3.6 Noise and Vibration

Environmental Setting

PHYSICAL SETTING

Noise

Characterization and Measurement

Noise is commonly defined as unwanted sound that annoys or disturbs people and potentially causes an adverse psychological or physiological effect on human health. Because noise is an environmental pollutant that can interfere with human activities, evaluation of noise is necessary when considering the environmental impacts of a proposed project.

Sound is mechanical energy (vibration) transmitted by pressure waves over a medium such as air or water. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient (existing) sound level. Although the decibel (dB) scale, a logarithmic scale, is used to quantify sound intensity, it does not accurately describe how sound intensity is perceived by human hearing. The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called A-weighting, written as dBA and referred to as A-weighted decibels. Table 3.6-1 defines sound measurements and other terminology used in this chapter, and Table 3.6-2 summarizes typical A-weighted sound levels for different noise sources.

In general, human sound perception is such that a change in sound level of 1 dB cannot typically be perceived by the human ear, a change of 3 dB is barely noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level, if sound levels increase or decrease, respectively.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (Leq), the minimum and maximum sound levels (Lmin and Lmax), percentile-exceeded sound levels (such as L10, L20), the day-night sound level (Ldn), and the community noise equivalent level (CNEL). Ldn and CNEL values differ by less than 1 dB. As a matter of practice, Ldn and CNEL values are considered to be equivalent and are treated as such. These measurements are defined in Table 3.6-1.

For a point source such as a stationary compressor or construction equipment, sound attenuates (lessens in intensity) based on geometry at a rate of 6 dB per doubling of distance. For a line source

such as free flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance (California Department of Transportation, 2013a). Atmospheric conditions including wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically in the range of 1–2 dB per doubling of distance. Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Surrounding Land Uses and Existing Noise Sensitive Receptors

There are a wide variety of land uses located throughout the Planning Area, including noise-sensitive land uses. Noise-sensitive land uses, or sensitive receptors, are those uses that are most sensitive to high noise levels, including residences, religious facilities, schools, child care centers, hospitals, long-term health care facilities, convalescent centers, and retirement homes. All of these land use types, except hospitals, long-term health care facilities, and convalescent centers, occur within the Planning Area.

Existing Noise Environment

The different types of noise sources that typically occur in an urban environment are discussed at a general level in this section. The sources of noise include traffic noise, aircraft overflights, and stationary noise at existing land uses.

Noise Monitoring

Noise monitoring conducted for the Draft BART to Livermore Extension Project EIR included three long-term (LT) measurement locations within the Planning Area, and thus help to characterize the existing noise environment. The locations and noise levels associated with these measurements (LT-3, LT-4 and LT-5) are included in Table 3.6-3, and measurement locations are shown in Figure 3.6-1.

Table 3.6-1: Definition of Sound Measurements

Sound Measurements	*Definition*
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 micro-pascals.
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
C-Weighted Decibel (dBC)	The sound pressure level in decibels as measured using the C-weighting filter network. The C-weighting is very close to an unweighted or *flat* response. C-weighting is only used in special cases when low-frequency noise is of particular importance. A comparison of measured A- and C-weighted level gives an indication of low frequency content.
Maximum Sound Level (Lmax)	The maximum sound level measured during the measurement period.
Minimum Sound Level (Lmin)	The minimum sound level measured during the measurement period.
Equivalent Sound Level (Leq)	The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy.
Percentile-Exceeded Sound Level (Lxx)	The sound level exceeded *xx* % of a specific time period. L_{10} is the sound level exceeded 10% of the time. L_{90} is the sound level exceeded 90% of the time. L_{90} is often considered to be representative of the background noise level in a given area.
Day-Night Level (Ldn)	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.
Peak Particle Velocity (Peak Velocity or PPV)	A measurement of ground vibration defined as the maximum speed (measured in inches per second) at which a particle in the ground is moving relative to its inactive state. PPV is usually expressed in inches/second.
Frequency: Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.

Table 3.6-2: Typical A-weighted Sound Levels

Common Outdoor Activities	*Noise Level (dBA)*	*Common Indoor Activities*
	—110—	Rock band
Jet flyover at 1,000 feet		
	—100—	
Gas lawnmower at 3 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		
Gas lawnmower, 100 feet	—70—	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	—60—	
		Large business office
Quiet urban daytime	—50—	Dishwasher in 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—	
		Broadcast/recording studio
	—10—	
Lowest threshold of human hearing	—0—	Lowest threshold of human hearing

Notes:
dBA = A-weighted decibel

Source: California Department of Transportation, 2013a.

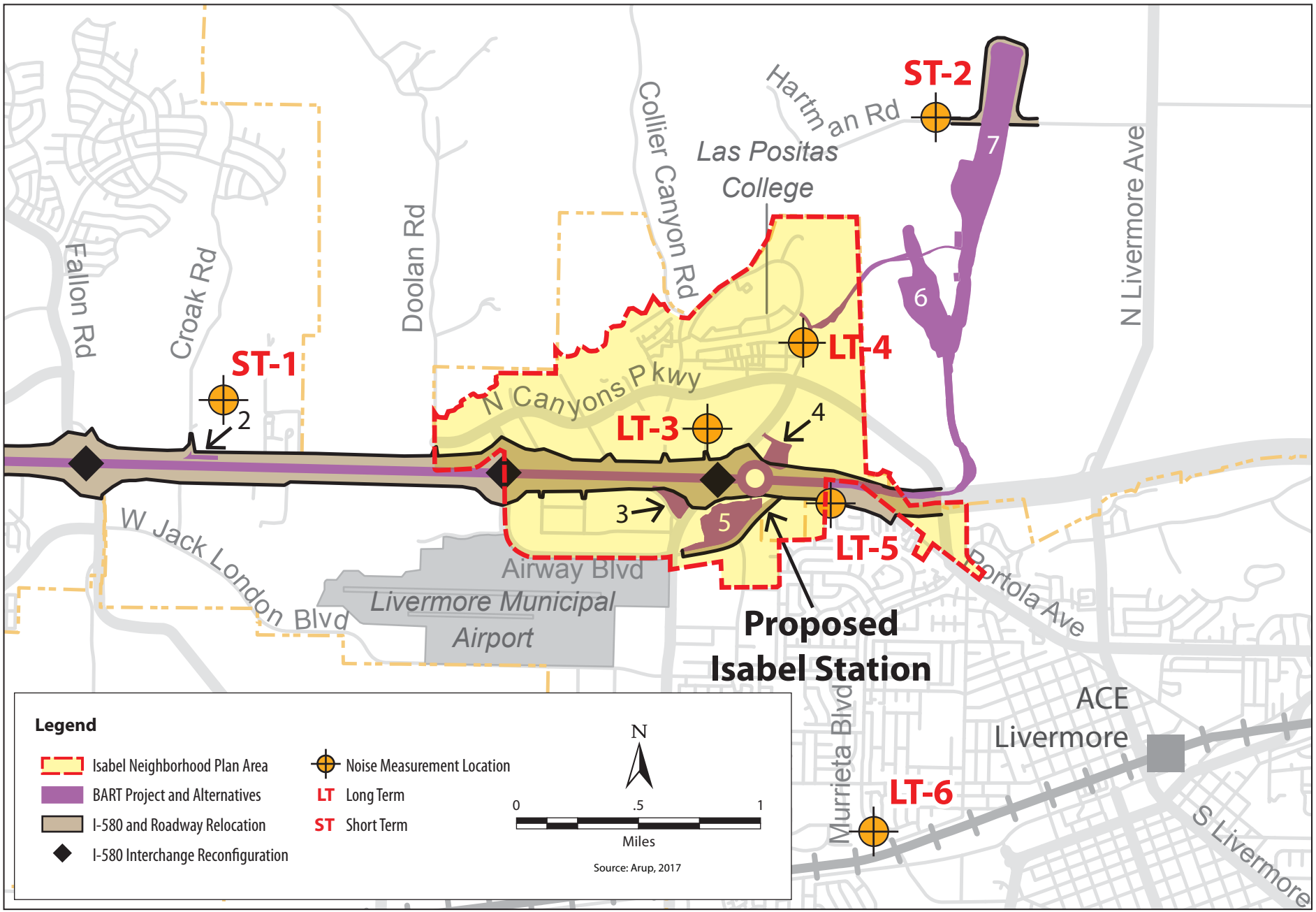

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Figure 3.6-1
Noise Measurement Locations

Table 3.6-3: Relevant Noise Measurement Data from BART to Livermore Extension Draft EIR

Measurement Number (From BART to Livermore Extension EIR)	*Location*	*Date/Time*	*Predominant Noise Source*	*Primary Land Use Category*	*Noise Level (Ldn)*
LT-3	Near terminus of Gateway Avenue and Shea Center Drive, Livermore, CA. Future residential neighborhood as identified in preliminary concept plans for the Isabel Neighborhood Plan.	Wednesday 9/14/2016 (midnight to midnight)	Distance Traffic from I-580	Residential	61
LT-4	Near Campus Drive at Montage Neighborhood, Livermore, CA.	Wednesday 9/14/2016 (midnight to midnight)	Traffic from I-580	Residential	64
LT-5	Near Saddleback Circle and Sutter Street, Livermore, CA. This location is protected from freeway noise by an existing berm and partial sound wall that was captured by the monitor.	Wednesday 9/14/2016 (midnight to midnight)	Traffic from I-580	Residential	66

Source: BART to Livermore Extension Project Draft EIR. San Francisco Bay Area Rapid Transit District, 2017.

Existing Noise Sources

Traffic Noise

The dominant source of noise in the Planning Area and in most urban areas is noise from vehicle traffic on roadways. There are several major roadways in and adjacent to the Planning Area, including I-580, Isabel Avenue, Airway Boulevard, North Canyon Parkway, Portola Avenue, and Collier Canyon Road. However, vehicle traffic on smaller roadways is the dominant source of noise in most areas of the Planning Area. This analysis of impacts resulting from the proposed Plan evaluates traffic noise levels on a detailed basis for a number of roadways in the Planning Area with and without the proposed Plan.

Airport Overflight Noise

The greatest potential for noise intrusion from airports occurs when aircraft land, take off, or run their engines while on the ground. The Livermore Municipal Airport is located adjacent to the project site, with runways approximately 0.25 miles south of the Planning Area. The Livermore Municipal Airport is owned and operated by the City, as a division of the Public Works Department. Noise contours developed in the 2012 Airport Land Use Compatibility Plan (ALUCP) for the airport shows noise contours of 65 dB CNEL associated with the airport extending to the Planning Area (Alameda County Airport Land Use Commission, 2012). Figure 3.6-2 shows the existing airport noise contours in the vicinity of the Planning Area.

