

3.9 NOISE

The purpose of this section is to analyze potential noise impacts of the proposed project. This section evaluates short-term, construction-related impacts as well as long-term buildout (operational) conditions. Information in this section is based on the City of Lafayette *General Plan (General Plan)*, City of Lafayette Municipal Code, and traffic information contained in the *Soldier Field Subdivision Project Traffic Impact Analysis*, prepared by RBF Consulting (June 10, 2005).

3.9.1 Environmental Setting

3.9.1.1 Noise Characteristics and Measurement

Noise is typically described as any unwanted or objectionable sound. Sound is technically described in terms of the loudness (amplitude) and frequency (pitch) of the sound. The standard unit of measurement of the loudness of sound is the decibel (dB). Because the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against sound frequencies in a manner approximating the sensitivity of the human ear.

The decibel scale is logarithmic. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range, similar to how the Richter scale measures earthquake magnitudes. In terms of human response to noise, a sound that is 10 dBA higher than another is perceived to be twice as loud; 20 dBA higher, four times as loud; and so forth. Everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Examples of various sound levels in different environments are shown in Figure 3.9-1 (Common Environmental Noise Levels).

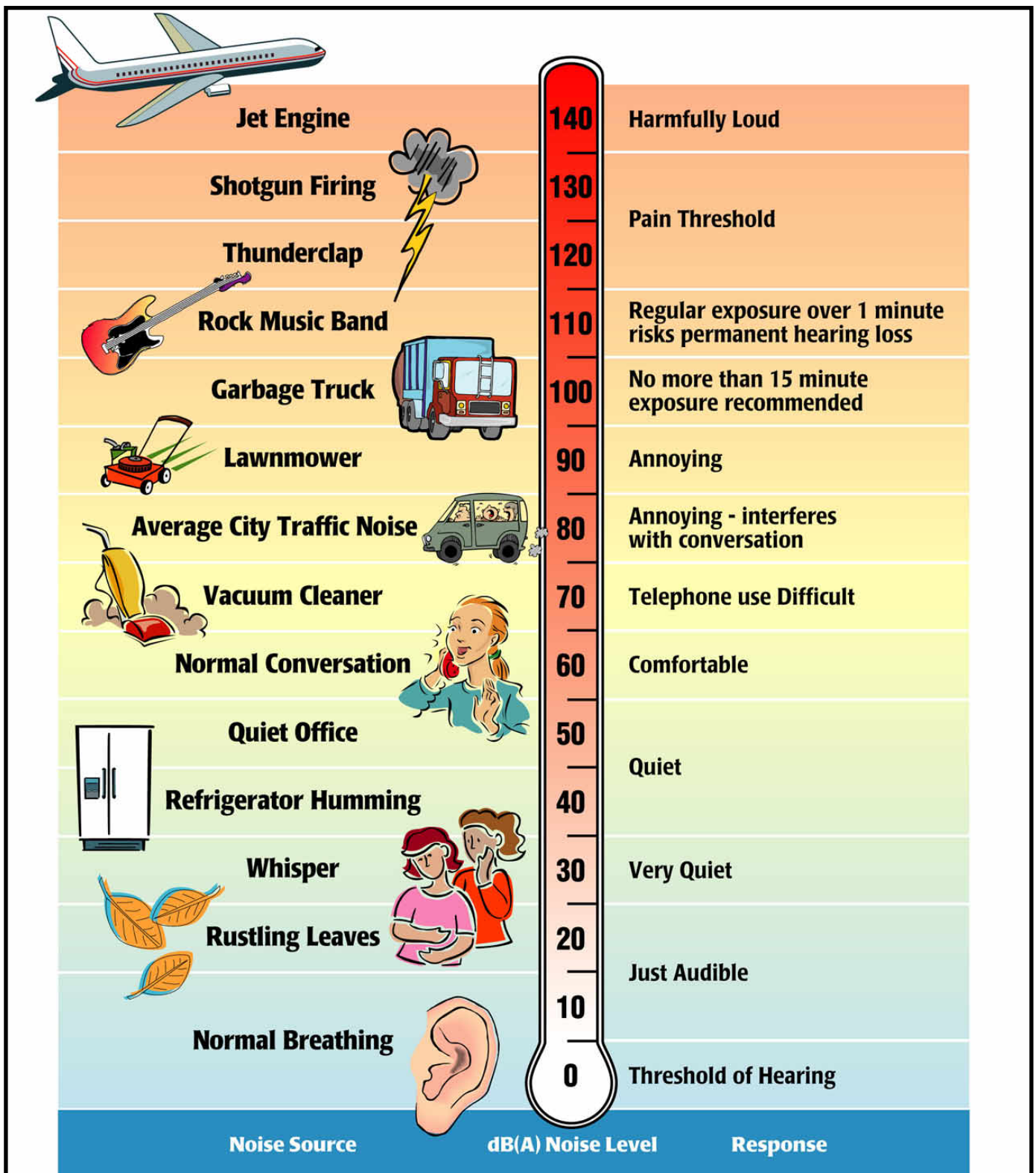
In most situations, a 3-dBA change in sound pressure level is considered a “just-detectable” difference. A 5-dBA change (either louder or quieter) is readily noticeable, and a 10-dBA change is a doubling (if louder) or a halving (if quieter) of the subjective loudness. Sound from a small localized source (approximating a “point” source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (drops off) at a rate of 6 dBA for each doubling of the distance (6 dBA/DD). This decrease, due to the geometric spreading of the energy over an ever-increasing area, is referred to as the *inverse square law*.

