4.10 NOISE

This chapter includes an evaluation of the potential environmental consequences from adoption and implementation of the proposed project related to noise generation. Additionally, this chapter describes the environmental setting, including regulatory framework and existing noise conditions in the project area, and identifies mitigation measures, if required, that would avoid or reduce significant impacts. The technical data used for the analysis in this chapter is located in Appendix F, Noise Data, of this Draft EIR.

This evaluation uses procedures and methodologies as specified by the California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA).

4.10.1 ENVIRONMENTAL SETTING

4.10.1.1 OVERVIEW OF NOISE FUNDAMENTALS

Noise Descriptors

The following are brief definitions of terminology used in this chapter:

- **Sound.** A vibratory disturbance that, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise**. Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Hertz (Hz)**. A unit of frequency of change in state or cycle in a sound wave. The nearly universal usage is one (complete) cycle in one second. The unit 'Hertz', named after the German physicist Heinrich Hertz (1857-1894) replaces the previous 'cycles per second (cps)' nomenclature.
- **Decibel (dB)**. A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals (20 µPa).
- **Vibration Decibel (VdB).** A unitless measure of vibration, expressed on a logarithmic scale and with respect to a defined reference vibration velocity. In the U.S., the standard reference velocity is 1 micro-inch per second ($1x10^{-6}$ in/sec).
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear.
- **Equivalent Continuous Noise Level (L_{eq}); also called the Energy-Equivalent Noise Level.** The value of an equivalent, steady sound level which, in a stated time period (often over an hour) and at a stated location, has the same A-weighted sound energy as the time-varying sound. Thus, the L_{eq} metric is a single numerical value that represents the equivalent amount of variable sound energy received by a receptor over the specified duration.
- **Statistical Sound Level (L_n).** The sound level that is exceeded "n" percent of time during a given sample period. For example, the L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50 percent of the time (during each sampling period); that is, half of the sampling time, the changing noise levels are above this value and half of the time they are below it. This is called the

"median sound level." The L_{10} level, likewise, is the value that is exceeded 10 percent of the time (i.e., near the maximum) and this is often known as the "intrusive sound level." The L_{90} is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."

- **Day-Night Level (L_{dn} or DNL).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m. For general community/environmental noise, CNEL and L_{dn} values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are interchangeable and are treated as being equivalent in this assessment.
- **Sensitive Receptor.** Noise- and vibration-sensitive receptors include land uses where quiet environments are necessary for enjoyment and public health and safety. Residences, schools, motels and hotels, libraries, religious institutions, hospitals, and nursing homes are examples.

Characteristics of Sound

When an object vibrates, it radiates part of its energy in the form of a pressure wave. Sound is that pressure wave transmitted through the air. Technically, airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure that creates sound waves. Sound is described in terms of loudness or amplitude (measured in dB), frequency or pitch (measured in Hertz [Hz] or cycles per second), and duration or time variations (measured in seconds or minutes).

Amplitude

Noise is measured on a logarithmic scale, which has a more manageable range of numbers, and a decibel is the standard unit for measuring sound pressure amplitude.[1] All noise levels in this analysis, reported in terms of dB, are relative to the industry-standard reference sound pressure of 20 micropascals.

On a logarithmic scale, an increase of 10 dB is 10 times more intense than 1 dB, while 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud). Changes of 1 to 3 dB are detectable under quiet, controlled conditions, and changes of less than 1 dB are usually not discernible (even under ideal conditions). A 3 dB change in noise levels is considered the minimum change that is detectable with human hearing in outside environments. A change of 5 dB is readily discernible to most people in an exterior environment, and a 10 dB change is perceived as a doubling (or halving) of the sound. These relationships are summarized in Table 4.10-1.

[1] The commonly held threshold of audibility is 20 micropascals, and the threshold of pain is around 200 million micropascals, a ratio of one to 10 million. By converting these pressures to a logarithmic scale (i.e., decibels), the range becomes a more convenient 0 dB to 140 dB.

TABLE 4.10-1 NOISE PERCEPTIBILITY

± 3 dB	Threshold of human perceptibility
± 5 dB	Clearly noticeable change in noise level
± 10 dB	Half or twice as loud
± 20 dB	Much quieter or louder

Source: Bies and Hansen 2009.

Frequency

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all, but are "felt" more as a vibration. Similarly, though people with extremely sensitive hearing can hear sounds as high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above about 10,000 Hz and below about 200 Hz.

When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to approximate the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal in a manner corresponding to the way the human ear perceives sound. The A-weighted noise level has been found to correlate well with people's judgments of the "noisiness" of different sounds and has been used for many years as a measure of community and industrial noise.

Since most people do not routinely work with decibels or A-weighted sound levels, it is often difficult to appreciate what a given sound pressure level number means. To help relate noise level values to common experience, Table 4.10-2 shows typical noise levels from common noise sources.

TABLE 4.10-2 TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Onset of physical discomfort	120+	
	110	Rock Band (near amplification system)
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at three feet		
	90	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal speech at 3 feet
Heavy Traffic at 300 feet	60	

TABLE 4.10-2 TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Theater, Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
Extremely Remote Area		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

Source: Caltrans 2009.

Although the A-weighted scale and the energy-equivalent metric are commonly used to quantify the range of human response to individual events or general community sound levels, the degree of annoyance or other response also depends on several other perceptibility factors, including:

- Ambient (background) sound level
- General nature of the existing conditions (e.g., quiet rural or busy urban)
- Difference between the magnitude of the sound event level and the ambient condition
- Duration of the sound event
- Number of event occurrences and their repetitiveness
- Time of day that the event occurs

Temporal Effects

Time variation in noise exposure is typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called L_{eq}), or alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. For example, the L_{50} noise level represents the noise level that is exceeded 50 percent of the time; half the time the noise level exceeds this level and half the time the noise level is less than this level. This level is also representative of the level that is exceeded 30 minutes in an hour. Similarly, the L_2, L_8 and L_{25} values represent the noise levels that are exceeded 2, 8, and 25 percent of the time or 1, 5, and 15 minutes per hour, respectively. These “n” values are typically used to demonstrate compliance for stationary noise sources with many cities’ noise ordinances. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period, respectively.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, State law and many local jurisdictions use an adjusted 24-hour noise descriptor called the

Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment (or "penalty") of 5 dBA be added to the actual noise level for the hours from 7:00 p.m. to 10:00 p.m. and 10 dBA for the hours from 10:00 p.m. to 7:00 a.m. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 p.m. and 10:00 p.m. Both descriptors give roughly the same 24-hour level, with the CNEL being only slightly more restrictive (i.e., higher). The CNEL or L_{dn} metrics are commonly applied to the assessment of roadway and airport-related noise sources.

Propagation

Sound dissipates exponentially with distance from the noise source. This phenomenon is known as "spreading loss." For a single-point source, sound levels decrease by approximately 6 dB for each doubling of distance from the source (conservatively neglecting ground attenuation effects, air absorption factors, and barrier shielding). For example, if a backhoe at 50 feet generates 84 dBA, at 100 feet the noise level would be 79 dBA, and at 200 feet it would be 73 dBA. This drop-off rate is conservative and is appropriate for noise generated by onsite operations from stationary equipment/activities at a project site. This approach is commonly used for construction equipment noise evaluations. For more detailed assessments, if ground-level absorptive vegetation or other "soft site" conditions are considered, the distance attenuation (drop-off) rate would be increased by 1.5 dB per distance doubling; for a total of 7.5 dB per propagation distance doubling.

If noise is produced by a line source, such as highway traffic, the sound decreases by 3 dB for each doubling of distance over a reflective ('hard site') surface such as concrete or asphalt. Line source noise in a relatively flat environment with ground-level absorptive vegetation decreases by 4.5 dB for each doubling of distance.

Psychological and Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. Extended periods of noise exposure above 90 dBA would result in permanent cell damage, which is the main driver for employee hearing protection regulations in the workplace. When the noise level reaches 120 dBA, an unpleasant 'tickling' sensation occurs in the human ear; even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. A sound level of 160 to 165 dBA will result in dizziness or loss of equilibrium. In comparison, for community environments, the ambient or background noise problem is widespread, though generally worse in urban areas than in outlying, less-developed areas. Elevated ambient noise levels can result in noise interference (e.g., speech interruption/masking, sleep disturbance, disturbance of concentration) and cause annoyance.

NOISE

Loud noise can be annoying and it can have negative health effects.[2,3,4] The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction.
- Interference with activities such as speech, sleep, learning.
- Physiological effects such as startling and hearing loss (both temporary and permanent).