Stationary Source Noise

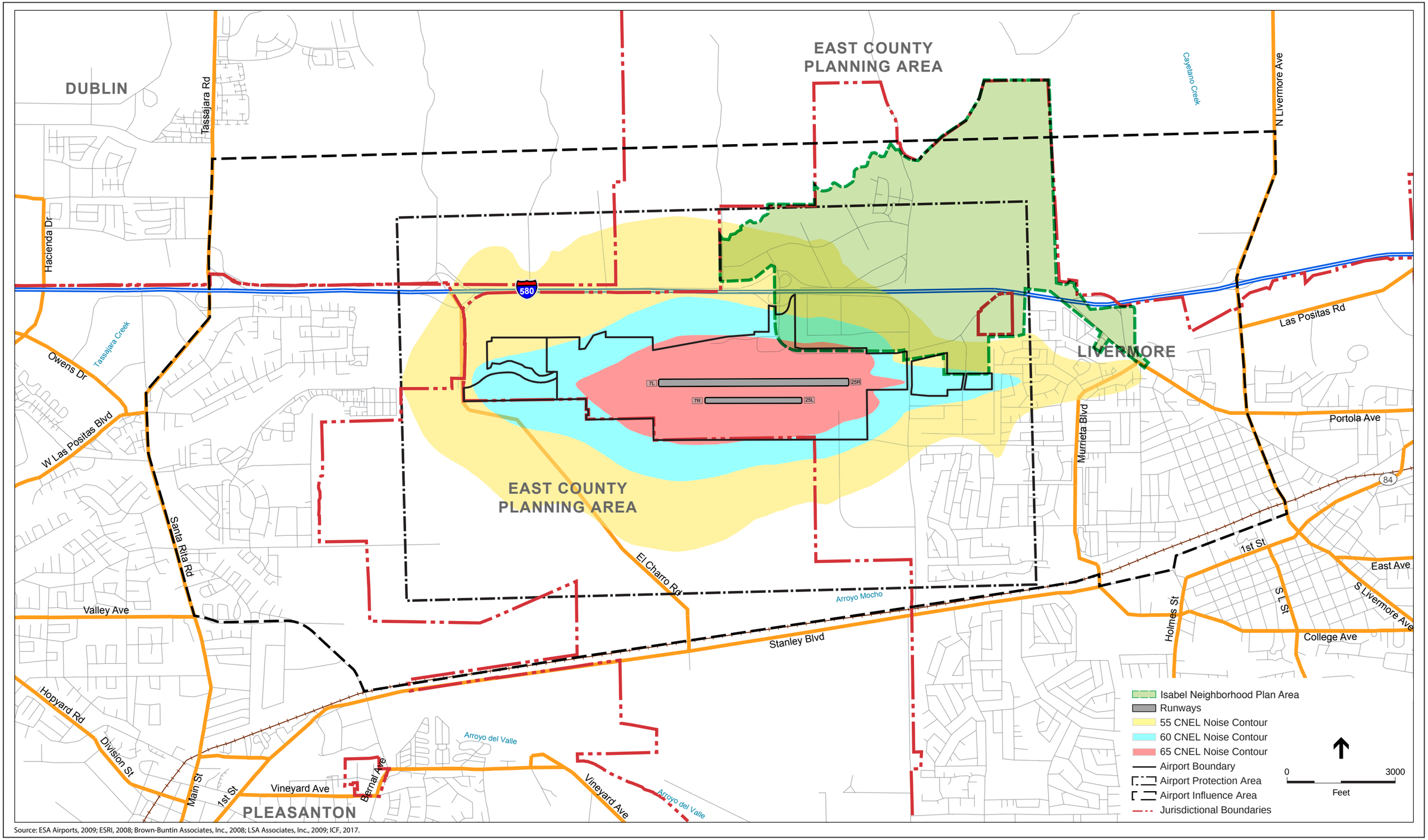
Noise from stationary sources includes noise generated by residential activity and commercial and other non-residential uses. Such noise would be primarily limited to noise generated by heating, ventilation, and air conditioning (HVAC), and other noise at commercial and industrial land uses. Many potential sources of stationary source noise exist in the Planning Area.

Ground Vibration

Characterization and Measurement

While sound is the transmission of energy through the air, groundborne vibration is the transmission of energy through the ground or other solid medium, and is perceived by humans as motion (of the ground, floor, or building). Vibrations can also generate noise by transmitting energy through the air.

Groundborne vibration can be quantified in two main ways. One commonly used descriptor is PPV, or Peak Particle Velocity. As seismic waves travel outward from a vibration source, they cause rock and soil particles to oscillate. The actual distance that these particles move is usually only a few ten-thousandths to a few thousandths of an inch. The rate or velocity (in inches per second) at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the peak particle velocity (PPV). This type of vibration will be discussed in more detail below under Construction Vibration.



Source: ESA Airports, 2009; ESRI, 2008; Brown-Buntin Associates, Inc., 2008; LSA Associates, Inc., 2009; ICF, 2017.

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Figure 3.6-2
Existing Airport Noise Contours

Groundborne vibration can also be quantified by the root-mean-square (RMS) velocity amplitudes, which can be useful for assessing human annoyance. The RMS amplitude is expressed in terms of the velocity level in decibel units (VdB). The background vibration velocity level in residential areas is usually around 50 VdB or lower. The vibration velocity level threshold of perception for humans is approximately 65 VdB. Most perceptible indoor vibration is caused by sources within buildings, such as the operation of mechanical equipment, movement of people, or the slamming of doors. Typical outdoor sources of perceptible groundborne vibration are heavy construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible.

Table 3.6-4 summarizes the typical groundborne vibration velocity levels and average human response to vibration that may be anticipated when a person is at rest in quiet surroundings. If the person is engaged in any type of physical activity, vibration tolerance increases considerably. The duration of the event has an effect on human response, as does its daily frequency of occurrence. Generally, as the duration and frequency of occurrence increase, the potential for adverse human response increases.

Table 3.6-4: Typical Levels of Groundborne Vibration

Human or Structural Response	*Vibration Velocity Level (VdB)*	*Typical Sources (50 feet from source)*
Threshold for minor cosmetic damage to fragile buildings	—100—	Blasting from construction project
		Bulldozer or heavy-tracked construction equipment
Difficulty in reading computer screen	—90—	
		Upper range of commuter rail
Threshold for residential annoyance for occasional events (e.g., commuter rail)	—80—	Upper range of rapid transit
Threshold for residential annoyance for frequent events (e.g., rapid transit)		Typical commuter rail Bus or truck over bump
	—70—	Typical rapid transit
Approximate threshold for human perception of vibration; limit for vibration-sensitive equipment		Typical bus or truck on public road
	—60—	
		Typical background vibration
	—50—	

Source: Federal Transit Administration, 2006.

Groundborne noise is a secondary component of groundborne vibration. When a building structure vibrates, noise is radiated into the interior of the building. Typically, this is a low-frequency sound that can be perceived as a low rumble. The magnitude of the sound depends on the frequency characteristic of the vibration and the manner in which the room surfaces in the building radiate sound. Groundborne noise is quantified by the A-weighted sound level inside the building. The sound level accompanying vibration is generally 25 to 40 dBA lower than the vibration velocity level in VdB. Groundborne vibration levels of 65 VdB can result in groundborne noise levels of up to 40 dBA, which can disturb sleep. Groundborne vibration levels of 85 VdB can result in groundborne noise levels of up to 60 dBA, which can be annoying to daytime noise-sensitive land uses such as schools (Federal Transit Administration, 2006).

Construction Vibration

As described above, vibration resulting from the operation of heavy construction equipment is often reported in PPV, which is the rate or velocity, in inches per second, at which rock and soil particles oscillate as seismic waves travel outward from a vibration source.

The operation of heavy construction equipment, particularly pile driving equipment and other impact devices (e.g., pavement breakers), creates seismic waves that radiate along the surface of and downward into the ground. These surface waves can be felt as ground vibration. Vibration from operation of this equipment can result in effects ranging from annoyance of people to damage of structures. Variations in geology and distance result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes decrease with increasing distance.

Perceptible groundborne vibration is generally limited to areas within a few hundred feet of construction activities. Vibration amplitude attenuates over distance and is a complex function of how energy is imparted into the ground and the soil or rock conditions through which the vibration is traveling. The following equation is used to estimate the vibration level at a given distance for typical soil conditions (Federal Transit Administration, 2006). PPVref is the reference PPV at 25 feet (Table 3.6-5).

$$PPV = PPV_{ref} \times (25/Distance)^{1.5}$$

Table 3.6-5 summarizes typical vibration levels generated by construction equipment (Federal Transit Administration, 2006) at the reference distance of 25 feet and other distances as determined using the attenuation equation above.

Tables 3.6-6 and 3.6-7 summarize guidelines developed by the California Department of Transportation (Caltrans) for damage and annoyance potential from transient and continuous vibration that is usually associated with construction activity. Equipment or activities typical of continuous vibration include: excavation equipment, static compaction equipment, tracked vehicles, traffic on a highway, vibratory pile drivers, pile-extraction equipment, and vibratory compaction equipment. Equipment or activities typical of single-impact (transient) or low-rate repeated impact vibration include: impact pile drivers, blasting, drop balls, "pogo stick" compactors, and crack-and-seat equipment (California Department of Transportation, 2013b).

Table 3.6-5: Vibration Source Levels for Construction Equipment

Equipment	*PPV at 25 Feet*	*PPV at 50 Feet*	*PPV at 75 Feet*	*PPV at 100 Feet*	*PPV at 175 Feet*
Pile driver (impact)[a]	0.65	0.230	0.125	0.081	0.035
Pile driver (sonic/vibratory)[a]	0.65	0.230	0.125	0.081	0.035
Hoe ram or large bulldozer	0.089	0.0315	0.0171	0.0111	0.0048
Large bulldozer	0.089	0.0315	0.0171	0.0111	0.0048
Loaded trucks	0.076	0.0269	0.0146	0.0095	0.0041
Jackhammer	0.035	0.0124	0.0067	0.0044	0.0019
Small bulldozer	0.003	0.0011	0.0006	0.0004	0.0002

Note:

a. The Caltrans Transportation and Construction Vibration Guidance Manual (Caltrans 2013b) is used as the source for vibration from a vibratory pile driver, in order to ensure consistency with the BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017).

Source: Federal Transit Administration, 2006.