Noise Measurement Scales

Numerous methods have been developed to measure sound over a period of time. These methods include: (1) the community noise equivalent level (CNEL); (2) the equivalent sound level (Leq); and (3) the day/night average sound level (Ldn). These methods are described below.

Equivalent Sound Level (Leq)

The Leq is the sound level containing the same total energy over a given sampling time period. The Leq is the steady sound level that, in a stated period of time, would contain the same acoustic energy as the time-varying sound level during the same period. Leq is typically computed over sampling periods of one, 8 and 24 hours.



Source:

Melville C. Branch and R. Dale Beland, *Outdoor Noise in the Metropolitan Environment*, 1970.

Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004)*, March 1974.

Community Noise Equivalent Level (CNEL)

The predominant community noise rating scale used in California for land use compatibility assessments is the CNEL. The CNEL reading represents the average of 24 hourly readings of equivalent levels (Leq) based on an A-weighted decibel and adjusted upward to compensate for increased noise sensitivity in the evening and at night. These adjustments are +5 dBA for the evening (7:00 p.m. to 10:00 p.m.) and +10 dBA for the night (10:00 p.m. to 7:00 a.m.). CNEL may be indicated by “dBA CNEL” or just “CNEL.”

Day Night Average (Ldn)

The Ldn measures the 24-hour average noise level at a given location. It was adopted by the U.S. Environmental Protection Agency (EPA) for developing criteria for evaluating community noise exposure. It is based on a measure of the Leq and is calculated by averaging the Leqs for each hour of the day at a given location after penalizing the “sleeping hours” (defined as 10:00 p.m. to 7:00 a.m.) by adding 10 dBA to compensate for the increased sensitivity of people to noises that occur at night.

Lmax and Ln

The maximum noise level recorded during a noise event is expressed as Lmax. The sound level exceeded over a specified time frame is expressed as Ln (i.e., L90, L50, L10, etc.). L50 is the level exceeded 50 percent of the time; L10 ten percent of the time; etc.

Noise Attenuation

Noise barriers attenuate (reduce) noise by approximately 5 dBA; additional noise reduction may be achieved, depending on the barrier’s height, material, location and length. A row of buildings reduces noise by up to 5 dBA; each additional row further reduces noise by 1.5 dBA, up to a maximum reduction of approximately 10 dBA. The exact degree of noise attenuation depends on the nature and orientation of the structure and intervening barriers.