In most cases, environmental noise produces effects in the first two categories only. However, unprotected workers in some industrial work settings may experience noise effects in the last category.

Fundamentals of Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration is normally associated with activities stemming from operations of railroads or vibration-intensive stationary sources, but can also be associated with construction equipment such as jackhammers, pile drivers, and hydraulic hammers.

Like noise, vibration is transmitted in waves, but through the earth or solid objects. Unlike noise, vibration is typically of a frequency that is felt rather than heard. Vibration can be either natural as in the form of earthquakes, volcanic eruptions, sea waves, landslides, or man-made as from explosions, the action of heavy machinery or heavy vehicles such as trains. Both natural and man-made vibration may be continuous such as from operating machinery, or transient as from an explosion. As with noise, vibration can be described by both its amplitude and frequency. Amplitude may be characterized in three ways: displacement, velocity, and acceleration.

Vibration displacement is the distance that a point on a surface moves away from its original static position. The instantaneous speed that a point on a surface moves is the velocity, and the rate of change of the speed is the acceleration. Each of these descriptors can be used to correlate vibration to human response, building damage, and acceptable equipment vibration levels. During construction, the operation of construction equipment can cause groundborne vibration. During the operational phase of a project, receptors may be subject to levels of vibration that can cause annoyance due to noise generated from vibration of a structure or items within a structure.

Vibration amplitudes are usually described in terms of either the peak particle velocity (PPV) or the root mean square (RMS) velocity. PPV is the maximum instantaneous peak of the vibration signal, and RMS is the square root of the average of the squared amplitude of the signal. PPV is more appropriate for evaluating potential building damage, and RMS is typically more suitable for evaluating human response.

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[2] U.S. Environmental Protection Agency (EPA). 1978, November. *Protective Noise Levels*. EPA 550/9-79-100. (Condensed version of 1971 and 1974 documents.)

[3] U.S. Environmental Protection Agency (EPA). 1974, March. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. Washington, D.C.: U.S. EPA Office of Noise Abatement and Control

[4] U.S. Environmental Protection Agency (EPA). 1971, December. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. Prepared by Bolt Beranek and Newman (Cambridge, MA) for the U.S. EPA Office of Noise Abatement and Control. Washington, D.C.

The units for PPV and RMS velocity are normally inches per second (in/sec). However, vibration is often presented and discussed in dB units in order to compress the range of numbers (in a similar fashion as for sound energy). In this study, PPV and RMS velocities are in in/sec, and vibration levels are in dB relative to 1 micro-inch per second (abbreviated as VdB). Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration. Man-made vibration problems are therefore usually confined to relatively short distances from the source (500 to 600 feet or less).

Vibrations also vary in frequency and this affects perception. Typical construction vibrations fall in the 10 to 30 Hz range and usually occur around 15 Hz. Traffic vibrations exhibit a similar range of frequencies; however, due to their suspension systems, buses often generate frequencies around 3 Hz at high vehicle speeds. It is less common, but possible, to measure traffic frequencies above 30 Hz.

The way in which vibration is transmitted through the earth is called propagation. Propagation of groundborne vibrations is complicated and difficult to predict because of the endless variations in the soil and rock through which waves travel. There are three main types of vibration propagation: surface, compression and shear waves. Surface waves, or Raleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. Compression waves, or P-waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e. in a "push-pull" fashion). P-waves are analogous to airborne sound waves. Shear waves, or S-waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse or "side-to-side and perpendicular to the direction of propagation." As vibration waves propagate from a source, the energy is spread over an ever-increasing area such that the energy level striking a given point is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced with distance as a result of material damping in the form of internal friction, soil layering, and void spaces. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

As with airborne sound, annoyance with vibrational energy is a subjective measure, depending on the level of activity and the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Persons accustomed to elevated ambient vibration levels, such as in an urban environment, may tolerate higher vibration levels. Table 4.10-3 displays the human response and the effects on buildings resulting from continuous vibration (in terms of various levels of PPV).

TABLE 4.10-3 HUMAN REACTION TO TYPICAL VIBRATION LEVELS

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006–0.019	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibration begins to annoy people	Virtually no risk of "architectural" (i.e. not structural) damage to normal buildings
0.20	Vibrations annoying to people in buildings	Threshold at which there is a risk to "architectural" damage to normal dwelling –

TABLE 4.10-3 HUMAN REACTION TO TYPICAL VIBRATION LEVELS

Vibration Level, PPV (in/sec)	Human Reaction	Effect on Buildings
		houses with plastered walls and ceilings
0.4–0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage

Source: California Department of Transportation (Caltrans), Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office. 2004, June. *Transportation- and Construction-Induced Vibration Guidance Manual.* Prepared by ICF International.

Human response to ground vibration has been correlated best with the velocity of the ground, typically expressed in terms of the vibration decibel of VdB.[5] The U.S. Federal Transit Administration (FTA) has developed rational vibration limits that can be used to evaluate human annoyance to groundborne vibration. These criteria are primarily based on experience with rapid transit and commuter rail systems.[6] Railroad and transit operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of track. Trains generate substantial vibration due to their engines, steel wheels, heavy loads, and wheel-rail interactions.

Similarly, construction operations generally include a wide range of activities that can generate groundborne vibration, which varies in intensity. In general, blasting and demolition as well as pile driving and vibratory compaction equipment generate the highest vibrations. Because of the impulsive nature of such activities, PPV is used to measure and assess groundborne vibration and assess the potential of vibration to induce structural damage and annoyance for humans. Vibratory compactors or rollers, pile drivers, and pavement breakers can generate perceptible amounts of vibration at up to 200 feet. Heavy trucks can also generate groundborne vibrations, which can vary, depending on vehicle type, weight, and pavement conditions. Potholes, pavement joints, discontinuities, differential settlement of pavement, all increase the vibration levels from vehicles passing over a road surface. Construction vibration is normally of greater concern than vibration from normal traffic flows on streets and freeways with smooth pavement conditions.[7]

4.10.1.2 REGULATORY FRAMEWORK

Federal Regulations

U.S. Environmental Protection Agency

In addition to FHWA standards, the U.S. Environmental Protection Agency (USEPA) has identified the relationship between noise levels and human response. The USEPA Office of Noise Abatement and Control

[5] The reference velocity is 1 x 10^{-6} in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB.

[6] Federal Transit Administration (FTA). 2006, May. *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation (DoT). FTA-VA-90-1003-06.

[7] California Department of Transportation (Caltrans), Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office. 2004, June. *Transportation- and Construction-Induced Vibration Guidance Manual.* Prepared by ICF International.

issued the Federal Noise Control Act of 1972, which set programs and guidelines to identify and address the effects of noise on public health and welfare, and the environment. Although the primary responsibility of regulating noise was transferred to state and local governments in 1982, the USEPA provided guidelines for noise levels that would be considered safe for community exposure without the risk of adverse health or welfare effects. The USEPA found that to prevent hearing loss over the lifetime of a receptor, the yearly average L_{eq} should not exceed 70 dBA. Interference with activity and annoyance will not occur if exterior levels are maintained at an L_{eq} of 55 dBA and interior levels at or below 45 dBA. While these levels are relevant for planning and design and useful for informational purposes, they are not land use planning criteria because they do not consider economic cost, technical feasibility, or the needs of the community. The USEPA also set 55 dBA L_{dn} as the basic goal for exterior residential noise intrusion. However, other federal agencies, in consideration of their own program requirements and goals, as well as difficulty of actually achieving a goal of 55 dBA L_{dn}, have settled on the 65 dBA L_dn level as their standard. At 65 dBA L_{dn}, activity interference is kept to a minimum, and annoyance levels are still low. It is also a level that can realistically be achieved.

Occupational Health and Safety Administration

The federal government regulates occupational noise exposure common in the workplace through the Occupational Health and Safety Administration (OSHA) under the USEPA. Such limitations would apply to the operation of construction equipment and could also apply to any proposed industrial land uses. Noise exposure of this type is dependent on work conditions and is addressed through a facility's Health and Safety Plan, as required under OSHA, and is therefore not addressed further in this analysis.

U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) has set a goal of 65 dBA L_{dn} as a desirable maximum exterior standard for residential units developed under HUD funding.[8] (This level is also generally accepted within the State of California.) While HUD does not specify acceptable interior noise levels, standard construction of residential dwellings constructed under Title 24 standards typically provides in excess of 20 dBA of attenuation with the windows closed. Based on this premise, the interior L_{dn} should not exceed 45 dBA.

