VdB." Human perception to vibration starts at levels as low as 67 VdB and sometimes lower. Annoyance due to vibration in residential settings starts at approximately 70 VdB. Groundborne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of the building, the motion does not provoke the same adverse human reaction.

In extreme cases, excessive groundborne vibration has the potential to cause structural damage to buildings. Common sources of groundborne vibration include trains and construction activities such as blasting, pile driving and operating heavy earthmoving equipment.

c. Noise Regulatory Framework. The following section provides brief discussions of the regulatory framework related to noise.

(1) U.S. Environmental Protection Agency (EPA). In 1972 Congress enacted the Noise Control Act. This act authorized the EPA to publish descriptive data on the effects of noise and establish levels of sound "requisite to protect the public welfare with an adequate margin of safety." These levels are separated into health (hearing loss levels) and welfare (annoyance levels), as shown in Table IV.G-3. The EPA cautions that these identified levels are not standards because they do not take into account the cost or feasibility of the levels. For protection against hearing loss, 96 percent of the population would be protected if sound levels are less than or equal to a L_{eq} (24) of 70 dBA. The "(24)" signifies a L_{eq} duration of 24 hours. The EPA activity and interference guidelines are designed to ensure reliable speech communication at about 5 feet in the outdoor environment. For outdoor and indoor environments, interference with activity and annoyance should not occur if levels do not exceed 55 dBA and 45 dBA, respectively.

Table IV.G-3: Summary of EPA Noise Levels

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

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

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

Table IV.G-4: Summary of Human Effects in Areas Exposed to 55 dB CNEL

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

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

For the purposes of this EIR, the EPA findings provide a more complete understanding of the issue of noise as well as a context in which to evaluate the proposed project.

(2) National Environmental Policy Act. The National Environmental Policy Act (NEPA) is a federal law that establishes environmental policy for the nation, provides an interdisciplinary

framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account. Under NEPA, potential adverse impacts and measures to mitigate these impacts must be identified, including the identification of impacts for which no mitigation or only partial mitigation is available.

(3) State of California. The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the "State Noise Insulation Standard," it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. The State has also established land use compatibility guidelines for determining acceptable noise levels for specified land uses. The State's land use compatibility guidelines are shown in Table IV.G-5 below.

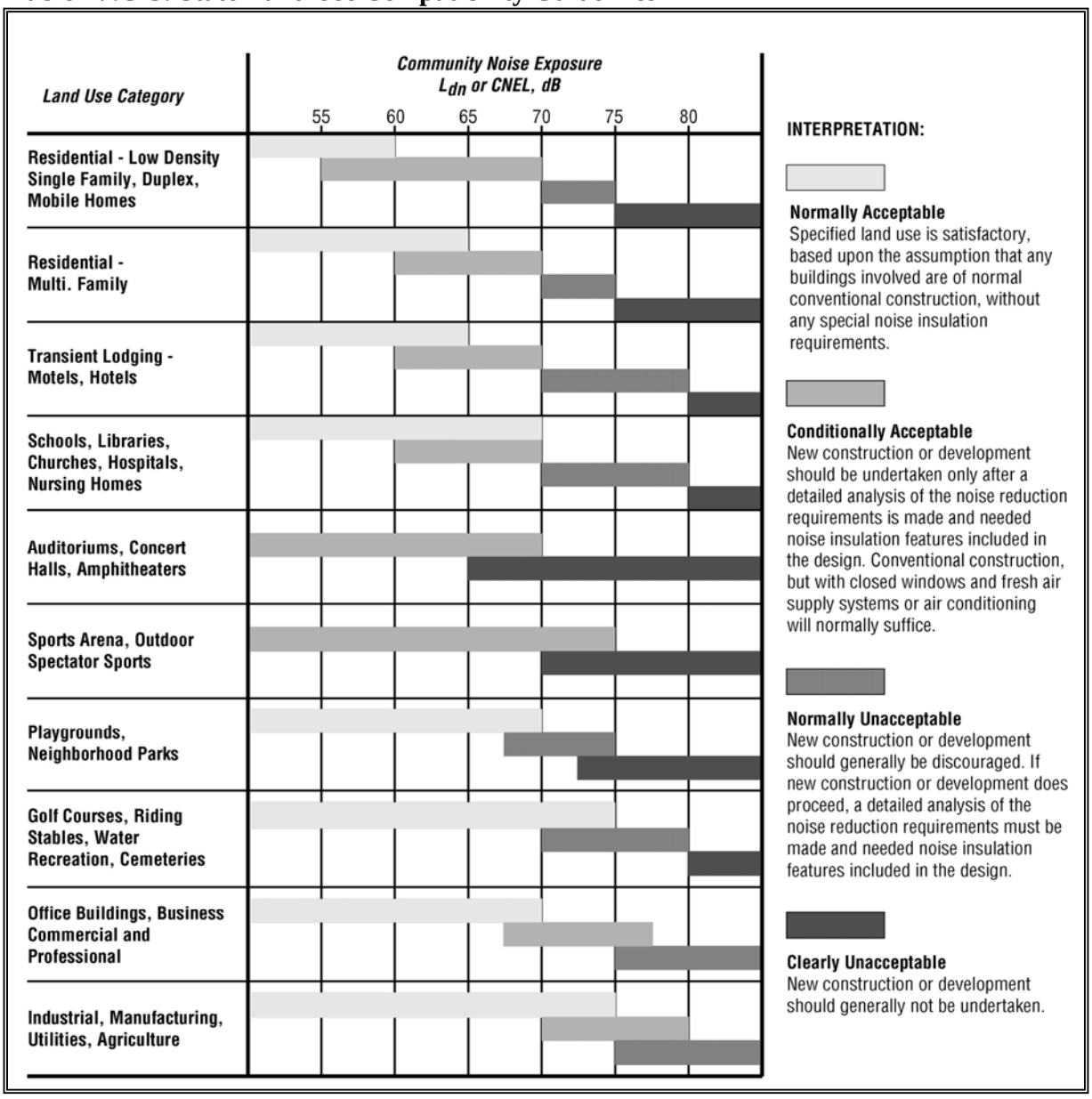
d. Overview of the Existing Noise Environment. The Study Area comprises primarily open space land uses, although at various points it is bordered by urban land uses and is therefore influenced by surrounding or adjacent noise sources. Generally, the ambient noise environment in the parks is characterized by natural noise sources such as wind, birds, and domestic and wild animals. Existing human-generated noise sources which affect the ambient noise environment throughout the Study Area are described below.