Vibration Characteristics

Vibration is a unique form of noise. It is unique because its energy is carried through structures and the earth, whereas other noise is carried through the air. Thus, vibration is generally felt rather than heard. Some vibration effects can be caused by noise (e.g., the rattling of windows from passing trucks). The vibration phenomenon is related to the coupling of the acoustic energy at frequencies that are close to the resonant frequency of the material being vibrated. Typically, groundborne vibration generated by man-made activities attenuates rapidly as distance from the source of the vibration increases. Vibration, which spreads through the ground rapidly, diminishes in amplitude with distance from the source. The ground motion caused by vibration is measured as particle velocity in inches per second and, in the U.S., is referenced as vibration decibels (VdB).

The vibration velocity threshold for humans is approximately 65 VdB. A vibration velocity of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Most perceptible indoor vibration comes from sources within buildings, such as operation of mechanical equipment, movement of people, or the slamming of doors. 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 from traffic is barely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity, to 100 VdB, which is the general threshold at which minor damage can occur to fragile buildings.

3.9.1.2 Sensitive Receptors

Sensitive populations (“sensitive receptors”) are more susceptible to the effects of noise impacts than are the general population. Land uses considered sensitive receptors are residences, schools, playgrounds, childcare centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers and retirement homes. The project site is located in a residential neighborhood and thus is near sensitive receptors.

3.9.1.3 Noise Sources In Project Area

Stationary Noise Sources

The primary sources of stationary noise in the project vicinity are residential activities (i.e., heating and cooling systems, pool and spa equipment, human voices and landscape maintenance). The noise associated with these sources may represent a single-event noise occurrence, a short-term noise, or a long-term, continuous noise. There are no significant sources of industrial noise or stationary noise within the City of Lafayette (City).

Mobile Noise Sources

The major source of noise in the City is vehicular traffic, including automobiles, trucks, buses and motorcycles. The level of vehicular noise generally varies with the volume of traffic, the number of trucks or buses, the speed of traffic and the distance from the roadway. Noise generated by vehicular traffic in the City is greatest along State Route 24 (SR-24), which is the dominant noise source in the City. Local roadways (Moraga Road, First Street, Pleasant Hill Road and Mt. Diablo Boulevard) are also sources of traffic-generated noise. The proposed project would be located a significant distance from SR-24 within an existing residential neighborhood, which is not subject to the traffic along the major roadway arterials within the City. Traffic within the project area is relatively low and, therefore, would not be considered a significant noise source.

3.9.2 Regulatory Setting

It is difficult to specify noise levels that are generally acceptable to everyone; what is objectionable to one person may be unnoticed by another. Standards may be based on documented complaints in response to documented noise levels, or on studies of the ability of people to sleep, talk or work under various noise conditions. All such studies, however, acknowledge that individual responses vary considerably. Standards usually address the needs of most of the general population.

3.9.2.1 State of California

California Government Code

California Government Code Section 65302(f) mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines established by the California Department of Health Services, as shown in Table 3.9-1 (Land Use Compatibility Noise Guidelines).

Table 3.9-1 Land Use Compatibility Noise Guidelines

Land Use Category	Community Noise Exposure (CNEL)			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential - Low Density, Single-Family, Duplex, Mobile Homes	50 – 60	55 - 70	70-75	75-85
Residential - Multiple Family	50 – 65	60 - 70	70 - 75	70 – 85
Transient Lodging - Motel, Hotels	50 – 65	60 - 70	70 - 80	80 – 85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 – 70	60 - 70	70 - 80	80 – 85
Auditoriums, Concert Halls, Amphitheaters	NA	50 - 70	NA	65 – 85
Sports Arenas, Outdoor Spectator Sports	NA	50 - 75	NA	70 – 85
Playgrounds, Neighborhood Parks	50 – 70	NA	67.5 - 75	72.5 - 85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 – 70	NA	70 - 80	80 – 85
Office Buildings, Business Commercial and Professional	50 – 70	67.5 - 77.5	75 - 85	NA
Industrial, Manufacturing, Utilities, Agriculture	50 – 75	70 - 80	75 - 85	NA

CNEL = community noise equivalent level in A-weighted decibels (dBA); NA = not applicable.

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

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

NORMALLY UNACCEPTABLE: New construction or development should 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 must be included in the design.

CLEARLY UNACCEPTABLE: New construction or development should generally not be undertaken.

Source: California Office of Planning and Research, *General Plan Guidelines*, October 2003.