State Regulations

The California Department of Health Services' Office of Noise Control (ONC) has studied the correlation of noise levels and their effects on various land uses. As a result, a set of generalized exterior and interior noise standards was generated for residential, commercial, institutional/public, and open space land uses.[9] These noise standards, in terms of the CNEL noise metric, are summarized in Appendix F of this Draft EIR. The ONC also prepared a land use compatibility chart for community noise which is intended to

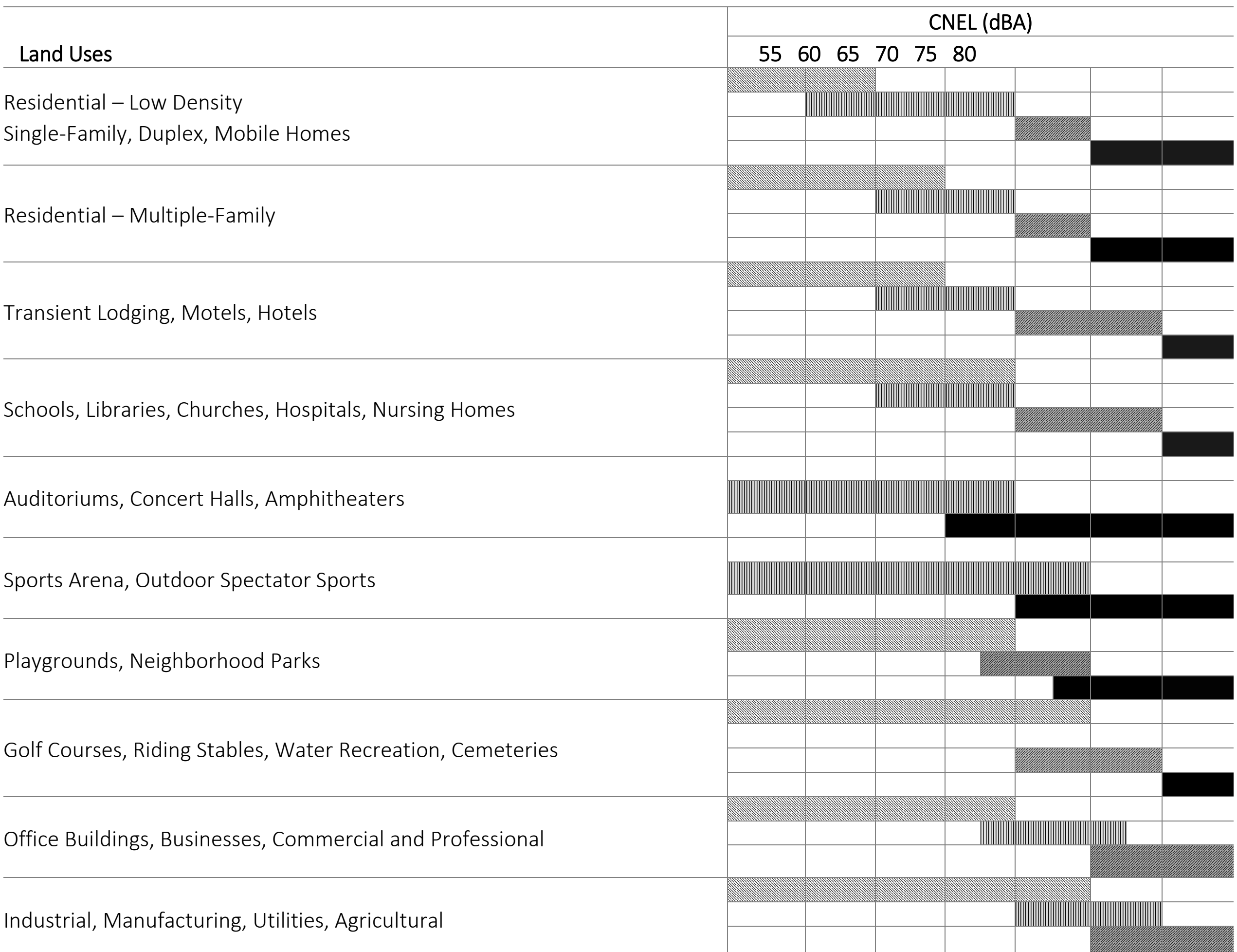
[8] U.S. Department of Housing and Urban Development (HUD). 1985, March. *Noise Guidebook: A Reference Document for Implementing the Department of Housing and Urban Development's Noise Policy.*

[9] Residential' includes single and multifamily, duplex, and mobile homes; 'Commercial' includes hotel, motel, transient housing, commercial retail, bank, restaurant, office building, research and development, professional offices, amphitheater, concert hall, auditorium, movie theater, gymnasium (multipurpose), sports club, manufacturing, warehouse, wholesale, utilities, and movie theaters uses; 'Institutional / Public' includes, hospital, school classrooms/playground, church, and library uses; and 'Open Space' includes parks.

NOISE

provide urban planners with a tool to gauge the compatibility of land uses relative to existing and future noise levels. The table identifies 'normally acceptable', 'conditionally acceptable', 'normally unacceptable' and 'clearly unacceptable' noise levels for various land use types. A 'conditionally acceptable' or 'normally unacceptable' designation implies new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements for each land use is made and needed noise insulation features are incorporated in the design. By comparison, a 'normally acceptable' designation indicates that standard construction can occur with no special noise reduction requirements. These noise compatibility guidelines, also in terms of the CNEL noise metric, are shown in Table 4.10-4.

TABLE 4.10-4 LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS



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.	**Normally Unacceptable:** New construction or development should generally be discouraged. If new construction does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and the 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.	**Clearly Unacceptable:** New construction or development generally should not be undertaken.

Source: Office of Noise Control, Guidelines for the Preparation and Content of Noise Elements of the General Plan, February 1976. Included in the Governor's Office of Planning and Research, California, General Plan Guidelines, Appendix C, October 2003.

Since all city or county jurisdictions must include a noise element in their general plans, many jurisdictions have simply adopted the state compatibility guidelines, while other authorities modify the state chart to have a customized set of guidelines for their locale. The City uses the State of California's Land Use Compatibility Guidelines as shown in Table 4.10-4 above.

The California Building Code (CBC), Title 24, Part 2, Volume 1, Chapter 12, Interior Environment, Section 1207.11.2, Allowable Interior Noise Levels, requires that residences' interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric is evaluated as either the day-night average sound level (L_{dn}) or the community noise equivalent level (CNEL); using the noise metric that is consistent with the noise element of the particular local general plan.

The California Green Building Standards Code (CALGreen), Chapter 5, Division 5.5, has additional requirements for insulation that affect exterior-interior noise transmission for non-residential structures (which include multi-family structures 4 stories or greater). Pursuant to Section 5.507.4.1, Exterior Noise Transmission, Prescriptive Method, wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet:

- A composite sound transmission class (STC) rating of at least 50, or
- A composite outdoor-indoor transmission class (OITC) rating of no less than 40 with exterior windows of a minimum STC of 40, or OITC of 30 if the project location is within the 65 dBA CNEL or L_{dn} noise contour of an airport (military, public, private, or heliport), freeway, expressway, railroad, industrial source, or fixed-guideway source (as determined by the noise element of the general plan). Where noise contours are not readily available, projects exposed to a noise level of 65 dBA $L_{eq\text{-}1\,hr}$ during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum of STC 40 (or OITC 30).

  Residential structures within the noise contours identified above require an acoustical analysis showing that the structure has been designed to limit intruding noise in the prescribed allowable levels. To comply with these regulations, future applicants for new residential projects are required to submit an acoustical analysis report. The acoustical analysis report is required to show topographical relationship of noise sources and dwelling site, identification of noise sources and their characteristics, predicted noise spectra at the exterior of the proposed dwelling structure considering present and future land usage, basis for the prediction (measured or obtained from published data), noise attenuation measures to be applied, and an analysis of the noise insulation effectiveness of the proposed construction showing that the prescribed interior noise level requirements are met. If interior allowable noise levels are met by requiring that windows be un-openable or closed, the design for the structure must also specify the means that will be employed to provide ventilation and cooling, if necessary, to provide a habitable interior environment.