(1) Existing Traffic Noise. The amount of traffic-related noise throughout the Study Area varies according to many factors, such as volume of traffic on roadways, vehicle mix (percentage of cars, trucks and buses), average traffic speed, and distance of park areas from the roadway. Portions of the Study Area are located near major roadway noise sources including Interstate 580 (I-580), Interstate 880 (I-880), Interstate 80 (I-80), State Route 24, and State Route 13. However, the majority of the Study Area is not located near major roadway noise sources.

(2) Existing Stationary Noise. Commercial noise sources are located within and adjacent to various portions of the Study Area and include restaurant and commercial noise sources such as parking lot and delivery truck activities, compressors, and exhaust fans. Other existing stationary noise sources within the Study Area include active recreational use areas as well as equipment operation associated with park maintenance, such as brush clearing and landscaping.

(3) Existing Aircraft Noise. While occasional aircraft-related noise is audible at various points throughout the Study Area, the area is not located within an airport land use plan. In addition, the Study Area is not located within the vicinity of a private airstrip. Therefore, implementation of the Plan would not expose people working in the Study Area to excessive noise levels associated with airport operations.

Table IV.G-5: State Land Use Compatibility Guidelines



Source: Governor's Office of Planning and Research. 2003 General Plan Guidelines.

2. Impacts and Mitigation Measures

The following section analyzes the potential noise impacts from implementation of the Plan. Criteria of significance used to determine the severity of these potential impacts are discussed first, followed by those impacts that would likely be considered less-than-significant based on the data and analysis included in this report. Potentially significant impacts are then described.

a. Criteria of Significance. The project would result in a significant noise impact if it would:

- Expose persons to or generate noise levels in excess of standards established in local noise ordinances or applicable standards of other agencies.
- Result in a substantial permanent increase or a substantial temporary or periodic increase in ambient noise levels in the Study Area's vicinity above levels existing without the project.
- Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.

b. Less-Than-Significant Noise Impacts. The less-than-significant noise effects associated with implementation of the Plan are described below.

(1) Operational Noise Impacts. Implementation of the proposed Plan would be expected to generate short-term, temporary increases in the ambient noise level throughout the Study Area.

Two types of short-term noise impacts could occur during fuel reduction activity phases of the proposed project. First, clearing crew commutes and the transport of mechanical equipment to the various activity sites would incrementally increase noise levels on access roads in the Study Area's vicinity. Although there would be a relatively high single event noise exposure potential causing an intermittent noise nuisance (passing trucks at 50 feet would generate up to a maximum of 86 dBA L_{max}), the effect on longer-term (hourly or daily) ambient noise levels would be very small. Therefore, impacts associated with worker commute and equipment transport to fuel reduction sites would be less than significant.

The second type of short-term noise impact is related to noise generated during fuel reduction activities. Certain fuel reduction methods proposed by the Plan (such as the use of mechanical equipment to remove vegetation or the use of grazing animals) would result in the short-term generation of noise above ambient levels while these activities are taking place. Proposed fuel reduction treatment methods include hand labor treatments, mechanical treatments, chemical treatments, prescribed burning, and grazing. Of these fuel reduction methods, hand labor and mechanical treatments would be the primary sources for noise impacts associated with project implementation.

Hand labor is a fuel reduction treatment technique that uses tools such as shovels, Pulaski hoes, McLeod fire tools, weed whips (potentially using different blades according to materials being treated) and "weed wrenches" (tools that pull both shrub and root system out), chain saws, hand saws, machetes, pruning shears, and loppers. Chippers are often used in conjunction with hand labor to process cut materials into mulch for onsite disposal.