Table 3.6-6: Vibration Damage Potential Threshold Criteria Guidelines

	Maximum PPV (inches/second)	
Structure and Condition	*Transient Sources*	*Continuous/Frequent Intermittent Sources*
Extremely fragile historic buildings, ruins, ancient monuments	0.1	0.1
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.3
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Notes:

Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

PPV = peak particle velocity.

Source: California Department of Transportation 2013b.

Table 3.6-7: Vibration Annoyance Potential Criteria Guidelines

	Maximum PPV (inches/second)	
Human Response	*Transient Sources*	*Continuous/Frequent Intermittent Sources*
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Notes:

Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

PPV = peak particle velocity.

Source: California Department of Transportation 2013b.

Train Vibration

The Federal Transit Administration (FTA)'s Transit Noise and Vibration Impact Assessment is specifically developed for determining significant noise and vibration impacts for mass transit projects involving rail or bus facilities, and includes vibration impact criteria,

Table 3.6-8 summarizes the criteria developed by the FTA for assessing groundborne vibration from train passages. The criteria vary, depending on the frequency of events. Similar to the noise criteria, the criteria presented in Table 3.6-8 are based on type of land use. Category 1 land uses include hospitals and manufacturing facilities that have vibration-sensitive equipment. All types of residential land uses are considered Category 2. Category 3 land uses are institutional, with facilities used primarily during the day, such as schools and churches.

Table 3.6-8: Groundborne Vibration Impact Criteria

	Groundborne Vibration Impact Level (VdB)		
Land Use Category	*Frequent Events*[a]	*Occasional Events*[b]	*Infrequent Events*[c]
Category 1: Buildings where vibration would interfere with interior operations (research facilities, hospitals with vibration sensitive equipment)	65[d]	65[d]	65[d]
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime uses (schools, churches)	75	78	83

Notes:

a. *Frequent Events* is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.

b. *Occasional Events* is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this number of operations.

c. *Infrequent Events* is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.

d. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research may require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating, ventilation, and air-conditioning systems and stiffened floors.

N/A = not applicable

Source: California Department of Transportation 2013b.

REGULATORY SETTING

Federal, state, and local agencies regulate different aspects of environmental noise. Generally, the federal government sets noise standards for transportation-related noise sources that are closely linked to interstate commerce. These sources include aircraft, locomotives, and trucks. No federal noise standards are directly applicable to the Proposed Specific Plan because the City is not receiving federal aid for implementation of the proposed Plan. The State government sets noise standards for transportation noise sources such as automobiles, light trucks, and motorcycles. Noise sources associated with industrial, commercial, and construction activities are generally subject to local control through performance standards in municipal codes or noise ordinances and General Plan policies. Local general plans identify general principles that are intended to guide and influence development plans. State law mandates the inclusion of several key elements in a general plan including the noise element. The noise element of the general plan typically provides land use compatibility standards for noise. The State and local noise policies and regulations that are applicable to the General Plan update are described below.

State Regulations

California Noise Insulation Standards, California Code of Regulations, Title 24

Part 2, Title 24 of the California Code of Regulations "California Noise Insulation Standards" establishes minimum noise insulation standards to protect persons within new hotels, motels, dormitories, long-term care facilities, apartment houses, and dwellings other than single-family residences. Under this regulation, interior noise levels attributable to exterior noise sources cannot exceed 45 Ldn in any habitable room.

General Plan Consistency with Airport Land Use Compatibility Plans

Public Utilities Code 21675 requires each airport land use commission to formulate an airport land use compatibility plan. California Government Code 65302.3 further requires that general plans be consistent with airport land use compatibility plans. In addition, general plans and applicable specific plans must be amended to reflect amendments to the airport land use compatibility plan.

Local Regulations

Implementation of the proposed Plan may affect noise-sensitive uses in Livermore. The following local policies related to noise may apply to implementation of the proposed Plan.

City of Livermore General Plan Noise Element

The Noise Element of the City of Livermore's General Plan establishes goals and polices for ensuring that existing and proposed land uses are compatible with their noise environments. In the General Plan, the City has established compatibility guidelines for exterior noise for different categories of land uses, as shown in Table 3.6-9 (presented in dBA CNEL or Ldn).

In addition, the City's General Plan Noise Element includes objectives and policies that call for the adoption of design standards and noise attenuation programs to prevent or reduce noise to acceptable levels. The element states that new noise-sensitive developments, such as schools, residences, and hospitals, proposed in high noise level areas undergo acoustical testing to ensure noise levels are acceptable. The General Plan seeks to reduce impacts from ground-borne vibrations from rails operations by setting a minimum distance between the centerline of tracks and the location of habitable buildings, as well as interior noise level limits. Noise mitigation strategies are also outlined for construction practices and temporary uses, such as fairs or exhibits. For construction, the Noise Element outlines decibel levels and time periods where noise is either allowed to exceed standards temporarily or are further restricted.

The Noise Element of the General Plan also addresses noise from traffic, the largest continual noise source in the city. Policies to address traffic noise include ones to support federal and State legislation to attain lower operating noise levels on motor vehicles, restrictions on heavy truck traffic through residential neighborhoods, and proper design of street circulation, coordination of routing, and other traffic control measures. For specific information on noise restrictions regarding construction activities and heavy machinery, see General Plan Noise Element Objective N-1.5.

Table 3.6-9: City of Livermore General Plan Land Use Compatibility Guidelines for Exterior Noise

	Common Noise Exposure (dBA CNEL or Ldn)			
Land Use Category	*Normally Acceptable*[a]	*Conditionally Acceptable*[a]	*Normally Unacceptable*[a]	*Clearly Unacceptable*[a]
Residential – Low Density, Single Family, Duplex, Mobile Homes	≤60	55-70	70-75	>75
Residential – Multi. Family	≤65	60-70	70-75	>75
Transient lodging – Motels, Hotels	≤65	60-70	70-80	>80
Schools, Libraries, Churches, Hospitals, Nursing Homes	≤70	60-70	70-80	>80
Auditoriums, Concert Halls, Amphitheaters	–	<70	-	>65
Sports Arena, Outdoor Spectator Sports	–	<75	-	>70
Playgrounds, Neighborhood Parks	≤70	–	70-75	>75
Golf Courses, Riding Stables, Water Recreation, Cemeteries	≤75	–	70-80	>80
Office Buildings, Businesses, Commercial and Professional	≤70	70-75	75+	–
Industrial, Manufacturing, Utilities, Agriculture	≤75	70-80	75+	–

Notes:

Where dBA levels overlap between these categories, determination of noise level acceptability will be made on a project-by-project basis.

a. Normally Acceptable: If the noise level is within the "normally acceptable" level, noise exposure would be acceptable for the intended land use. Development may occur without requiring an evaluation of the noise environment unless the use could generate noise impacts on adjacent uses.

b. Conditionally Acceptable: If the noise level is within the "conditionally acceptable" level, noise exposure would be conditionally acceptable; a specified land use may be permitted only after detailed analysis of the noise environment and the project characteristics to determine whether noise insulation or protection features are required. Such noise insulation features may include measures to protect noise-sensitive outdoor activity areas (e.g., at residences, schools, or parks) or may include building sound insulation treatments such as sound-rated windows to protect interior spaces in sensitive receptors.

c. Normally Unacceptable: If the noise level is within the "normally unacceptable" level, analysis and mitigation are required. Development should generally not be undertaken unless adequate noise mitigation options have been analyzed and appropriate mitigations incorporated into the project to reduce the exposure of people to unacceptable noise levels.

d. Clearly Unacceptable: If the noise level is within the "clearly unacceptable" level, new construction or development should not be undertaken unless all feasible noise mitigation options have been analyzed and appropriate mitigations incorporated into the

Source: City of Livermore, 2013.

City of Livermore Municipal Code

Chapter 9.36 of the City's Municipal Code contains the City's Noise Ordinance, which provides descriptions of activities that would constitute a noise disturbance and noise limitations. The City's Municipal Code regulations below would be applicable to the proposed Plan.

9.36.040 Blowers, fans and combustion engines

The operation of any noise-creating blower, power fan or internal combustion engine, the operation of which causes noise due to the explosion of operating gases or fluids, is prohibited, unless the noise from such blower or fan is muffled and such engine is equipped with a muffler device to deaden such noise in such a manner so as not to be plainly audible at a distance of either 75 feet from the source of the noise, or between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on City-observed holidays.

9.36.050 Exhausts from engines, boats or vehicles

The discharge into the open air of the exhaust of any steam engine, stationary internal-combustion engine, motorboat or motor vehicle, except through a muffler or other device which will effectively prevent loud or explosive noises therefrom in such a manner so as not to be plainly audible at the distance of either 75 feet from the source of the noise, or the property line, whichever is greater, is prohibited.

9.36.080 Hammers, pile drivers, pneumatic tools and similar equipment.

The operation between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on City-observed holidays of any pile driver, pneumatic tools, derrick, electric hoist, sandblaster or other equipment used in construction, demolition or other repair work, the use of which is attended by loud or unusual noise, is prohibited.

9.36.110 Exceptions

A. The city engineer and/or building official shall have the authority to authorize construction activities during the hours restricted by this chapter for the following reasons:

1. A public agency, other than the city, requires as a condition of a permit that the construction be done during the restricted hours.

2. Public health, safety or welfare requires the work to be done during the restricted hours.

3. Specific construction activities (such as large concrete foundation pours) can be identified and approved to occur as an exemption to this ordinance in the conditions of approval for a project at the time of the public hearing.

B. If the city engineer and/or building official approves the exception or it is an exception allowed by the conditions of approval for the project, the following shall be done by the contractor or city staff:

1. Notify the Livermore police department, watch commander, at least 24 hours in advance.
2. Notify residents and business owners that are adjacent to the work area at least 24 hours in advance. The limits of this notification shall be determined by the city engineer and/or building official

Impact Analysis

SIGNIFICANCE CRITERIA

Implementation of the proposed Plan would have a potentially significant adverse impact if it would:

Criterion 1: Expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies.

Criterion 2: Expose persons to or generate excessive groundborne vibration or groundborne noise levels.

Criterion 3: Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 4: Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Criterion 5: Be located within an airport land use plan area, or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport and expose people residing or working in the project area to excessive noise levels.

Criterion 6: Be located in the vicinity of a private airstrip and expose people residing or working in the project area to excessive noise levels.