Local Regulations

General Plan 2035

The Noise and Safety (NS) element of the General Plan 2035 discusses sources of noise within the city, projected increases in noise levels, and a noise contour map of traffic-generated noise levels. The Land Use Compatibility Standards (Figure 12-1 on page 12-4 of the Element) establishes the same standards presented in the State of California's Land Use Compatibility Guidelines (Table 4.10-4 above). The NS element includes the following goals and policies specific to noise and applicable to the proposed project:

- Goal NS-B: Maintain an acceptable community noise level to protect the health and comfort of people living, working and/or visiting in Santa Rosa, while maintaining a visually appealing community.
  - Policy NS-B-1: Do not locate noise-sensitive uses in proximity to major noise sources, except residential is allowed near rail to promote future ridership.
  - Policy NS-B-2: Encourage residential developers to provide buffers other than sound walls, where practical. Allow sound walls only when projected noise levels at a site exceed land use compatibility standards in Figure 12-1.

    In some established neighborhoods and subdivisions, sound walls may provide the only alternative to reduce noise to acceptable community standards. The Design Review process shall evaluate sound wall aesthetics and landscaping to ensure attractiveness along with functionality.

  - Policy NS-B-3: Prevent new stationary and transportation noise sources from creating a nuisance in existing developed areas. Use a comprehensive program of noise prevention through planning and mitigation, and consider noise impacts as a crucial factor in project approval.

    The Land Use Compatibility Standards specify normally acceptable levels for community noise in various land use areas.

  - Policy NS-B-4: Require new projects in the following categories to submit an acoustical study, prepared by a qualified acoustical consultant:
    - All new projects proposed for areas with existing noise above 60 dBA DNL. Mitigation shall be sufficient to reduce noise levels below 45 dBA DNL in habitable rooms and 60 dBA DNL in private and shared recreational facilities. Additions to existing housing units are exempt.
    - All new projects that could generate noise whose impacts on other existing uses would be greater than those normally acceptable (as specified in the Land Use Compatibility Standards).
  - Policy NS-B-5: Pursue measures to reduce noise impacts primarily through site planning. Engineering solutions for noise mitigation, such as sound walls, are the least desirable alternative.
  - Policy NS-B-6: Do not permit existing uses to generate new noises exceeding normally acceptable levels unless:
    - Those noises are mitigated to acceptable levels; or
    - The activities are specifically exempted by the City Council on the basis of community health, safety, and welfare.
  - Policy NS-B-7: Allow reasonable latitude for noise generated by uses that are essential to community health, safety, and welfare. These include emergency medical helicopter and vehicle operations, and emergency vehicle sirens.
  - Policy NS-B-8: Adopt mitigations, including reduced speed limits, improved paving texture, and traffic controls, to reduce noise to normally acceptable levels in areas where noise standards may be exceeded (e.g., where homes front regional/arterial streets and in areas of mixed use development.)
  - Policy NS-B-9: Encourage developers to incorporate acoustical site planning into their projects. Recommended measures include:

  - Incorporating buffers and/or landscaped earth berms;
  - Orienting windows and outdoor living areas away from unacceptable noise exposure;
  - Using reduced-noise pavement (rubberized-asphalt);
  - Incorporating traffic calming measures, alternative intersection designs, and lower speed limits; and
  - Incorporating state-of-the-art structural sound attenuation and setbacks.
- Policy NS-B-10: Work with private enterprises to reduce or eliminate nuisance noise from industrial and commercial sources that impact nearby residential areas. If progress is not made within a reasonable time, the city shall issue abatement orders or take other legal measures.
- Policy NS-B-11: Work with CalTrans to assign a high priority to traffic noise mitigation programs. Support construction of attractive sound walls, as necessary along Highway 101 and Highway 12.
- Policy NS-B-12: Cooperate with Santa Rosa Memorial Hospital, Sutter Medical Center, and other hospitals proposing helipads. Minimize the noise and safety impacts of medical emergency helicopters through location and design of landing pads, regulation of flight times and frequency and, if necessary, sound attenuating alterations to nearby residences.
- Policy NS-B-13: Prohibit new helipads in developments of industrial, commercial, office, or business park uses. The City may make an exception if the helipad will provide a significant benefit for community health, safety, and welfare.
- Policy NS-B-14: Discourage new projects that have potential to create ambient noise levels more than 5 dBA DNL above existing background, within 250 feet of sensitive receptors.

Santa Rosa City Code

The City regulates noise through Chapter 17-16, Noise, of the Santa Rosa City Code (SRCC). The City's noise ordinance is designed to protect people from non-transportation noise sources such as construction activity, machinery, air conditioners, maintenance, and landscaping activities.

General Stationary Noise Sources

SRCC Section 17-16.030 establishes that the following criteria (in Table 4.10-5) will be used as a base (ambient noise level) from which noise levels can be compared.

Section 17-16.040, Standards for Determining Violation, provides a list of qualitative variables to take into account when determining whether a noise disturbs the peace and quiet of a neighborhood, including background noise levels, proximity to residences, time of day, and duration. More specifically, Section 17-16.120, Machinery and Equipment, states that noise produced by machinery, equipment, pumps, fans, heating, ventilation and air conditioning (HVAC), and similar mechanical devices is not to exceed the ambient base noise level by more than 5 dB at receiving properties. Other sections discuss restrictions on noise sources such as leaf blowers and sound-amplifying equipment.

TABLE 4.10-5 AMBIENT BASE NOISE LEVEL CRITERIA

Zone	Time	Sound Level A (decibels) Community Environment Classification
R-1 and R-2	10:00 pm to 7:00 am	45
	7:00 pm to 10:00 pm	50
	7:00 am to 7:00 pm	55
Multi-family	10:00 pm to 7:00 am	50
	7:00 am to 10:00 pm	55
Office & Commercial	10:00 pm to 7:00 am	55
	7:00 am to 10:00 pm	60
Intensive Commercial[a]	10:00 pm to 7:00 am	55
	7:00 am to 10:00 pm	65
Industrial	Anytime	70

Notes:
[a] See Appendix B of the City Clerk's file as set forth on a map on file in the office of the City clerk.
Source: Santa Rosa City Code, Section 17-16.030.

Construction Noise

The SRCC does not specifically contain limitations on the hours of operation for construction equipment. Additionally, there are no quantified limits on specific construction noise level emissions. However, as stated above, Section 17.16-120, Machinery and Equipment, sets standards for operating machinery and equipment, which could include construction-related equipment, not to exceed ambient base noise level by more than 5 dB at receiving properties. Furthermore, it is the City's standard practice to limit construction hours from 7:00 a.m. to 6:00 p.m. Monday through Friday, 9:00 a.m. to 5:00 p.m. on Saturdays, and construction is prohibited on Sundays and all City-recognized holidays.

Project-Applicable Vibration Standards

The SRCC does not include quantitative thresholds for vibration. In lieu of such quantified thresholds, it is common practice to rely on published information from the FTA. The FTA provides criteria for acceptable levels of ground-borne vibration for various types of special buildings that are sensitive to vibration. The FTA criteria are often used to evaluate vibration impacts during construction and are used herein for impact assessment thresholds. FTA Noise and Vibration Impact Guidelines for construction impact identifies that an impact would occur if construction activities generate vibration that is strong enough to (a) physically damage buildings or (b) cause undue annoyance at sensitive receptors. The threshold for human annoyance at residential receptors during the daytime is 78 VdB. The threshold for vibration-induced architectural damage is 0.2 peak particle velocity (PPV) in inches per second (in/sec) for typical wood-framed buildings.[10]

[10] Federal Transit Administration (FTA). 2006, May. *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation (DoT). FTA-VA-90-1003-06.

Vibration-Related Annoyance

The human reaction to various levels of vibration is highly subjective and varies from person to person. The FTA criteria for annoyance are shown below in Table 4.10-6. These criteria are based on the work of many researchers that suggested that humans are sensitive to vibration velocities in the range of 8-80 Hz.

TABLE 4.10-6 GROUNDBORNE VIBRATION CRITERIA: HUMAN ANNOYANCE

Land Use Category	Max L_v (VdB)[a]	Description
Workshop	90	Distinctly felt vibration. Appropriate to workshops and non-sensitive areas
Office	84	Felt vibration. Appropriate to offices and non-sensitive areas.
Residential – Daytime	78	Barely felt vibration. Adequate for computer equipment.
Residential – Nighttime	72	Vibration not felt, but groundborne noise may be audible inside quiet rooms.

Notes:
[a] Lv is the velocity level in decibels, as measured in 1/3-octave bands of frequency over the frequency ranges of 8 to 80 Hz.
Source: Federal Transit Administration (FTA). 2006, May. *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation (DoT). FTA-VA-90-1003-06.

Vibration-Related Architectural Damage

Structures amplify groundborne vibration and wood-frame buildings, such as typical residential structures, are more affected by ground vibration than heavier buildings. The level at which groundborne vibration is strong enough to cause architectural damage has not been determined conclusively. The most conservative estimates are reflected in the FTA standards, shown in Table 4.10-7.