Mechanical fuel reduction treatments could involve the use of tractors, backhoes, and graders, depending on terrain and the type and amount of fuel reduction necessary. As shown in Table IV.G-6, sound levels of

Table IV.G-6: Typical Mechanical Equipment Maximum Noise Levels, L_{max}

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Scrapers	83 to 91	87
Haul Trucks	83 to 94	88
Dozers	85 to 90	88
Tractors	77 to 82	80
Front-End Loaders	86 to 90	88
Chain Saw - gasoline	72 to 88	85
Trucks	81 to 87	85

Source: Bolt, Beranek & Newman, 1987. *Noise Control For Buildings And Manufacturing Plants.*

typical mechanized equipment (e.g., backhoes, tractors, and trucks) range from approximately 72 to 94 decibels at 50 feet from the source. An increase in noise level would primarily be experienced close to the noise source. The magnitude of these impacts would depend on the type of activity, the noise level generated by various pieces of equipment, the duration of the activity, and the distance between the noise source and the receiver. During vegetation clearing operations, it is EBRPD protects the public's health and safety by restricting public access to the activity areas through the use of signs and barriers which would also allow for a noise attenuation buffer.

Prolonged loud mechanical noise could also disturb nesting birds, resulting in nesting failure and/or nest abandonment. Chapter IV, Fuel Reduction Methods of the Plan contains a discussion of timing considerations for fuel reduction activities and Table IV-1 identifies those months of the year when particular practices may need to be implemented (e.g., pre-treatment nesting surveys or avoidance of nests or breeding habitat) to avoid adverse affects to special-status species or protected nesting birds known to occur in the Study Area. Additionally, implementation of Mitigation Measure BIO-2 that requires that nest surveys be conducted within 15 days prior to treatment if performed during the nesting season (February-July) and deemed necessary by the pre-assessment survey to locate and avoid protected nesting birds would reduce noise impacts on nesting bird species to a less-than-significant level.

The District's ongoing policy is to require that vegetation management and clearing activities be limited to the hours between 8:00 a.m. and 5:00 p.m. and only occur on weekdays.[1,2] In addition, the short-term nature of most fuel reduction activities means that these activities would only occur in one location for a short period, such as a few days or one week, before moving to a different location. Thus any sensitive receptors would be exposed to mechanical equipment noise for only a short period of time while fuel reduction activities occurred in the vicinity. Therefore, noise in excess of existing standards from mechanical equipment and noise impacts associated with fuel reduction activities identified in the Plan resulting in temporary increases in ambient noise levels would be temporary and generally less-than-significant.

(2) Groundborne Vibration and Noise Impacts. Implementation of the Plan would not result in any permanent groundborne vibration or groundborne noise sources within the Study Area. Therefore, no permanent groundborne noise and vibration impacts would occur, and no mitigation would be required.

Fuel reduction activities resulting from implementation of the Plan may include the use of heavy equipment such as bulldozers, off-road trucks, and tractors. As shown in Table IV.G-7, typical groundborne vibration levels measured at a distance of 50 feet from heavy mechanical equipment in full operation, such as large bulldozers, can range up to approximately 87 VdB. These vibration levels at this distance are well below the damage

Table IV.G-7: Typical Vibration Source Levels for Construction Equipment

Equipment	Approximate VdB at 25 feet
Large bulldozer	87
Loaded trucks	86
Small bulldozer	58

Source: Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment.* May.

[1] EBRPD, 2007. Bid Documents: East Bay Hills Tree Removal Project, Contract Number: 153M-07-755. Technical Specifications 5.5. September.

[2] EBRPD, 2007. Bid Documents: East Bay Hills Vegetation Clearance and Fire Hazard Reduction Services Project, Exhibit A. December.

threshold for buildings of normal northern California construction. Additionally, fuel management activities involving heavy equipment would only occur, for very short and intermittent periods of time and on weekdays between the hours 8:00 a.m. and 5:00 p.m., per District policy. Therefore, short-term vibration impacts associated with fuel reduction activities would be less-than-significant.

c. Potentially Significant Noise Impacts. As described above, certain fuel reduction methods proposed by the Plan (such as the use of mechanical equipment to remove vegetation) would result in the short-term generation of noise above ambient levels while these activities are taking place.

Impact NOI-1: Implementation of the proposed Plan has the potential to result in short-term generation of noise and groundbourne noise vibrations. (S)

Implementation of the following mitigation measure would reduce any potential noise and vibration impacts on sensitive receptors to a less-than-significant level.

> Mitigation Measure NOI-1: The District shall limit noise-producing fuel reduction activities that involves the use of large machinery (e.g., haul trucks, tractors and backhoes) undertaken by park staff or contractors to weekdays between the hours 8:00 a.m. and 5:00 p.m. This requirement shall be incorporated into the District's bid documents for fuel management activities. (LTS)