METHODOLOGY AND ASSUMPTIONS

Construction Noise

Because the proposed Plan is being evaluated in this EIR at a program level, noise levels associated with construction activities were evaluated qualitatively using general construction noise levels provided by the U.S. Environmental Protection Agency (EPA) for different site categories (e.g., housing, office buildings) and construction phases (e.g., ground clearing, excavation). These general construction noise levels were assumed to be representative of the noise that could occur from the construction of reasonably foreseeable development under the proposed Plan, because the noise levels were developed by the EPA to be broadly applicable to construction activities. As such, using

the estimates of noise levels for general construction activity from the EPA provides a reasonable estimate of impacts associated with future development under the proposed Plan.

Traffic Noise

Multi-day noise level measurements were taken for the Draft BART to Livermore Extension Project EIR in the vicinity of the Planning Area. Specifically, as noted above, long-term measurements LT-3, LT-4, and LT-5 from the Draft BART to Livermore Extension Project EIR are located within the Planning Area. These measurements help document existing ambient noise levels in the Planning Area, which are dominated by traffic noise.

Peak hour A.M. and P.M. traffic volumes for key intersections within and adjacent to the Planning Area, along with other traffic data used to assess noise impacts, were provided by Kittelson & Associates, Inc. as part of the traffic analysis for the proposed Plan. Three project conditions (existing, Year 2040 without-project, and Year 2040 with-project) were modeled to analyze potential traffic noise impacts associated with buildout of the proposed Plan. The Year 2040 with-project scenario represents Year 2040 with the development of the INP as well as the BART to Livermore extension. The Year 2040 without-project scenario represents Year 2040 without the development of the INP or the BART to Livermore extension.

Note that for the purposes of this analysis the Year 2040 without-project scenario is considered the baseline that is compared to with-project noise levels, as opposed to existing conditions. Using the Year 2040 without-project as the baseline would result in a more reasonable assessment of potential impacts resulting from plan implementation. The Year 2040 without-project scenario includes the buildout of the General Plan as currently planned, and the Year 2040 with-project scenario includes buildout of the proposed Plan in place of the General Plan in the Planning Area.

For the purposes of this analysis, average daily traffic (ADT) was estimated for each segment by taking the combined peak-hour segment volumes (A.M. + P.M.) and multiplying that total by five.[1] These segment ADT volumes were then used to calculate the Ldn levels associated with traffic along each roadway segment. ADT values for I-580 near the Planning Area were used to model traffic noise associated with vehicles on the freeway.

The ADT volumes for each roadway segment were then used along with the FHWA Traffic Noise Model (TNM) Version 2.5 to calculate Ldn at a distance of 50 feet from the roadway centerlines for local roadways, and 150 feet from the roadway centerline for freeway segments. Other inputs to the FHWA model included vehicle travel speeds and the percentages of medium- and heavy-duty truck traffic on each roadway. Travel speeds not available as part of the traffic analysis were obtained from Google Earth imagery, or estimated based on adjacent roadways in the vicinity.

[1] This methodology was decided upon in consultation with the traffic Engineer (Kittelson), and is a commonly used method of estimating ADT from peak-hour traffic volumes.

In general, traffic noise increases of 3 dBA are barely perceptible to people. Thus, the following thresholds are applied to determine the significance of project-related traffic noise increases:

1. In places where the Year 2040 with-project noise level is greater than the Normally Acceptable noise level according to the City of Livermore Land Use Compatibility Guidelines for Exterior Noise (Table 3.6-9), any noise increase relative to the 2040 without-project baseline greater than 3 dBA is considered a significant traffic noise increase; and
2. Along all roadway segments adjacent to the Planning Area that would be considered noise-sensitive, any Year 2040 with-project noise level that is greater than the Normally Acceptable noise level according to the City of Livermore Land Use Compatibility Guidelines for Exterior Noise would be considered potentially significant.

A 3-dB increase over baseline (Year 2040 without-project) noise levels where the without-project or with-project noise environment is greater than "normally acceptable" would be considered a substantial permanent increase in the ambient noise levels (even though it would be expected to be "barely perceptible"). This is because an increase of 3 dB would add to a noise level that already exceeds satisfactory standards for the applicable land use per the Land Use Compatibility Guidelines.

BART Train Noise and Vibration

Noise associated with BART train noise and vibration will be evaluated based on information in the BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017). FTA impact criteria were used to analyze BART train noise and vibration in the EIR.

Stationary Source Noise

As noted above, this analysis is evaluating impacts associated with the proposed Plan at the program level. Accordingly, specific details on future mechanical equipment or HVAC equipment and layout are unknown at this time. Therefore, stationary source impacts are discussed on a qualitative basis.

Construction Vibration

Vibration from construction equipment was evaluated using methods recommended by Caltrans (California Department of Transportation, 2013b) and the Federal Transit Administration (Federal Transit Administration, 2006) using the source levels and criteria shown in Tables 3.6-5 through 3.6-7. Table 3.6-4 specifies the typical human responses in the presence of transient and continuous sources of vibration. As vibration that is clearly felt in a residential or other land use that may be sensitive to vibration would likely be unwanted and considered an annoyance, this analysis assumes that any vibration from construction activity that is distinctly perceptible (0.04 PPV in/sec for continuous/frequent intermittent sources) or stronger, based on Table 3.6-7, would be considered a significant impact.

Aircraft Noise

To assess noise associated with aircraft in the Planning Area, noise contours from the Livermore Municipal Airport Land Use Compatibility Plan (Alameda County, 2012) were used to identify

aircraft noise exposure in the vicinity of the Planning Area. This airport is located adjacent to the southern border of the Planning Area. Additionally, the nearest private airstrip (Meadowlark Field Airport) was identified, and potential noise from aircraft at this airstrip was also considered.

IMPACTS AND MITIGATION MEASURES

Impact 3.6-1 Implementation of the proposed Plan could expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies. (Construction, *Less than Significant;* Operation*, Significant and Unavoidable*)

Construction Noise

Implementation of the proposed Plan would provide a framework for future development to occur in the Planning Area, and future development would result in noise-generating construction activities. Because specific details with respect to future projects that would be implemented under the proposed Plan are not currently available, and because it is assumed that a variety of future projects may be developed under the proposed Plan, noise levels associated with construction activities are evaluated qualitatively using general construction noise levels. Table 3.6-10 summarizes typical noise levels produced during key construction phases for various types of projects (U.S. Environmental Protection Agency, 1971).

Table 3.6-10: Noise Levels of Key Construction Phases by Construction Type

	Sound Level at 50 Feet (dBA)			
Construction Phase	*Housing*	*Industrial*	*Public Works*	*Non-Residential*
Ground clearing	85	87	88	91
Excavation	89	90	90	87
Foundations	82	89	92	87
Building/facility construction	81	85	88	88
Finishing and clean-up	86	89	90	87

Source: Based on U.S. Environmental Protection Agency 1971.

Construction activities associated with future projects would be temporary and related construction noise impacts would be short-term. Each individual construction activity would have the potential to generate noise levels that could be in excess of applicable local thresholds, or that could cause a disturbance to nearby noise-sensitive receptors. As shown in Table 3.6-10, at 50 feet from the source, the noise levels for all project types and phases would be above 80 dBA.

The severity of construction-related noise impacts depends on the proximity of construction activities to sensitive receptors, the presence of intervening barriers, the number and types of equipment used, and the duration of the activity. While these factors cannot be considered in detail for future projects under the proposed Plan, it is assumed that individual projects would be implemented in compliance with City standards. The City noise ordinance allows construction during "daytime hours," and prohibits construction between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday (with no construction allowed on City-observed holidays). Future development

under the proposed Plan would be required to comply with these restrictions; if a project requests to deviate, the project proponent would need to obtain permission to do so from the city engineer per Municipal Code Section 9.36.110, Exceptions. The City engineer and/or building official has the authority to authorize construction activities during the restricted hours on a case-by-case basis. Construction that complies with the time-of-day restrictions for construction activities would result in less than significant noise impacts with regard to the generation of noise in excess of thresholds. If a project receives authorization to deviate from the allowable hours for construction, then it would still be in compliance with the City Noise Ordinance. Therefore, as all future development projects would either comply with the hourly restrictions for construction activities, or receive approval from the City to deviate from these limitations, this impact would be less than significant.

Mitigation Measures

None required.

Operational Traffic Noise

Future development associated with the proposed Plan would result in an increase in traffic in and adjacent to the Planning Area, development of new roads, and placement of new sensitive receptors within the Planning Area. According to the General Plan Noise Element, a noise level of up to 60 dBA Ldn is considered normally acceptable for low density, single-family, duplex, and mobile homes, and a noise level of 65 dBA Ldn is considered normally acceptable for multi-family residences and transient lodging such as motels and hotels. Noise levels of up to 70 dBA Ldn are considered normally acceptable at schools, libraries, churches, hospitals, playgrounds and parks, office buildings, commercial uses and businesses.

For most residential receptors located adjacent to a roadway, the 60 dBA Ldn noise standard—which applies to low density, single family, duplex, and mobile home residential land uses—from the City Noise Element would apply. Standard building construction can typically provide an exterior-to-interior noise reduction of up to 20 dB. Note that a noise reduction in the range of 25 to 35 dB is achievable with upgraded acoustical treatments and that the Noise Element allows noise levels at residential land uses to be up to 70 dBA Ldn if all needed noise insulation features are included in the design of the building. However, this analysis uses the 60 dBA Ldn allowable noise level of the City Noise Element as the basis for the analysis (where up to a 3-dB increase is allowed for roadways segments with resultant noise levels above this noise level).

An initial analysis was conducted using a reference distance of 50 feet from each roadway segment centerline for local roadways, and 150 feet from the roadway centerline for the I-580 freeway segments in the project vicinity. Refer to Appendix C for these modeling results.

Traffic Noise Impacts to Existing Sensitive Land Uses

Traffic noise impacts along roadways and at intersections with adjacent existing sensitive receptors were analyzed using threshold (1). Under this threshold, a traffic noise impact is considered to be significant where the Year 2040 with-project noise environment is greater than the "Normally Acceptable" noise level and the Plan-related traffic noise increase relative to the 2040 without-project baseline is greater than 3 dB.

Modeling demonstrated that noise levels along three segments would increase by 3 dB or more in areas where with-project noise levels would exceed 60 dBA Ldn, or the applicable land use compatibility guideline.

Table 3.6-11 presents Year 2040 without-project and Year 2040 with-project noise levels for segments where a potentially significant traffic noise impact would occur due to an increase of 3 dB or more from without-project conditions in areas where Year 2040 with-project noise levels are in excess of the applicable land use compatibility guidelines. The 60 dBA Ldn compatibility guideline was applied in all cases, as all residences in these areas would fit into the "low density, single family, duplex, and mobile home residential land use" category. Modeling results for all segments are included in Appendix C.