In evaluating land use compatibility, the guidelines classify noise levels as normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable for various land use types. For single-family homes, a normally acceptable exterior noise environment is up to 60 CNEL and conditionally acceptable is up to 70 CNEL.

3.9.2.2 Local Requirements

City of Lafayette General Plan

According to the *General Plan*, a standard (maximum noise level) of 45 dBA for indoor noise is required for all new residential development. In addition, a standard of 55 dBA Ldn is required for outdoor noise.

City of Lafayette Noise Ordinance

The City of Lafayette regulates construction noise through the Noise Ordinance. City of Lafayette Municipal Code Section 5-207, Prohibited Acts, states that:

Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work between the hours of 10:00 p.m. and 7:00 a.m. on weekdays, or at any time on weekends or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line or at any time violates the provisions of Section 5-205, except emergency work or public service utilities. This subsection shall not apply to the use of domestic power tools for maintenance purposes.

Section 5-205, Maximum Permissible Noise Levels by Receiving Land Use, states the following:

- (a) The noise standards for the various categories of land use identified by the Noise Control Officer as presented in Table 5-205 (Table 3.9-2) shall, unless otherwise specifically indicated, apply to all such property within the designated zone.
- (b) No person shall produce, suffer or allow to be produced by any machine, animal or device, or any combination of same on any property owned, leased, occupied or otherwise controlled by such person, any noise which causes the noise level when measured on any other property to exceed:
 - The noise standard for that land use as specified in Table 5-205 (Table 3.9-2) for a cumulative period of more than 30 minutes in any hour;
 - The noise standard plus five dB for a cumulative period of more than 15 minutes in any hour;
 - The noise standard plus ten dB for a cumulative period of more than five minutes in any hour;
 - The noise standard plus 15 dB for a cumulative period of more than one minute in any hour; or
 - The noise standard plus 20 dB for any period of time.
 - If the measured local background noise level exceeds that permissible for the applicable time period within any of the first four noise limit categories described in subsection (b), the allowable noise exposure standard shall be increased in five-dB increments in each category as appropriate to encompass or reflect said ambient noise level.
 - In the event the alleged offensive noise contains a steady, audible tone such as a whine, screech, or hum, or is an impulsive noise such as hammering, or contains music or speech conveying informational content, the standard limits set forth in Table 5-205 (Table 3.9-2) shall be reduced by 5dB.

Table 3.9-2 Outdoor Noise Limits

Land Use	Time Period	Noise Level Limit (dBA)
Residential	Nighttime (10:00 pm – 7:00 am)	45
	Daytime (7:00 am – 10:00 pm)	50
Multi-Family	Nighttime (10:00 pm – 7:00 am)	50
Schools, Libraries	Nighttime (10:00 pm – 7:00 am)	55
Commercial	Nighttime (10:00 pm – 7:00 am)	55
	Daytime (7:00 am – 10:00 pm)	60

Source: City of Lafayette Municipal Code

3.9.3 Environmental Analysis

3.9.3.1 Thresholds of Significance

The proposed project would result in a significant impact if it would:

- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Expose persons to or generate excessive ground borne vibration or ground borne noise levels;
- Substantially permanently increase ambient noise levels in the project vicinity above levels existing without the project; or
- Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

3.9.3.2 Potential Impacts and Mitigation

Potential Impact 3.9-1: Would the proposed project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? (Less Than Significant Impact)

Project implementation would introduce noise from automobiles, heating and cooling systems, pool and spa equipment, human voices, pets and landscape maintenance. These sources would not increase noise levels that exceed the City's standards. Impacts would be less than significant and no mitigation would be required.

Potential Impact 3.9-2: Would the proposed project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels? (Less Than Significant Impact)

Project construction would cause some groundbourne vibration, primarily during grading and earth moving activities. Groundbourne vibrations and groundbourne noise drop off rapidly over very short distances and, therefore, impacts would be less than significant. No mitigation would be required.