TABLE 4.10-7 GROUNDBORNE VIBRATION CRITERIA: ARCHITECTURAL DAMAGE

	Building Category	PPV (in/sec)	L_v (VdB)[a]
I.	Reinforced concrete, steel, or timber (no plaster)	0.5	102
II.	Engineered concrete and masonry (no plaster)	0.3	98
III.	Non-engineered timber and masonry buildings	0.2	94
IV.	Buildings extremely susceptible to vibration damage	0.12	90

Notes:
[a] RMS velocity calculated from vibration level (VdB) using the reference of one microinch/second.
Source: Federal Transit Administration (FTA). 2006, May. *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation (DoT). FTA-VA-90-1003-06.

4.10.1.3 EXISTING NOISE ENVIRONMENT

Project and Nearby Sensitive Receptors

Certain land uses are particularly sensitive to noise and vibration. In general, these uses include residences, schools, hospital facilities, houses of worship, and open space/recreation areas where quiet environments are necessary for the enjoyment, public health, and safety of the community. Commercial uses are not considered noise- or vibration-sensitive uses.

The Southeast Greenway Area (project site) is currently undeveloped land. Land uses surrounding the project area consist primarily of residential and commercial uses. Sensitive receptors near the project site include residences, schools, and churches in neighborhoods adjacent to the Project site. Medical uses at Sutter Pacific Memorial Foundation are also considered sensitive receptors. The nearest schools to the project area are Merryhill School (on Mayette Avenue), Spring Creek Elementary School (on Mayette Avenue), and Montgomery High School (on Hahman Drive). Classrooms at these schools lie within 430 feet of the nearest boundary of the Southeast Greenway Area.

On-Road Vehicles

Noise from motor vehicles is generated by engine vibrations, the interaction between tires and the road, and the exhaust system. Reducing the average motor vehicle speed reduces the noise exposure of receptors adjacent to the road. Each reduction of five miles per hour reduces noise by about 1.3 dBA.

Given the existing of mobile-source noise in the vicinity of the project, it is necessary to determine the noise currently generated by vehicles traveling through the Southeast Greenway Area. Average daily traffic volumes were based on the existing daily traffic volumes calculated using peak hour intersection movements provided by W-Trans Transportation Consultants.

The traffic noise levels for this project were estimated using a version of the FHWA Highway Traffic Noise Prediction Model. The FHWA model determines a predicted noise level through a series of adjustments to a reference sound level. These adjustments account for traffic flows, speed, truck mix, varying distances from the roadway, length of exposed roadway, and noise shielding. Vehicle speeds on each roadway were assumed to be the posted speed limit, and no reduction in speed was assigned due to congested traffic flows. Current roadway characteristics, such as the number of lanes and speed limits, were determined from field observations and according to roadway classification.

The results of this modeling indicate that average noise levels along arterial segments currently range from approximately 60 dBA to 74 dBA CNEL (as calculated at a distance of 50 feet from the centerline of the road). The segment “Farmers Lane south of Bennett Valley Road” is planned to be constructed under the General Plan 2035 before the future buildout scenario year 2040. The segments “New east of Farmers Lane” and “New north of Hoen Avenue Frontage Road” are projections for a roadway that would be constructed with implementation of the proposed project. These future and project-related segments have been included in the table below for consistency with other traffic noise tables in this section. Noise levels for existing conditions along analyzed roadways are presented in Table 4.10-8.

TABLE 4.10-8 EXISTING CONDITIONS TRAFFIC NOISE LEVELS

Roadway	Segment	Daily Traffic Volumes	Noise Level at 50 Feet (dBA CNEL)	Distance to Noise Contour (feet)		
				70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
Farmers Lane	North of 4th Street	3,190	61.8	14	31	66
Farmers Lane	4th St to Montgomery Drive	26,520	72.5	73	157	339
Farmers Lane	Montgomery Drive to Sonoma Avenue	25,330	72.3	71	153	329
Farmers Lane	Sonoma Ave to Patio Court	27,230	72.6	74	160	345
Farmers Lane	Patio Court to Hoen Avenue	31,730	73.3	82	177	382
Farmers Lane	Hoen Avenue to Vallejo Street	36,140	73.8	90	194	417
Farmers Lane	Vallejo Street to SR 12 Westbound ramp	34,870	73.7	88	189	407
Farmers Lane	SR 12 Westbound to SR12 Eastbound/ Hoen Avenue Frontage Road	22,350	71.7	65	140	303
Farmers Lane	SR 12 Eeastbound/ Hoen Avenue Frontage Road to Bennett Valley	11,580	68.9	42	91	195
Farmers Lane	South of Bennett Valley	-	-	-	-	-
4th Street	Rogers Way to Farmers Lane	23,540	72.0	68	145	313
4th Street	Farmers Lane to Brush Creek Road	31,930	73.3	83	178	384
Montgomery Drive	Shortt Road to Farmers Lane	5,770	64.4	21	46	99
Montgomery Drive	Farmers Lane to Hahman Drive	13,170	68.0	37	79	171
Sonoma Avenue	Shortt Road to Farmers Lanr	8,100	65.9	27	57	124
Sonoma Avenue	Farmers Lane to Hahman Drive	9,380	68.0	37	79	170
Patio Court	Farmers Lane to Hahman Drive	2,510	60.8	12	26	56
Hoen Avenue	Sonoma Avenue to Farmers Lane	1,110	57.2	7	15	33
Hoen Avenue	Farmers Lane to Hahman Drive	3,990	62.8	17	36	77
Vallejo Street	Mount Olive Drive to Farmers Lane	2,740	59.7	10	22	48
Vallejo Street	Farmers Lane to Hahman Drive	650	50.2	2	5	11
Hwy 12 Westbound Ramp	West of Farmers Lane	20,480	69.9	49	106	228
New	East of Farmers Lane	-	-	-	-	-
Hwy 12 Eeastbound / Hoen Avenue Frontage Road	West of Farmers Lane	23,320	70.5	54	116	250
Hoen Avenue Frontage Road	Farmers Lane to Townview Avenue	10,000	66.8	31	66	142
Hoen Avenue Frontage Road	Townview Avenue to New	10,000	66.8	31	66	142
Hoen Avenue Frontage Road	New to Hoen Avenue/ Cypress Way	20,630	70.0	50	107	231
Hoen Avenue Frontage Road	Hoen Avenue /Cypress Way to Franquette Avenue	20,710	70.0	50	107	231
Hoen Avenue	Franquette Avenue to Yulupa Avenue	18,700	69.5	47	100	216
Hoen Avenue	Yulupa Avenue to Summerfield Road	11,510	67.4	34	73	156
Hoen Avenue	Summerfield Road to Newanga Avenue	2,680	61.1	13	27	59
Bennett Valley Road	Gordon Lane to Farmers Lane	10,200	66.9	31	67	144

TABLE 4.10-8 EXISTING CONDITIONS TRAFFIC NOISE LEVELS

Roadway	Segment	Daily Traffic Volumes	Noise Level at 50 Feet (dBA CNEL)	Distance to Noise Contour (feet)		
				70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
Bennett Valley Road	Farmers Lane to Holland Drive	14,420	68.4	39	84	181
Townview Avenue	Hoen Avenue Frontage Road to Townview Lane	1,350	56.7	6	14	30
New	North of Hoen Avenue Frontage Road	-	-	-	-	-
Hoen Avenue	Hahman Drive to Hoen Avenue Frontage Road	4,850	63.6	19	41	87
Cypress Way	Hoen Avenue Frontage Road to Creekside Road	3,680	61.0	13	27	59
Franquette Avenue	Mayette Avenue to Hoen Avenue	2,210	60.2	11	24	52
Mayette Avenue	Franquette Avenue to Yulupa Avenue	2,650	61.0	13	27	58
Mayette Avenue	Yulupa Avenue to Summerfield Road	4,940	63.7	19	41	88
Yulupa Avenue	Spring Creek Drive to Mayette Avenue	9,390	66.5	29	63	136
Yulupa Avenue	Mayette Avenue to Hoen Avenue	10,930	67.2	33	70	151
Yulupa Avenue	Hoen Avenue to Sacramento Avenue	11,330	67.4	33	72	155
Summerfield Road	Mayette Avenue to Hoen Avenue	13,300	69.5	46	99	214
Summerfield Road	Hoen Avenue to Parktrail Drive	8,750	67.7	35	75	162

Source: FHWA Highway Traffic Noise Prediction Model based on traffic volumes provided by W-Trans in June 2017. Calculations included in Appendix F of this Draft EIR.