As shown in Table 3.6-11 three existing roadway segments would experience a 3 dB or more increase in areas where baseline without-project or resulting baseline with-project noise levels are in excess of the applicable land use compatibility guidelines (60 dBA Ldn in all cases). Potential impacts for the three roadway segments are described in detail below.

Portola Avenue West of Sandalwood Drive

Along the segment of Portola Avenue West of Sandalwood Drive (between Sandalwood Drive and Isabel Avenue), where new attached townhomes are currently being constructed, Year 2040 without-project noise levels would be 63.9 dBA Ldn, and Year 2040 with-project noise levels would be 67.2 dBA Ldn under the proposed Plan (both of which are in excess of the compatibility guideline. As future noise levels would be in excess of the 60 dBA Ldn, compatibility guidelines for single-family or duplex/townhome-style residences, the project-related traffic noise increase of 3.3 dB along Portola Avenue West of Sandalwood Drive would result in a potentially significant impact.

East Airway Boulevard east of Sutter Street and west of Via Mateo

Under the proposed Plan, noise levels along the segment of East Airway Boulevard east of Sutter Street and west of Via Mateo (the entrance to Sun Valley Mobile Estates) would be 61.0 dBA Ldn under Year 2040 without-project conditions whereas Year 2040 with-project noise levels would be 66.0 dBA Ldn (both of which are in excess of the compatibility guideline). Although residences located along some of East Airway Boulevard near Sutter Street would be exposed to noise from I-580, which could overshadow noise from traffic on the local roadway, the existing freeway sound wall located on the south side of the I-580 along East Airway would substantially reduce highway noise. As such, freeway noise would not be expected to overshadow noise from East Airway Boulevard along this segment. As future noise levels would be in excess of the 60-dBA Ldn compatibility guideline along this segment, the project-related traffic noise increase of 4.9 dB would result in a potentially significant impact.

The single-family homes near the intersection of Sutter Street and East Airway Boulevard, however, are located between 200 and 300 feet away from the centerline, which is much further than the modeled standard distance of 50 feet from the roadway centerline. At a distance of 200 feet, the noise level would be reduced from 66 dB Ldn to 60 dB Ldn, not accounting for shielding that is provided by the existing berm (south of E. Airway Boulevard) that blocks the line of sight from East Airway Boulevard to these single-family homes. The berm would further reduce the noise level by approximately 5 dB under both Year 2040 without-project and Year 2040 with-project conditions.

With the reduction in noise from the berm, noise levels under both with-project and without-project conditions would be less than 60 Ldn. Impacts to the single-family homes located along East Airway Boulevard east of Sutter Street would therefore be less than significant.

The mobile homes located east of this single-family development, however, do not have a berm or soundwall blocking the line of sight between the homes and East Airway Boulevard. These mobile homes are also located much closer to East Airway Boulevard than the single-family development described above (located as close as 75 feet from the centerline of the roadway). At a distance of 75 feet from the roadway centerline, Year 2040 without-project noise levels would be approximately 60 Ldn and with-project noise levels would be approximately 64.5 Ldn. Although these noise levels are reduced from the original modeling at a distance of 50 feet, with-project noise levels are in excess of the compatibility standard and implementation of the plan would be result in an approximate 4-dB increase in noise. The BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017) includes a mitigation measure that proposes a soundwall in this general area; however, it cannot be assumed that this wall will be built and/or would reduce the potential noise impacts discussed in this analysis.

As the project-related traffic noise increase in this area would be in excess of 3 dB and as noise levels under with-project scenarios would be in excess of 60 Ldn, traffic noise impacts at these mobile homes located along the segment of East Airway Boulevard east of Sutter Street would be potentially significant.

East Airway Boulevard east of Via Mateo and West/N of Portola Avenue

The segment of East Airway Boulevard west/north of Portola Avenue and east of Via Mateo (the entrance to Sun Valley Mobile Estates) would experience noise levels of 61.7 dBA Ldn under Year 2040 without-project conditions. Noise levels under Year 2040 with-project noise levels would be 66.3 dBA Ldn. Therefore, the project-related traffic noise increase along this segment would be 4.6 dB. The BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017) includes a mitigation measure that proposes a soundwall in this general area; however, it cannot be assumed that this wall will be built and/or would reduce the potential noise impacts discussed in this analysis.

Although the centerline of I-580 is located approximately 130 feet from the centerline of East Airway Boulevard along the western portion of the segment, East Airway Boulevard veers south, away from I-580, along the eastern portion of this segment. Near the intersection of East Airway Boulevard and Portola Avenue, this segment is located over 1,100 feet from the centerline of I-580. Noise from I-580 drops off at a rate of 3 dB per doubling of distance as the roadway veers away from the freeway. Therefore, freeway noise may not overshadow the noise from the local roadway (East Airway Boulevard) in this area. In addition, the existing freeway noise barrier would reduce freeway noise in the area substantially, so freeway noise would be less likely to overshadow noise from the local roadway.

Because Year 2040 noise levels from East Airway Boulevard would be in excess of the 60-dBA Ldn compatibility guideline in this area, the Plan-related traffic noise increase of 4.6 dB that would occur along the segment of East Airway Boulevard west/north of Portola Avenue under the proposed Plan would result in a potentially significant impact.

Table 3.6-11: Roadway Segments with Project-related Traffic Noise Level Increases of 3 dB or More

Roadway	*Segment Location*	*Distance (feet)*	*Existing Land Use Category from LU Compatibility Table?*	*Future Land Use Type*	*Existing Land Use Compatibility Guideline (dBA Ldn)*	*Existing dB Ldn*	*Year 2040 Without-Project dB Ldn*	*Year 2040 + Project dB Ldn*	*2040 + Project and 2040 Without-Project Delta (Ldn)*	*Significant direct Project Impact due to 3 dB increase?*
Portola Avenue	West of Sandalwood Drive (between Sandalwood Drive and Isabel Avenue)	50	LD/SFR/ Duplex/MH	LD/SFR/ Duplex/ MH	60	63.9	63.9	67.2	**3.3**	**Yes**
E. Airway Boulevard	East of Sutter Street and west Via Mateo	50	LD/SFR/ Duplex/MH	LD/SFR/ Duplex/ MH	60	60.8	61.0	66.0	**4.9**	**Yes**
E. Airway Boulevard	East of Via Mateo and West/N of Portola Avenue	50	LD/SFR /Duplex/MH	LD/SFR /Duplex/ MH	60	61.5	61.7	66.3	**4.6**	**Yes**

Notes:

LD/SFR/Duplex/MH includes "Low Density, Single Family, Duplex, Mobile Homes" (refer to the compatibility guidelines in Table 3.6-9), MFR = Multi-Family Residential, C = Commercial, Business or Office.

In areas where multiple uses are located along a single segment, the most stringent (aka 60 dBA Ldn) standard applies.

Source: ICF, 2018.

Conclusions related to Traffic Noise Impacts at Existing Sensitive Land Uses

As described above, potentially significant traffic noise impacts to existing residences would be expected to occur along three roadway segments under the proposed Plan. Because there are no intervening soundwalls or other features that would reduce the contribution of future projects under the proposed Plan along these segments, Plan-related traffic noise impacts along three roadway segments would be significant.

Implementation of Mitigation Measure NOI-1, described below, could reduce noise levels at impacted receptors along these roadway segments to less than significant levels. However, it may not be feasible in all cases to implement the measures identified in Mitigation Measure NOI-1 (e.g, it may not be possible to build a solid soundwall if there are driveways along the segment). This impact is therefore considered to be significant and unavoidable.

Mitigation Measures

MM NOI-1 Implement Traffic Noise Reduction Measures at Existing Sensitive Receptors.

The City shall implement off-site traffic noise reduction measures along the following three roadway segments such that the Plan-related increase in traffic noise for sensitive receptors is 3 dB or less:

- Portola between of Sandalwood Drive and Isabel Avenue
- East Airway Boulevard east of Sutter Street and west of Via Mateo (around the mobile home development)
- East Airway Boulevard east of Via Mateo and West/N of Portola Avenue (around the mobile home development)

Measures that can be implemented include, but are not limited to:

- Construction of solid barriers between the roadway and adjacent residential uses; and
- Installation of "quiet" pavement, such as open-graded asphalt, along the area of the roadway adjacent to residences.

The City shall prepare a noise control plan for impacted existing land uses that identifies the location, design, and effectiveness of the specific treatments to be implemented.

Traffic Noise Compatibility for Future On-site Sensitive Land Uses

Year 2040 with-project traffic would result in noise levels in excess of the land use compatibility standard in some areas. For the purposes of this analysis, all roadway segments modeled to have Year 2040 with-project noise levels in excess of 60 dBA Ldn (which is the most conservative compatibility standard, and applies to low density, single-family, duplex, and mobile home residential land uses) were analyzed more closely to determine potential land use compatibility conflicts for proposed Plan land uses.

Note that up to 70 dBA Ldn is considered to be "Conditionally Acceptable" for both multi-family and single-family residential uses, with the inclusion of necessary noise insulation or protection features as determined after a detailed analysis of the noise environment and the project character-

istics. These noise insulation features may include measures to protect noise-sensitive outdoor activity areas (e.g., at residences, schools, or parks) or may include building sound insulation treatments such as sound-rated windows to protect interior spaces in sensitive receptors. However, to provide a conservative analysis, the "normally acceptable" noise level of 60 dBA Ldn for low density, single-family, duplex (including townhome-style homes), and mobile home residential uses and 65 dBA Ldn for multi-family residential uses were used.

As described previously, all analyzed roadway segments that were modeled to have Year 2040 with-project noise levels in excess of 60 dBA Ldn were identified as areas with potentially significant effects, and analyzed further. Land use diagrams for the proposed Plan were reviewed, and the proposed future land uses located along each of the potentially affected roadway segments were identified. The actual land use compatibility guidelines, based on the actual land uses in each area, were then identified for each potentially affected segment, and a more detailed analysis was conducted. This more detailed analysis entailed comparing Year 2040 with-project noise levels to the actual/applicable compatibility guideline for the specific land use located along each roadway segment.

According to this analysis, 25 roadway segments within the Planning Area, as identified in Table 3.6-12, are expected to have Year 2040 with-project noise levels in excess of the land use compatibility standard that applies to the proposed adjacent land uses. These segments are identified in Table 3.6-12. Refer to Appendix C for all of the modeling results of the Year 2040 with-project traffic noise analysis.