Potential Impact 3.9-3: Would the proposed project result in substantial permanent increase in ambient noise levels in the project vicinity above existing noise levels without the project? (Less Than Significant Impact With Mitigation)

Long-Term (Vehicular) Operational Noise Sources

According to the *Soldier Field Subdivision Project Traffic Impact Analysis* (RBF Consulting, June 10, 2005), the project would add a total of 114 daily vehicle trips. Typically, noise models like the FHWA-RD-77-108 are used to measure the anticipated noise levels resulting from a proposed project. However, considering the relatively small increase in traffic that would be generated by the proposed project, no modeling was conducted.

For evaluation of operational noise due to project-related traffic, a noise increment of 3 dBA is used as a significance threshold. A doubling of traffic volumes (100 percent increase in traffic volume) typically

results in a 3-dBA increase in traffic noise.¹ The proposed project would minimally increase traffic volume and the increase would be well below 100 percent. Additionally, the patterns of usage of the local roadway system would not change from construction of the eight residential units. Traffic volumes associated with the project operation would be minimal and would not result in congestion or changes in behavior of residents in the area. Thus, a less than significant increase in noise from traffic on the local street system would result and no mitigation would be required.

Long-Term (Stationary) Noise Sources

Residential Uses

Future development of the eight proposed residential units would create new stationary noise sources typical of any residential development. The sources of typical noise in residential areas are children playing, pets, amplified music, car repair, pool and spa equipment, woodworking, lawn care and home repair. Such activities do not usually exceed the 55-dBA outdoor noise standard and would primarily occur during the daytime activity hours of 7:00 a.m. to 10:00 p.m. Furthermore, project residents would be required to comply with the noise standards set forth in the City of Lafayette Municipal Code. Noise impacts from residential activities would be less than significant and no mitigation would be required.

Mechanical Equipment

Mechanical equipment such as heating, ventilation and air conditioning (HVAC) units would likely be included in the proposed eight residential units. Noise levels from mechanical equipment would be reduced by orientation of the equipment away from sensitive receptors, proper selection of equipment and the installation of equipment with proper acoustical shielding (muffling). In addition, the proposed project would be required to comply with noise standards contained in Table 3.9-2 above. Implementation of Mitigation Measure 3.9-3 would ensure that impacts would be less than significant.

Mitigation Measure 3.9-3: Prior to issuance of a building permit for each custom home, the location of electrical and mechanical equipment (e.g., ventilation and air conditioning units) shall be shown on construction drawings. Such equipment shall be located as far away as feasible from sensitive-receptor areas. Additionally, the following shall be considered before installation: proper selection and sizing of equipment and installation of equipment with proper acoustical shielding. Furthermore, mechanical equipment shall comply with the noise standards of the City as specified in Table 3.9-2 (Outdoor Noise Limits).

Landscape Maintenance

Development of the proposed project would introduce new landscaping requiring periodic maintenance. Noise generated by a gasoline-powered lawnmower is estimated to be approximately 70 dBA at a distance of five feet. Such noise would decrease by 6 dBA for each doubling of the distance from the point source (the lawnmower). Maintenance activities would be conducted only during daytime hours for brief periods of time and would increase ambient noise levels in the project vicinity; however, gasoline lawnmower noise levels at the nearest residential property line typically do not exceed the City's 55-dBA noise standard. Impacts from landscape maintenance would be less than significant and no mitigation would be required.

¹ Federal Highway Administration, <http://www.fhwa.dot.gov/environment/polguid.pdf>, June 24, 2005.

Potential Impact 3.9-4: Would the proposed project result in a temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? (Potentially Significant Impact)

Construction activities associated with the proposed project would include grading and construction of buildings. The proposed project is relatively small in size and would not require extensive construction lasting for long periods of time. Groundborne noise and other types of construction-related noise impacts would typically occur during initial site preparation, which would create the highest levels of noise but would also generally be the shortest of all construction phases. High groundborne and miscellaneous noise levels would be created by the operation of heavy equipment such as trucks, backhoes, bulldozers, excavators, front-end loaders, compactors and scrapers. Table 3.9-3 (Typical Construction Equipment Noise Levels) indicates anticipated equipment noise levels during project construction. Typical operating cycles for these types of construction equipment are one or two minutes of full-power operation followed by three or four minutes at lower power settings. Other primary sources of acoustical disturbance would be random incidents, which would last less than one minute, such as dropping large pieces of equipment or the hydraulic movement of machinery lifts.