Stationary Source Noise

Stationary sources of noises may occur from all types of land uses. Residential uses would generate noise from landscaping, maintenance activities, and air conditioning systems. Office and commercial uses would generate noise from ventilation systems, loading docks, parking lot activities, and other sources. Noise generated by residential, office, or commercial uses are generally short and intermittent. For the developed land surrounding the project site, land uses are primarily residential and commercial. Noise from stationary sources is regulated through the SRCC.

Airport Noise

The nearest public airport is the Sonoma County Airport, located approximately 9 miles northwest of the project area. The nearest heliport is at the Santa Rosa Memorial Hospital, located approximately one mile northwest of the project site. The nearest private airport is Graywood Ranch Airport, located approximately 6 miles to the southeast of the project area.

4.10.1 STANDARDS OF SIGNIFICANCE

Implementation of the proposed project would result in a significant impact if it would:

1. Expose people to, or generation of, noise levels in excess of standards established in the General Plan or the Municipal Code, and/or the applicable standards of other agencies.
2. Expose people to, or generation of, excessive groundborne vibration or groundborne noise levels.
3. Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
4. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
5. Expose people residing or working in the vicinity of the project site to excessive aircraft noise levels, for a project located within an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport.
6. Expose people residing or working in the project site to excessive noise levels, for a project within the vicinity of a private airstrip.

4.10.2 ENVIRONMENTAL IMPACTS

NOISE-1 Implementation of the proposed project would not cause exposure of people to, or generation of, noise levels in excess of standards established in the General Plan or the Municipal Code, and/or the applicable standards of other agencies.

A significant impact would occur if future development under the proposed project would result in an increase of traffic noise levels of 5 dBA if their resultant noise level were to remain within the objectives of the General Plan 2035 (e.g., 60 dBA CNEL at single-family residential, 65 dBA CNEL at multi-family residential) or with an increase of 3 dBA if the resultant level were to meet or exceed the objectives of the General Plan 2035. A significant stationary-source impact would occur if the activities or equipment at the project site produce noise levels at nearby sensitive receptors in excess of local standards.

Traffic Noise

Future development under the proposed project would cause increases in traffic along local roadways. A substantial increase is defined as a noise increase greater than 3 dBA over existing conditions. Sensitive land uses include residential, schools, churches, nursing homes, hospitals, and open space/recreation areas. Commercial and industrial areas are not considered noise sensitive and generally have higher tolerances for exterior and interior noise levels.

The traffic noise levels were estimated using the FHWA Highway Traffic Noise Prediction Model. The FHWA model predicts noise levels through a series of adjustments to a reference sound level. These adjustments account for distances from the roadway, traffic flows, vehicle speeds, car/truck mix, length of exposed roadway, and road width. The distances to the 70, 65, and 60 CNEL contours for selected roadway segments in the vicinity of proposed project site are included in Appendix F of this Draft EIR.

Table 4.10-9 presents the noise level increases on roadways over existing conditions at 50 feet from the centerline of each roadway segment due to the project. The “Future plus Project” traffic noise levels include effects of future regional ambient growth and growth due to the project, evaluated for the year 2040. “Project Contribution” represents the effect the project would have on future noise levels by comparing the difference between “Future plus Project” noise levels and future noise levels due exclusively to ambient growth. Appendix F of this Draft EIR includes tables showing traffic noise levels for all four scenarios: Existing, Existing plus Project, Future, and Future plus Project.

TABLE 4.10-9 PROJECT BUILDOUT TRAFFIC NOISE INCREASES

		dBA CNEL @ 50 ft.			
Roadway	Segment	Existing	Future + Project	Overall Increase	Project Contribution
Farmers Lane	North of 4th Street	61.8	62.4	0.6	0.0
Farmers Lane	4th St to Montgomery Drive	72.5	73.0	0.6	0.1
Farmers Lane	Montgomery Drive to Sonoma Avenue	72.3	72.8	0.5	0.1
Farmers Lane	Sonoma Ave to Patio Court	72.6	73.1	0.5	0.1
Farmers Lane	Patio Court to Hoen Avenue	73.3	73.7	0.5	0.0
Farmers Lane	Hoen Avenue to Vallejo Street	73.8	74.5	0.7	0.1
Farmers Lane	Vallejo Street to SR 12 Westbound ramp	73.7	74.3	0.7	0.0
Farmers Lane	SR 12 Westbound to SR12 Eastbound/ Hoen Avenue Frontage Road	71.7	72.5	0.8	0.2
Farmers Lane	SR 12 Eeastbound/ Hoen Avenue Frontage Road to Bennett Valley	68.9	70.3	1.4	0.0
Farmers Lane	South of Bennett Valley	-	68.0	-	-
4th Street	Rogers Way to Farmers Lane	72.0	72.3	0.3	0.0
4th Street	Farmers Lane to Brush Creek Road	73.3	73.8	0.5	0.0
Montgomery Drive	Shortt Road to Farmers Lane	64.4	65.8	1.4	0.0
Montgomery Drive	Farmers Lane to Hahman Drive	68.0	68.6	0.6	0.0
Sonoma Avenue	Shortt Road to Farmers Lanr	65.9	66.4	0.5	0.0
Sonoma Avenue	Farmers Lane to Hahman Drive	68.0	68.3	0.4	0.0
Patio Court	Farmers Lane to Hahman Drive	60.8	61.1	0.3	0.1
Hoen Avenue	Sonoma Avenue to Farmers Lane	57.2	59.5	2.3	0.3
Hoen Avenue	Farmers Lane to Hahman Drive	62.8	65.6	2.8	0.2
Vallejo Street	Mount Olive Drive to Farmers Lane	59.7	60.0	0.3	0.0
Vallejo Street	Farmers Lane to Hahman Drive	50.2	50.4	0.2	0.0
Hwy 12 Westbound Ramp	West of Farmers Lane	69.9	70.1	0.2	0.1
New	East of Farmers Lane	-	52.4	-	-
Hwy 12 Eeastbound / Hoen	West of Farmers Lane	70.5	71.0	0.5	0.0

TABLE 4.10-9 PROJECT BUILDOUT TRAFFIC NOISE INCREASES

		dBA CNEL @ 50 ft.			
Roadway	Segment	Existing	Future + Project	Overall Increase	Project Contribution
Avenue Frontage Road					
Hoen Avenue Frontage Road	Farmers Lane to Townview Avenue	66.8	67.9	1.0	0.5
Hoen Avenue Frontage Road	Townview Avenue to New	66.8	67.9	1.1	0.5
Hoen Avenue Frontage Road	New to Hoen Avenue/ Cypress Way	70.0	70.5	0.5	0.0
Hoen Avenue Frontage Road	Hoen Avenue /Cypress Way to Franquette Avenue	70.0	70.5	0.6	0.1
Hoen Avenue	Franquette Avenue to Yulupa Avenue	69.5	70.0	0.5	0.2
Hoen Avenue	Yulupa Avenue to Summerfield Road	67.4	68.0	0.5	0.1
Hoen Avenue	Summerfield Road to Newanga Avenue	61.1	61.4	0.3	0.0
Bennett Valley Road	Gordon Lane to Farmers Lane	66.9	66.2	-0.7	0.0
Bennett Valley Road	Farmers Lane to Holland Drive	68.4	68.8	0.5	0.0
Townview Avenue	Hoen Avenue Frontage Road to Townview Lane	56.7	56.3	-0.3	0.0
New	North of Hoen Avenue Frontage Road	-	59.4	-	-
Hoen Avenue	Hahman Drive to Hoen Avenue Frontage Road	63.6	65.2	1.6	0.1
Cypress Way	Hoen Avenue Frontage Road to Creekside Road	61.0	62.6	1.6	0.0
Franquette Avenue	Mayette Avenue to Hoen Avenue	60.2	61.4	1.2	0.0
Mayette Avenue	Franquette Avenue to Yulupa Avenue	61.0	62.5	1.5	0.0
Mayette Avenue	Yulupa Avenue to Summerfield Road	63.7	64.6	0.9	0.0
Yulupa Avenue	Spring Creek Drive to Mayette Avenue	66.5	67.3	0.8	0.2
Yulupa Avenue	Mayette Avenue to Hoen Avenue	67.2	67.8	0.6	0.1
Yulupa Avenue	Hoen Avenue to Sacramento Avenue	67.4	67.7	0.4	0.0
Summerfield Road	Mayette Avenue to Hoen Avenue	69.5	69.9	0.4	0.0
Summerfield Road	Hoen Avenue to Parktrail Drive	67.7	67.9	0.3	0.0

Source: FHWA Highway Traffic Noise Prediction Model based on traffic volumes provided by W-Trans (June 2017). Calculations in Appendix F of this Draft EIR.