As shown in Table 3.6-12, many of the planned land uses associated with the proposed Plan may be located in areas that could be considered incompatible with the Year 2040 with-project noise levels in the area based on this analysis.

Table 3.6-12: Roadway Segments with Project-related Traffic Noise Level Increases of 3 dB or More

Roadway	*Segment Location*	*Future Land Use Type*	*Land Use Compatibility Guideline (dBA Ldn) for Future Uses*	*Year 2040 + Project dB Ldn*	*Exceedance of Compatibility Standard?*
North Canyons Parkway	West of Gateway Drive	LD/SFR/Duplex/MH & C	60/70	**67.3**	Yes
North Canyons Parkway	East of Gateway Drive[a]	LD/SFR/Duplex/MH	60	**65.5**	Yes
North Canyons Parkway	West of Collier Canyon Road[a]	LD/SFR/DUPLEX/MH	60	**67.9**	Yes
North Canyons Parkway	East of Collier Canyon Road	LD/SFR/DUPLEX/MH	60	**66.1**	Yes
Portola Avenue	West of Road 1	LD/SFR/DUPLEX/MH & MFR	60/65	**65.9**	Yes
Portola Avenue	East of Road 1 and West of Road 2	LD/SFR/DUPLEX/MH & MFR	60/65	**65.9**	Yes
Portola Avenue	East of Road 2 and West of Main Street	LD/SFR/DUPLEX/MH & MFR	60/65	**66.3**	Yes
Portola Avenue	East of Main Street and West of Montage Drive/Road 3	LD/SFR/DUPLEX/MH & MFR	60/65	**66.3**	Yes
Portola Avenue	East of Montage Drive/Road 3 and West of Road 4	LD/SFR/DUPLEX/MH & MFR	60/65	**66.2**	Yes
Portola Avenue	East of Road 4	MFR	65	**66.2**	Yes
Portola Avenue	West of Tranquility Circle	LD/SFR/DUPLEX/MH	60	**67.9**	Yes

Table 3.6-12: Roadway Segments with Project-related Traffic Noise Level Increases of 3 dB or More

Roadway	*Segment Location*	*Future Land Use Type*	*Land Use Compatibility Guideline (dBA Ldn) for Future Uses*	*Year 2040 + Project dB Ldn*	*Exceedance of Compatibility Standard?*
Portola Avenue	East of Tranquility Circle	LD/SFR/DUPLEX/MH	60	**67.2**	Yes
Portola Avenue	North of E. Airway Blvd	LD/SFR/DUPLEX/MH	60	**67.2**	Yes
Portola Avenue	South of Intersection w E. Airport Blvd	LD/SFR/DUPLEX/MH	60	**68.9**	Yes
Portola Avenue	West of Murrieta	LD/SFR/DUPLEX/MH	60	**68.6**	Yes
Portola Avenue	East of Murrieta	LD/SFR/DUPLEX/MH	60	**69.0**	Yes
E. Airway Boulevard	East of Bart Access and West of Stealth Street	MFR	65	**66.5**	Yes
E. Airway Boulevard	East of Stealth Street	LD/SFR/DUPLEX/MH	60	**65.8**	Yes
E. Airway Boulevard	West/N of Portola Avenue	LD/SFR/DUPLEX/MH	60	**66.3**	Yes
Isabel Avenue	North of Portola Avenue	LD/SFR/DUPLEX/MH	60	**63.6**	Yes
Isabel Avenue	South of Portola Avenue[b]	LD/SFR/DUPLEX/MH	60	**68.3**	Yes
Isabel Avenue	North of INP Road[b]	LD/SFR/DUPLEX/MH	60	**67.1**	Yes
Isabel Avenue	South of INP Road and North of BART Parking Road/Access (North)	MFR	65	**68.2**	Yes

Table 3.6-12: Roadway Segments with Project-related Traffic Noise Level Increases of 3 dB or More

Roadway	*Segment Location*	*Future Land Use Type*	*Land Use Compatibility Guideline (dBA Ldn) for Future Uses*	*Year 2040 + Project dB Ldn*	*Exceedance of Compatibility Standard?*
Isabel Avenue	South of BART Parking Road/Access[c]	C	70	**73.9**	Yes
Isabel Avenue	North of WB ramps[c]	C	70	**74.5**	Yes
Collier Canyon Road	North of N Canyons Pkwy	LD/SFR/DUPLEX/MH	60	**63.3**	Yes
BART Access	South of E. Airway Boulevard	LD/SFR/DUPLEX/MH & MFR	60/65	**60.1**	Yes
I-580	From Isabel Avenue to North Livermore Avenue	LD/SFR/DUPLEX/MH & MFR	60/65/70	**80.9**	Yes

Notes:

LD/SFR/Duplex/MH= Single-Family Residential, which includes "Low Density, Single Family, Duplex, Mobile Homes" (refer to the compatibility guidelines in Table 3.6-9), MFR = Multi-Family Residential, C = Commercial, Business or Office, NA = no currently developed sensitive use located along this segment. In areas where multiple uses are located along a single segment, the most stringent (aka 60 dBA Ldn) standard applies.

a. These two segments represent North Canyons Parkway between Gateway Drive and Collier Canyon Road. Traffic volumes at each end of the roadway segment are different as a result of driveway access between the two intersections that is not specifically addressed in the traffic analysis.

b. These two segments represent Isabel Avenue between Portola Avenue and INP Road. Traffic volumes at each end of the roadway segment are different as a result of driveway access between the two intersections that is not specifically addressed in the traffic analysis.

c. These two segments represent Isabel Avenue between the BART Parking Road/Access Road and the WB I-580 ramps located north of I-580. Traffic volumes at each end of the roadway segment are different as a result of driveway access between the two intersections that is not specifically addressed in the traffic analysis.

Source: ICF, 2018.

City of Livermore General Plan Policy P2 under Objective N-1.2 calls for the adoption of design standards and the identification of effective noise attenuation programs to prevent noise or reduce noise to acceptable levels in areas with noise levels greater than 65 dBA CNEL:

> **General Plan Policy P2.** The City shall require applicants for new noise-sensitive development, such as private schools, residences, and private hospitals, in areas subject to noise levels greater than 65 dBA CNEL to obtain the services of a professional acoustical engineer to provide a technical analysis and to design mitigation measures to attenuate noise to acceptable levels.

However, some proposed Plan land uses are either low density, single family, duplex, or mobile homes (refer to the compatibility guidelines in Table 3.6-9) that are normally compatible with noise levels of 60 dBA Ldn/CNEL or below, lower than the 65dBA CNEL threshold for the General Plan policy requirement of an acoustical analysis. Therefore, compliance with this General Plan policy would not ensure less than significant impacts for all new land uses associated with the proposed Plan. This impact would be considered potentially significant.

Implementation of the proposed Plan policies (described below) would ensure that interior noise levels would be within allowable levels for new uses developed under the Plan, and would ensure that exterior noise levels affecting common open space areas within private developments or recreation facilities would be below 70 dBA CNEL/Ldn.

Policy P-LU-19 described below, would help to reduce exterior noise levels at new land uses under the proposed Plan by requiring that project applicants for future development prepare a detailed acoustical analysis of the noise environment and project characteristics. However, as it may not be possible to reduce exterior noise to compatible levels in all instances, traffic noise impacts to future land uses developed under the proposed Plan would remain significant and unavoidable even with implementation of proposed policies.

Proposed Plan Goals and Policies that Reduce the Impact

Land Use Chapter

P-LU-19: Require that project applicants for future development in areas where noise is predicted to exceed compatibility standards prepare a detailed acoustical analysis of the noise environment and project characteristics. The analysis should determine whether noise insulation or protection features are required to achieve consistency with the applicable exterior and interior noise compatibility standards. The City shall review and approve the acoustical analyses for proposed projects prior to the issuance of building permits or as part of the planning entitlement process. Project applicants shall then be required to implement measures to ensure exterior and interior noise compatibility with the applicable standards, where feasible.

Environmental Resources Chapter

P-ENV-2: All residential building spaces must be improved or constructed in such a manner that noise levels do not exceed a maximum decibel rating of 45 dBA with windows closed. If windows must be closed 100% of the time to achieve this standard, a fresh air ventilation system must be utilized.

P-ENV-3: Require residential and other noise sensitive land uses within the 60 dBA or higher contours for freeway or major street noise to complete a noise analysis to verify that the interior noise standard can be met.

P-ENV-4: Although not anticipated, any noise sensitive land uses within the 60 dBA contour for the airport shall incorporate adequate noise attenuation into the design and site planning of the project in order to achieve an interior noise level of not more than 45 dBA CNEL.

P-ENV-5: Recreational facilities within new public parks and common open space areas on private development sites should be located and designed such that ambient noise levels do not exceed 70 dBA CNEL. This guideline does not apply to multi-use trails or private outdoor spaces within developments (refer to Chapter 2, Land Use, for open space definitions).

Mitigation Measures

No mitigation measures are available to reduce this impact to less than significant levels.

Train Noise from BART

In the BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017), year 2025 and year 2040 noise levels from BART train operations (Ldn) were calculated using the methods and equations contained in the FTA Guidelines. Predicted noise levels using FTA methodology resulted in the same values for BART train noise in 2040 as presented for 2025. According to this analysis, noise from operation of BART trains in the City of Livermore (including BART train operations, the Isabel Station, the Isabel Station bus transfer facility, the Isabel Station parking facility, the storage and maintenance facility, and wayside system facilities) would be below the established FTA standards at all analyzed noise sensitive receptors. Operational noise levels from the BART storage and Maintenance facility were also determined to be less than allowable levels at existing sensitive land uses in the BART to Livermore Extension Project Draft EIR. The proposed Plan would not place any sensitive land uses closer to this facility than currently exist.

With regard to BART train noise, the noise-sensitive receptor analyzed in the BART to Livermore Extension Project EIR that was located the closest to the BART alignment was a residence located 170 feet from the tracks, just south of I-580 between Santa Rita Road and El Charro Road. This modeled receiver location from the BART to Livermore Extension Project Draft EIR was used as a proxy location for the Plan-level analysis of BART train noise in this EIR. At this location, noise from BART activity was predicted to be 54 Ldn with the project, which included 5 dB of reduction due to shielding from an existing sound wall. In the absence of a sound wall, noise would likely be approximately 5 dB higher, or 59 Ldn, at a distance of 170 feet from the tracks. The FTA threshold at this receptor was 61 Ldn according to the BART to Livermore Extension Project Draft EIR. The BART to Livermore Extension Project Draft EIR determined that impacts due to noise from BART operations would be less than significant at this receptor (San Francisco Bay Area Rapid Transit District, 2017).