Table 3.9-3 Typical Construction Equipment Noise Levels

Type of Equipment	Maximum Level (dBA at 50 Feet)
Scraper	88
Bulldozer	87
Heavy Truck	88
Backhoe	85
Pneumatic Tool	85
dBA = A-weighted decibel	
Source: Cyril M. Harris, <i>Handbook of Noise Control</i> , 1979.	

A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously for at least one hour within a focused area of 15 yards of each other. The combined sound level of three of the loudest pieces of equipment (scraper, bulldozer and heavy truck) would be 92 dBA, measured at 50 feet from the noise source. Table 3.9-4 (Estimated Construction Noise in Project Area by Distance) assumes this combined source level and summarizes predicted noise levels at various distances from an active construction site. These estimations of noise levels take into account the distance to the receptor, attenuation from molecular absorption and anomalous excess attenuation. The proposed project would be directly adjacent to existing residential units and based upon the noise levels listed in Table 3.9-4, existing residences may experience noise levels exceeding the City's 55 dBA outdoor noise standard.

Table 3.9-4 Estimated Construction Noise in Project Area by Distance

Distance Attenuation	
Distance to Receptor (Feet)	Sound Level at Receptor (dBA)
50	92
100	86
200	80
400	73
600	69

800	67
1,000	64
1,500	60
2,000	57
2,500	54
3,000	51
4,000	47
<p>dBA = A-weighted decibel.</p> <p>The following assumptions were utilized:</p> <p>Basic sound level drop-off rate: 6.0 dBA per doubling distance</p> <p>Molecular absorption coefficient: 0.7 dBA per 1,000 feet</p> <p>Analogous excess attenuation: 1.0 dBA per 1,000 feet</p> <p>Reference sound level: 92 dBA</p> <p>Distance for reference sound level: 50 feet</p> <p>Simultaneous operation of 1 grader, 1 heavy truck, and 1 bulldozer</p>	

In addition to construction noise from a project site, construction periods would also cause increased noise along access routes due to the movement of equipment and workers to and from the site. Heavy construction equipment and vehicles are expected to be moved on-site during the initial construction period and would have a less than significant short-term noise impact on nearby roadways. Daily transportation of construction workers is not expected to cause a significant effect because this traffic would not substantially increase current daily traffic volumes in the area and would not be anticipated to increase traffic noise levels by more than 1 dBA.

Implementation of Mitigation Measures 3.9-4a, 3.9-4b and 3.9-4c would reduce impacts from temporary construction noise to a less than significant level.

Mitigation Measure 3.9-4a: Prior to the start of grading or construction, whichever occurs first, a sign stating the allowed days and hours for construction shall be posted in a conspicuous location on the project site where it can be viewed by all contractors. The sign shall be no smaller than two square feet nor larger than four square feet with lettering between three inches and five inches in height.

Mitigation Measure 3.9-4b: Prior to the start of grading or construction, whichever occurs first, a sign stating the name and telephone number of a disturbance coordinator shall be posted in a conspicuous location on the project site where it can be viewed by the public. The disturbance coordinator shall be responsible for addressing noise-related complaints.

Mitigation Measure 3.9-4c: Plans submitted for grading and building permits shall include the following noise mitigation copied onto the plans:

- a. Site improvement and construction work, including setup, loading or unloading of materials and equipment, and/or the maintenance, refueling or tune-up of any equipment shall be restricted to the hours of 7:00 a.m. to 6:00 p.m., Monday through Saturday. No construction shall occur on Sundays or federal holidays.
- b. All construction equipment powered by internal combustion engines shall be properly maintained and muffled to reduce noise levels to the maximum extent feasible.

- c. Unnecessary idling of internal combustion engines near existing noise sensitive receptors shall be prohibited.
- d. Stationary equipment shall be located as far away from residences as feasible, but in no case shall be closer than 40 feet to any property line or exceed 70 dBA at 50 feet. Non-stationary mobile equipment shall not exceed 83 dBA at 50 feet.
- e. Construction equipment staging shall be at least 200 feet from the nearest residence.