Table 4.10-9 shows that traffic noise increases resulting from the project contribution would range from 0.0 to 0.5 dBA CNEL, and overall increases due to both the project and regional growth would range from - 0.7 to 2.8 dBA CNEL. The segment “Farmers Lane south of Bennett Valley Road” is planned to be constructed under the existing General Plan 2035 before the future buildout scenario year 2040. The segments “New east of Farmers Lane” and “New north of Hoen Avenue Frontage Road” are projections for a roadway that would be constructed with implementation of the proposed project. Therefore, there is no “Existing” baseline for these three segments. Future traffic on the new segments planned as part of the proposed project would generate noise levels below 60 dBA CNEL and would not exceed the standards of the General Plan 2035.

No segments would experience substantial noise increases greater than 3 dBA over existing conditions. Therefore, impacts would be *less than significant*.

Stationary-Source Noise

SRCC Section 17-16.125 states that noise produced by machinery, equipment, pumps, fans, HVAC, and similar mechanical devices is not to exceed the ambient base noise level (listed above in Table 4.10-5) by more than 5 dB at receiving properties. SRCC Section 17-16.170 regulates hours of operation for sound-amplifying equipment and sets a noise level threshold of 15 dB above the ambient base noise level. Additionally, SRCC Section 17-16.040 provides a list of qualitative variables to take into account when determining whether a noise disturbs the peace and quiet of a neighborhood, including background noise levels, proximity to residences, time of day, and duration.

Onsite ventilation units and associated equipment at residential and mixed-use sites would be acoustically engineered with appropriate procurement specifications, sound enclosures, and parapet walls to minimize noise—all in accordance with City's stationary noise requirements—to ensure that such equipment does not exceed allowable noise limits. Other stationary sources for residential and mixed-use areas include landscaping, maintenance, truck deliveries, trash pickup, and parking lot activity. These sources are generally short and intermittent, and are not a substantial source of noise.

Outdoor recreational facilities that may be developed in the School Facilities designation adjacent to Montgomery High School in the West Subarea could include a swim center, running tracks, basketball courts and/or tennis courts, which would be available for use by Montgomery High School, other schools, and the community. Noise generated by these uses could include coaching, cheering, players yelling, and announcements. Since these facilities would be located adjacent to existing Montgomery High School sports facilities – including a football stadium – development of these new uses would not introduce any new types or concentrations of noise to the area that would be markedly different than the current conditions.

A potential future Community Gathering Place near Montgomery High School in the West Subarea could include a space for "large organized community events like festivals and concerts or a small amphitheater." Noise generated by outdoor festivals and common community events (i.e., farmer's markets and craft festivals) would primarily consist of conversation between attendees, which would be overshadowed by traffic noise along Hoen Avenue and other roadways in the vicinity. Concerts or other large events may include amplified sound from speakers and may take place during evening hours. Noise levels may be audible at nearby residences; however, amplified sound would be required to comply with the standards set by SRRC Section 17-16.170. Additionally, since events would be limited to a few hours in length, and would only occur periodically, they would not result in any significant increases to CNEL noise levels in the vicinity.

Noise sources associated with Public Plaza, Greenway, and Urban Agriculture designations (which may include trails, gardens, seating, and parking lots) would be limited to talking, landscape maintenance, and light parking lot activity. These noise sources would generally be overshadowed by traffic noise, and would not noticeably increase ambient noise levels in the vicinity.

Since noise generated by stationary sources would be subject to the restrictions set by the SRRC, would not exceed the standards set in the General Plan 2035 listed in Section 4.10.1.2, Regulatory Framework, above, and would not result in substantial increases in ambient noise levels, impacts due to stationary noise would be *less than significant*.

As implementation of the proposed project would not result in significant increases in traffic or stationary-source noise, long-term operational noise levels would not exceed local standards, and the impact would be *less than significant*.

Significance Without Mitigation: Less than significant.

NOISE-2 Implementation of the proposed project would not cause exposure of people to, or generation of, excessive groundborne vibration or groundborne noise levels.

The potential vibration impacts resulting from potential future development under the proposed project are addressed in this impact.

Construction Vibration Impacts

Construction operations can generate varying degrees of ground vibration, depending on the construction procedures and equipment. Operation of construction equipment generates vibrations that spread through the ground and diminish with distance from the source. The effect on buildings in the vicinity of the construction site depends on soil type, ground strata, and receptor-building construction. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to slight structural damage at the highest levels. Vibration from construction activities rarely reaches levels that can damage structures, but can achieve the audible and perceptible ranges in buildings close to the construction site. Table 4.10-10 lists vibration levels for construction equipment.

TABLE 4.10-10 VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Approximate Velocity Level at 25 Feet (VdB)	Approximate RMS[a] Velocity at 25 Feet (in/sec)
Pile Driver (impact) Upper Range	112	1.518
Pile Driver (impact) Lower Range	104	0.644
Pile Driver (sonic) Upper Range	105	0.734
Pile Driver (sonic) Lower Range	93	0.170
Large Bulldozer	87	0.089
Caisson Drilling	87	0.089
Jackhammer	79	0.035

TABLE 4.10-10 VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Approximate Velocity Level at 25 Feet (VdB)	Approximate RMS[a] Velocity at 25 Feet (in/sec)
Small Bulldozer	58	0.003
Loaded Trucks	86	0.076
FTA Criteria: Human Annoyance (Daytime/Nighttime)	78/72	—
FTA Criteria: Structural Damage	—	0.200

Notes
[a] RMS velocity calculated from vibration level (VdB) using the reference of 1 microinch/second.
Source: FTA 2006.

As shown in Table 4.10-10, vibration generated by construction equipment has the potential to be substantial, since it has the potential to exceed the FTA criteria of 78 VdB for human annoyance and 0.200 in/sec for structural damage. However, groundborne vibration is almost never annoying to people who are outdoors, so it is usually evaluated in terms of indoor receivers. Construction details and equipment for potential future development under the proposed project are not known at this time and therefore, are not evaluated in this Draft EIR.

While construction noise and vibration activities can be very loud and/or jarring/annoying resulting in disturbance to adjacent receptors, such activities are typically considered to be short-term. Future development under the proposed project with the potential to result in the use of vibration-causing equipment would be required to comply with the General Plan 2035 policies that are aimed at reducing noise-related impacts. Specifically, SRCC Section 17.16-120, Machinery and Equipment, standards for operating machinery and equipment, which could include construction-related equipment, would not be permitted to exceed ambient base noise level by more than 5 dB at receiving properties. Furthermore, compliance with General Plan 2035 Policy NS-B-4 requires future new projects that could generate noise impacts that would be greater than normally acceptable to submit an acoustical study prepared by a qualified acoustical consultant. Additionally, it is standard practice within the city that construction permits also require contractors to use best management practices such as the following:

- Post a construction site notice near the construction site access point or in an area that is clearly visible to the public. The notice shall include the following: job site address; permit number, name, and phone number of the contractor and owner; dates and duration of construction activities; construction hours allowed; and the City of Santa Rosa Community Development Director and construction contractor phone numbers where noise complaints can be reported and logged.
- Limit construction activities to the hours of 7:00 a.m. to 6:00 p.m. Monday through Friday, 9:00 a.m. to 5:00 p.m. on Saturdays, and prohibit construction on Sundays and all City-recognized holidays.
- Consider the installation of temporary sound barriers for construction activities immediately adjacent to occupied noise-sensitive structures.
- Restrict haul routes and construction-related traffic to the least noise-sensitive times of the day.
- Reduce non-essential idling of construction equipment to no more than five minutes.
- Ensure that all construction equipment is monitored and properly maintained in accordance with the manufacturer’s recommendations to minimize noise.

- Fit all construction equipment with properly-operating mufflers, air intake silencers, and engine shrouds, no less effective than as originally equipped by the manufacturer, to minimize noise emissions.
- If construction equipment is equipped with back-up alarm shut offs, switch off back-up alarms and replace with human spotters, as feasible.
- Stationary equipment (such as generators and air compressors) and equipment maintenance and staging areas shall be located as far from existing noise-sensitive land uses, as feasible.
- To the extent feasible, use acoustic enclosures, shields, or shrouds for stationary equipment such as compressors and pumps.
- Shut off generators when generators are not needed.
- Coordinate deliveries to reduce the potential of trucks waiting to unload and idling for long periods of time.
- Grade surface irregularities on construction sites to prevent potholes from causing vehicular noise. Minimize the use of impact devices such as jackhammers, pavement breakers, and hoe rams. Where possible, use concrete crushers or pavement saws rather than hoe rams for tasks such as concrete or asphalt demolition and removal.