For the proposed Plan, measured ambient noise levels in the vicinity of the Planning Area (as also presented in the BART EIR) were 61, 64, and 66 Ldn. Refer to Table 3.6-3 for more information

related to these measurements. According to the impact criteria for operational noise presented in Table 3.J-7 of the BART EIR, the following allowable thresholds would apply to areas with these ambient noise levels (refer to Table 3.6-13).

Table 3.6-13: Operational Noise Impact Criteria for Noise-Sensitive Land Uses

Existing Noise Exposure in Leq or Ldn/CNEL	*Bart Noise Impact Exposure Contribution (Leq or Ldn/CNEL, dBA)*		
	No Impact	*Moderate Impact*	*Severe Impact*
66	<62	62-67	>67
64	<61	61-65	>65
61	<59	59-64	>64

Source: FTA 2006; Table 3.J-7 from the BART to Livermore Extension Project Draft EIR (2017).

Based on Table 3.6-13, noise from BART equal to or greater than 59 dBA would have the potential to result in moderate impacts in the quieter portions of the Planning Area (based on noise measurements conducted for the BART EIR). Noise at a distance of 170 feet was determined to be approximately 59 dBA in the BART EIR without accounting for shielding. Because the proposed Plan would not locate any residential land uses closer than approximately 500 to 600 feet from the tracks (noise would be approximately 4.5 to 5.5 dB quieter at these distances), and would locate no land uses closer than over 200 feet from the tracks (noise would be almost 1.5 dB quieter at this distance), noise from BART operations is expected to be below the applicable thresholds for Planning Area land uses. Therefore, noise from BART operations is not expected to result in significant noise impacts to future development associated with the proposed Plan.

Further, and as described under Impact NOI-13(CU) in the Draft BART EIR (which looks at the cumulative impacts of the BART Project), the closest future residential development within the INP to BART tracks associated with the maintenance and storage facility (located 370 feet away) has an existing Ldn of 66 dBA. This would mean an acceptable Ldn contribution from BART trains would be less than 62 dBA. The Ldn contribution from BART trains at this receptor was determined to be 55 dBA in the Draft BART EIR, which would be below the applicable threshold and a would therefore be a less-than-significant impact. Because noise at the nearest residential receptors from BART train operations would be within allowable levels, impacts to proposed Plan noise-sensitive land uses from BART trains would be less than significant.

Mitigation Measures

None required.

Operational Noise from Noise-Generating Stationary Equipment

Development under the proposed Plan would have the potential to result in increased noise levels from new stationary noise sources which could be located near sensitive land uses. The development of new residences close to existing noise-generating land uses could also result in the exposure of residential land uses to noise that exceeds the City's noise standards. Stationary sources of noise could include car washes, recycling yards, industrial or manufacturing facilities, and HVAC equipment.

Because this is a program-level analysis, it is not possible at this time to determine the extent that noise sensitive land uses would be exposed to noise from equipment (as the specifics of equipment associated with future development is not known).

Future development under the proposed Plan, however, would be required to comply with policies included in the City's General Plan that would help reduce noise effects in the Planning Area. For example, Objective N-1.5 from the General Plan pertains to noise generated by mechanical equipment ("reduce the level of noise generated by mechanical and other noise generating equipment by means of public education, regulation, and/or political action"). Policy P1 under this objective states that the City shall require that industrial and commercial uses be designed and operated so as to avoid the generation of noise effects on surrounding sensitive land uses (e.g., residential, churches, schools, hospitals) from exceeding the following noise levels for exterior environments: (a) 55 dBA L50 (7:00 a.m. to 10:00 p.m.) (b) 45 dBA L50 (10:00 p.m. to 7:00 a.m.).

However, even with General Plan Policy P1 under Objective N-1.5, it is possible that stationary sources (such as mechanical equipment) could result in excessive noise at adjacent noise-sensitive land uses. This impact would be potentially significant.

Implementation of Policy P-ENV-7, listed below, would further reduce noise impacts from stationary sources of noise to less-than-significant levels.

Proposed Plan Goals and Policies that Reduce the Impact

Environmental Resources Chapter

P-ENV-7: The following limits shall apply to noise-generating land uses, as measured from the property line:

- In residential areas of the Isabel Neighborhood, exterior noise levels may not exceed 65 dBA from 7:00a.m. to 12:00a.m or 60 dBA from 12:00a.m. to 7:00a.m.
- Along Main Street and in the office, commercial, or business park areas of the Isabel Neighborhood, exterior noise levels may not exceed 75 dBA from 7:00a.m. to 12:00a.m or 65 dBA from 12:00a.m. to 7:00a.m.

Mitigation Measures

None required.

Special Event Operational Noise

The proposed Plan would include the development of parks and plazas which could be used for gatherings or events. The types of potential events that would occur in the Planning Area are not known at this time, so it is not possible to estimate potential noise generated by gatherings in these areas. However, all special events would be required to obtain a special event permit in accordance with the City of Livermore rules. To obtain a permit, event organizers must "be certain that all event activities comply with the local laws applicable to noise abatement" (City of Livermore, 2017a). The general noise compatibility guidelines from the City of Livermore General Plan are shown in Table 3.6-9. As any special event in the City would need to obtain a permit and demonstrate that they would comply with the local applicable noise standards, noise impacts related to special events occurring in the Planning Area would be less than significant.

Mitigation Measures

None required.

Impact 3.6-2 Implementation of the proposed Plan could expose persons to or generate excessive groundborne vibration or ground-borne noise levels. (*Significant and Unavoidable*)

Construction Vibration

Future development under the proposed Plan would result in construction activities that could generate temporary groundborne vibration. Typical vibration levels are shown in Table 3.6-4 (FTA, 2006). Construction activities associated with new development would be temporary and related vibration impacts would be short-term. Construction activity can result in varying degrees of vibration, depending on the type of machinery used.

Heavy duty equipment associated with some construction activities can produce vibration that may be felt by adjacent uses. The main concern associated with this type of vibration is annoyance. In extreme cases, vibration can cause damage to buildings, particularly those that are old or otherwise fragile. Activities such as pile-driving, blasting, and drilling have the highest potential for creating groundborne vibration impacts. The potential construction-related vibration impacts depend on the proximity of construction activities to sensitive receptors, the presence of intervening barriers, the number and types of construction equipment, and duration of construction equipment use. Perceptible groundborne vibration is generally limited to areas within a few hundred feet of construction activities.

It is not known if and where pile driving or other activities that generate high levels of vibration, such as drilling, may occur. However, it is likely that excavation or the use of a large bulldozer, which also generates vibration, would occur for many future development projects.

Future and existing development adjacent to construction sites could be exposed to excessive groundborne vibration temporarily (i.e. vibration that is distinctly perceptible [0.04 PPV in/sec] or stronger, based on Table 3.6-7). Table 3.6-14 shows that a pile driver, a hoe ram or large bull dozer (which generates vibration levels similar to an excavator), and loaded trucks all have the potential to generate vibration levels greater than the distinctly perceptible level of 0.04 PPV in/sec at a distance of 25 feet. At distances greater than 50 feet, only a pile driver (impact or vibratory/sonic) would be expected to generate distinctly perceptible vibration. An impact pile driver could create distinctly perceptible vibration (0.04 PPV in/sec) at distances of up to approximately 300 feet, and a sonic/vibratory pile driver could generate distinctly perceptible vibration at distances of up to 175 feet.

As construction equipment operating within 25 feet of sensitive land uses could generate distinctly perceptible vibration, non-pile driving construction activities occurring within 25 feet of sensitive uses could result in significant vibration impacts. In addition, pile driving occurring within approximately 175 feet or 300 feet of sensitive uses for vibratory/sonic pile drivers and impact pile drivers, respectively, could also result in significant vibration impacts. As the specific future projects to be developed under the INP are not known at this time, and as the level of construction activity that

would occur at various locations for future projects is also not known, it is possible the future construction activities could result in significant vibration impacts.

Table 3.6-14. Vibration Source Levels for Construction Equipment

Equipment	*PPV at 25 Feet*	*PPV at 50 Feet*	*PPV at 75 Feet*	*PPV at 100 Feet*	*PPV at 175 Feet*	*PPV at 300 Feet*
Pile driver (impact)[a]	0.65	0.230	0.125	0.081	0.035	0.016
Pile driver (sonic/vibratory)[a]	0.65	0.230	0.125	0.081	0.035	0.016
Hoe ram	0.089	0.0315	0.0171	0.0111	0.0048	0.002
Large bulldozer	0.089	0.0315	0.0171	0.0111	0.0048	0.002
Loaded trucks	0.076	0.0269	0.0146	0.0095	0.0041	0.002
Jackhammer	0.035	0.0124	0.0067	0.0044	0.0019	0.001
Small bulldozer	0.003	0.0011	0.0006	0.0004	0.0002	0.000

Notes:

a. The Caltrans Transportation and Construction Vibration Guidance Manual (Caltrans 2013b) is used as the source for vibration from a vibratory pile driver, in order to ensure consistency with the BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017)

PPV = peak particle velocity

Source: Federal Transit Administration 2006.

Proposed policy P-ENV-6 below would help reduce construction vibration effects at future and existing sensitive land uses. This policy would require developers constructing new development in the Planning Area to implement measures to reduce vibration. Such measures could include: operating heavy equipment as far as practical from residential uses; using smaller bulldozers (operating weight less than 20,000 pounds) when grading must occur within approximately 50 feet of residential uses or other vibration sensitive uses; and using quiet pile driving technology when feasible. However, even with these measures, it may not be feasible in all cases to mitigate construction vibration from individual projects to a less-than-significant level. While future developments may be able to achieve the necessary reduction through a combination of various different mitigation strategies, it is not possible to determine with a reasonable degree of certainty that it would be feasible for all future development in the Planning Area to do so. Therefore, this impact would be significant and unavoidable, even with the proposed policy.

Proposed Plan Goals and Policies that Reduce the Impact

P-ENV-6: Reduce vibration impacts associated with construction activities by requiring construction contractors to implement measures to help reduce vibration levels at nearby sensitive receptors. Measures to reduce vibration levels include, but are not limited to, the following:

- Operating heavy equipment as far as practical from residential uses;
- Using smaller bulldozers (operating weight less than 20,000 pounds) when grading must occur within approximately 50 feet of residential uses or other vibration sensitive uses; and

- Using quiet pile driving technology (such as predrilling piles, using sonic or vibratory pile drivers, or using more than one pile driver to shorten the total duration of pile driving).

Mitigation Measures

No mitigation measures are available to reduce this impact.