The implementation of these policies, future acoustical studies, and standard permitting practices would ensure that construction-related vibration impacts would be *less than significant*.

Operational Vibration Impacts

Typically, only industrial uses that use heavy machinery or rail projects where passing trains could generate perceptible levels of vibration would result in vibration concerns. Potential future development under the proposed project could result in mixed-use, residential uses and park and recreational uses, which do not contain sources that would generate substantial levels of vibration. Therefore, operational vibration impacts due to potential future development under the proposed project would be *less than significant*.

Significance Without Mitigation: Less than significant.

NOISE-3 Implementation of the proposed project would not cause a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the proposed project.

As presented in impact discussion NOISE-1 above, project-generated operational noise from traffic, stationary noise sources (i.e., mechanical systems), and operational activities will not result in a substantial permanent increase in ambient noise levels. Therefore, these on-going activities would generate *less-than-significant* noise impacts and no mitigation measures are needed.

Significance Without Mitigation: Less than significant.

NOISE-4 Implementation of the proposed project would cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Given this analysis is based on future development potential under the proposed project, a generalized, program-level set of assumed construction activities were used for the construction noise assessment. Noise generated during construction is based on the type of equipment used, the location of the equipment relative to sensitive receptors, and the timing and duration of the noise-generating activities. Sensitivity to noise is based on the location of the equipment relative to sensitive receptors, time of day, and the duration of noise-generating activities.

Implementation of the proposed project would result in up to 244 multi-family residential units and 12,000 square feet of commercial space within the Southeast Greenway Area, as well as recreational and park uses. This impact discussion describes the potential construction-related noise impacts resulting from future development that would be accommodated by the proposed project.

Two types of temporary noise impacts could occur during future construction activities associated with development that could occur under the proposed project. First, the transport of workers and movement of materials to and from the site could incrementally increase noise levels along local access roads. The second type of temporary noise impact is related to demolition, site preparation, grading, and/or physical construction. Construction is performed in distinct steps, each of which has its own mix of equipment and noise characteristics. Table 4.10-11 lists typical construction equipment noise levels recommended for noise-impact assessments, based on a distance of 50 feet between the equipment and noise receptor.

TABLE 4.10-11 CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Construction Equipment	Typical Max Noise Level (dBA L_{max})[a]	Construction Equipment	Typical Max Noise Level (dBA L_{max})[a]
Air Compressor	81	Pile-Driver (Impact)	101
Backhoe	80	Pile-Driver (Sonic)	96
Ballast Equalizer	82	Pneumatic Tool	85
Ballast Tamper	83	Pump	76
Compactor	82	Rail Saw	90
Concrete Mixer	85	Rock Drill	98
Concrete Pump	71	Roller	74
Concrete Vibrator	76	Saw	76
Crane, Derrick	88	Scarifier	83
Crane, Mobile	83	Scraper	89
Dozer	85	Shovel	82
Generator	81	Spike Driver	77
Grader	85	Tie Cutter	84
Impact Wrench	85	Tie Handler	80

TABLE 4.10-11 CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Construction Equipment	Typical Max Noise Level (dBA L_{max})[a]	Construction Equipment	Typical Max Noise Level (dBA L_{max})[a]
Jack Hammer	88	Tie Inserter	85
Loader	85	Truck	88
Paver	89		

Notes:
[a] Measured at 50 feet from the source.
Source: FTA 2006.

As shown in Table 4.10-11, construction equipment generates high levels of noise, with maximums ranging from 71 dBA to 101 dBA. Construction of individual future development projects that could occur under the proposed project would temporarily increase the ambient noise environment and would have the potential to affect noise-sensitive land uses in the vicinity of that future project.

Significant noise impacts may occur from operation of heavy earthmoving equipment and truck hauling that would occur with construction of individual development projects. Implementation of the proposed project would result in an increase in development intensity throughout the Southeast Greenway Area. Construction noise levels depend on the specific locations, site plans, and construction details of individual development projects, which are not known at this time. Construction-related noise would be localized and would occur intermittently for varying periods of time. Per the City's standard conditions of approval, all construction activities would be limited to the hours of 7:00 a.m. to 6:00 p.m. Monday through Friday, 9:00 a.m. to 5:00 p.m. on Saturdays, and prohibit construction on Sundays and all City-recognized holidays. .

Because specific project-level information for potential future development is not available at this time, the construction noise impacts at specific off-site or on-site sensitive receptors has not been quantified in this Draft EIR. Construction of future individual development projects that could occur under the proposed project would temporarily increase the ambient noise environment in the vicinity of each future development project, potentially affecting existing and future sensitive uses in the vicinity. Future development under the proposed project would be required to provide project-specific data to the City, and would be required to comply with the City's regulations to reduce any potential construction-related noise impacts to a less-than-significant level. Specifically, compliance with SRCC Section 17.16-120, Machinery and Equipment, standards for operating machinery and equipment, which could include construction-related equipment, would not be permitted to exceed ambient base noise level by more than 5 dB at receiving properties. Furthermore, General Plan 2035 Policy NS-B-4 requires new projects that could generate noise impacts that would be greater than normally acceptable to submit an acoustical study prepared by a qualified acoustical consultant. Additionally, implementation of the best management practices listed under impact discussion NOISE-2 would insure construction-related noise impacts are reduced. The implementation of these policies, future acoustical studies, and standard permitting practices would ensure that construction-related noise impacts be *less than significant*.

Significance Without Mitigation: Less than significant.

NOISE-5 Implementation of the proposed project would not cause exposure of people residing or working in the vicinity of the study area to excessive aircraft noise levels, for a project located within an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport.

The nearest public airport is the Sonoma County Airport, located approximately 9 miles northwest of the project area. Future development in the Southeast Greenway Area would not expose people onsite to excessive airport-related noise levels. Therefore, *no impact* would occur.

Significance Without Mitigation: No Impact.

NOISE-6 Implementation of the proposed project would not cause exposure of people residing or working in the project site to excessive noise levels, for a project within the vicinity of a private airstrip.

The nearest heliport is at the Santa Rosa Memorial Hospital, located approximately one mile northwest of the project site. While operations may, at times, be audible at the site, the relatively limited and sporadic use of this heliport would result in a negligible contribution to overall noise levels in the project area. The nearest private airport is Graywood Ranch Airport, located approximately 6 miles to the southeast of the project area. Future development under the proposed project would not expose people onsite to excessive noise levels from aircraft approaching or departing these aircraft facilities and *no impact* would occur.

Significance Without Mitigation: No Impact.

4.10.3 CUMULATIVE IMPACTS

NOISE-7 Implementation of the proposed project, in combination with past, present, and reasonably foreseeable projects, would not result in a significant cumulative impacts with respect to noise.

Operational Noise

To specifically estimate the proposed project's contribution to traffic noise, existing noise levels were compared to those projected with buildout of the proposed project. As demonstrated above, the proposed project's contribution to increases in ambient noise levels and vibration would be less than significant, even when accounting for traffic increases forecast in the Southeast Greenway Area.

As discussed above, potential new stationary sources resulting from future development under the proposed project would not be expected to substantially increase ambient noise levels in the area. Additionally, HVAC, amplified sound, and other stationary noise sources would be required to comply with the restrictions set in the SRCC. Of particular note with all existing and future stationary sources associated with the project is that they are generally localized in nature (as opposed to more area-wide sources such as roadways and freeways). For example, a single, roof-top ventilation unit or a single lawn-mower will only potentially affect listeners in the immediate vicinity; say within 100 feet (for discussion purposes). Given this relatively limited sphere of influence for any individual stationary source, the aggregation of stationary sources due to the proposed project and other future projects within the city would not be expected to be cumulatively considerable. Thus, cumulative impacts from project-related stationary noise sources would be *less than significant*.

Construction Noise

Construction activities may occur simultaneously and in close proximity to noise-sensitive receptors, resulting in potentially significant impacts. However, it cannot be determined whether other, close-proximity projects will be conducted simultaneously or what the extent of their potential noise emissions might be, since details of future individual development projects in the vicinity of the Southeast Greenway Area are currently unknown. With implementation of the pertinent General Plan 2035 policies, future acoustical studies, and standard permitting practices, the potential for excessive noise and/or vibration from construction activities would be reduced to a *less-than-significant* level.

Significance Without Mitigation: Less than significant.

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