Stationary Source Vibration

As development occurs, there is generally a potential for more operational vibration sources to be developed. However, implementation of the proposed Plan would not directly result in an increase of operational sources of vibration in the city. Additionally, should mechanical equipment be installed or new sources of vibration be constructed, the potential vibration effects would be analyzed in a project-specific environmental analysis. Further, vibration from mechanical equipment is generally localized, and it is unlikely that vibration effects would occur outside the immediate vicinity of the vibration-generating mechanical equipment. Stationary source vibration impacts associated with implementation of the proposed Plan would be less than significant.

Mitigation Measures

None required.

Traffic Vibration

Groundborne vibration generated by traffic traveling on roadways is generally below the threshold of perception at adjacent land uses, unless there are severe discontinuities in the roadway surface. This analysis assumes that roadways in the Planning Area are or would be reasonably maintained, with no severe discontinuities. Therefore, vibration generated by operational traffic would be less than significant.

Mitigation Measures

None required.

Train Vibration

Potential vibration impacts from the BART extension to Livermore were analyzed in the BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017). Vibration from the proposed BART extension project was evaluated in the EIR using the general vibration assessment approach described in the FTA guidance, which focuses on public disturbance from vibration. The guidance provides information on typical groundborne vibration levels for rapid transit, light rail vehicles, and locomotives as a function of distance. The FTA guidance considers vibration from light rail vehicles and rapid transit vehicles (such as BART) to be similar.

Vibration from rail operations can cause damage to buildings in addition to causing annoyance. However, damage impacts are typically only a concern if the buildings are adjacent to the tracks and constructed of materials that are susceptible to cracking. Given that the tracks are in the middle of I-580, there would be no structures adjacent to the tracks, and vibration impacts related to structural damage were determined not occur in the BART to Livermore Extension EIR. As such, there would be no impacts related to damage from train vibration within the Planning Area.

As described in the BART EIR, the FTA has established vibration-specific screening distance criteria, which are used as a first step to establishing the potential for vibration impacts to sensitive land uses. Table 3.6-15 presents the FTA-recommended screening distances for vibration impacts. According to this analysis, if no sensitive land uses are within the distances noted in Table 3.6-15, no further vibration analysis is needed (FTA, 2006).

Table 3.6-15. Screening Distances for Operational Vibration Assessment

	Screening Distance (feet)		
Type of Project Facility	*Category 1*	*Category 2*	*Category 3*
Rail Rapid Transit (Proposed Project and EMU Option)	600	200	120
Conventional Commuter Railroad (DMU Alternative)	600	200	120

Notes:

Category 1: Buildings where vibration would interfere with interior operations (research facilities, hospitals with vibration sensitive equipment)

Category 2: Residences and buildings where people normally sleep

Category 3: Institutional land uses with primarily daytime uses (schools, churches)

Source: BART to Livermore Extension Project Draft EIR (San Francisco Bay Area Rapid Transit District, 2017) (originally from Federal Transit Administration (FTA), 2006).

Although no specific Category 1 facilities (e.g. research facilities, hospitals with vibration sensitive equipment) are proposed to be located within 600 feet of the BART track under the proposed Plan, it is possible that a research and development use could be located in the Office or Business Park areas of the plan. Although it is unlikely that vibration-sensitive equipment would be located inside of the Office or Business park portions of the Plan area, it is possible. However, Policy P-LU-20, described below, would ensure that no facilities that include the use of vibration-sensitive equipment would be located within this 600-foot screening distance of the BART tracks.

Note that no Category 2 land uses (residences and buildings where people normally sleep) are proposed to be located within the 200-foot screening distance, and none are closer than approximately 500 from BART tracks. Finally, no Category 3 Land uses (e.g. schools, churches) are proposed to be located within 120 feet of the BART tracks.

As no Category 2 or Category 3 land uses would be located within the FTA screening distances from the BART tracks, and as implementation of Policy P-LU-20 below would ensure that no Category 1 land uses would be located within the applicable screening distance (600 feet) of the BART tracks, vibration impacts from BART operations to the proposed INP development would be less than significant.

Proposed Plan Goals and Policies that Reduce the Impact

P-LU-20: Prohibit Category 1 facilities (according to the FTA guidelines, including research facilities with vibration-sensitive equipment) that use vibration-sensitive equipment that could be affected by BART train vibration in areas located within 600 feet of the BART tracks (Noting that 600 feet is the FTA screening distance for Category 1 land uses). These types of facilities shall be allowed within the Planning Area in locations that are more than 600 feet from the BART tracks.

Mitigation Measures

None required.

Impact 3.6-3 Implementation of the proposed Plan could result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. (*Significant and Unavoidable*)

Traffic Noise

As discussed under Impact 3.6-1, proposed Plan implementation would result in potentially significant traffic noise increases along some segments within the Planning Area. These impacts could not be reduced to less than significant levels, as implementation of Mitigation Measure NOI-1, described previously, may not always be feasible. Therefore, impacts related to a substantial permanent increase in noise from project-related increased traffic would be significant and unavoidable.

Mitigation Measures

MM NOI-1. Implement Traffic Noise Reduction Measures at Existing Sensitive Receptors.

Stationary Equipment Noise

Noise from mechanical equipment in the Planning Area could include HVAC and other mechanical equipment (e.g., larger mechanical equipment, emergency generators, etc.). As discussed under Impact 3.6-1 above, Policy P1 under Objective N-1.5 in the City General Plan states that the City shall require that industrial and commercial uses be designed and operated so as to avoid the generation of noise effects on surrounding sensitive land uses (e.g., residential, churches, schools, hospitals) from exceeding the following noise levels for exterior environments: (a) 55 dBA L50 (7:00 a.m. to 10:00 p.m.) (b) 45 dBA L50 (10:00 p.m. to 7:00 a.m.).

In addition, Policy P-ENV-8 under the proposed Plan, described previously, would ensure that noise from noise-generating land uses, as measured from the property line, would be limited as follows:

- In residential areas of the Isabel Neighborhood, exterior noise levels may not exceed 65 dBA from 7:00 a.m. to 12:00 a.m or 60 dBA from 12:00 a.m. to 7:00 a.m.
- Along Main Street and in the office, commercial, or business park areas of the Isabel Neighborhood, exterior noise levels may not exceed 75 dBA from 7:00 a.m. to 12:00 a.m or 65 dBA from 12:00 a.m. to 7:00 a.m.

As discussed previously, noise impacts related to a substantial permanent increase in noise from the use of stationary equipment in the Planning Area would be less than significant with implementation of this policy.

Proposed Plan Goals and Policies that Reduce the Impact

Policy P-ENV-7 as listed under Impact 3.6-1 above.

Mitigation Measures

None required.

Impact 3.6-4 Implementation of the proposed Plan would not result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project (*Less than Significant*)

Construction Noise

As discussed under Impact 3.6-1, construction associated with future development under the proposed Plan would be required to comply with the hourly restrictions (no construction occurring from 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday, and Thursday; 8:00 p.m. Friday to 9:00 a.m. on Saturday, and no construction allowed on City-observed holidays). Outside of these hours, construction is allowed in the city and is not governed by a specific noise-level restriction. Therefore, noise increases resulting from construction during exempt hours would not be considered substantial. As development associated with the proposed Plan would comply with the hourly restrictions for construction activities, noise impacts related to a substantial temporary increase noise from construction activities would be less than significant.

Mitigation Measures

None required.

Special Event Noise

As discussed above under Impact 3.6-1, the proposed Plan would include the development of parks and plazas which could be used for gatherings or events. The types of potential events are not known at this time, so it is not possible to estimate potential temporary or periodic noise generated by gatherings in these areas. However, all special events would be required to obtain a special event permit in accordance with the City of Livermore rules. To obtain a permit, event organizers must "be certain that all event activities comply with the local laws applicable to noise abatement" (described previously; City of Livermore, 2017a). Any special event in the City would need to obtain a special event permit in accordance with the City of Livermore rules. To obtain a permit, event organizers must "be certain that all event activities comply with the local laws applicable to noise abatement" (City of Livermore, 2017a). Therefore, noise impacts related to special events occurring in the proposed Planning Area would be less than significant.

Mitigation Measures

None required.

Impact 3.6-5 The proposed Plan would be located within an airport land use plan area, or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, but would not expose people residing or working in the project area to excessive noise levels. (*Less than Significant*)

The closest public airport to the Planning Area is the Livermore Municipal Airport. This public airport has 459 aircraft based at the field, and is located adjacent to the southern border of the Planning Area. The 65, 60 and 55 CNEL contours for the airport extend at least partially into the Planning Area, as shown in Figure 3.6-2. The noise compatibility criteria for the Livermore Municipal Airport are shown in Table 3.6-16.

The portions of the Planning Area that are within the 65 CNEL contour are either proposed open space or business park land uses under the proposed Plan. The portions of the Planning Area that are within the 60 CNEL contour are either proposed business park, open space or general commercial land uses. Finally, the portions of the Planning Area that are within the 55 CNEL contour are either proposed business, commercial, school, open space and residential land uses.

According to the Noise Compatibility Criteria (Table 3-1 in the ALUCP, Table 3.6-16), commercial and industrial uses, school land uses, multi-family residential and hotel land uses, and most agricultural, recreational and outdoor uses are compatible ("permitted") in areas where noise is less than 65 CNEL, and are considered conditionally compatible in areas where noise is greater than 65 CNEL. Single-family residential is considered permitted in areas where noise is below 60 CNEL and conditionally compatible in areas where noise is below 65 CNEL (Alameda County, 2012). Therefore, as shown in Table 3.6-17, all proposed land uses associated with the Planning Area are located in areas where they would be compatible with the noise from the Livermore Airport.

Although new residential uses under the proposed Plan would be located outside the 55 dBA noise contours, occasional overflight noise would likely be audible at proposed future residences. Residents in the vicinity of the airport may consider this airport overflight noise to be an annoyance, in part because peak-hour noise would likely be greater than a 24-hour CNEL noise level. Because of this, even though all proposed land uses in the Planning Area would be located in areas where they would be compatible with airport noise, the proposed Plan includes policies to help further address concerns related to annoyance from airport noise.

As all proposed land uses associated with the proposed Plan would be located in areas where they would be compatible with the noise from the Livermore Airport, impacts related to the exposure of people residing or working in the Planning Area to excessive noise levels from aircraft at a public airport would be less than significant. In addition, policies included in the proposed Plan would help to further reduce any annoyance associated with occasional overflight noise. One policy that would help reduce the annoyance related to aircraft noise at future land uses is Policy P-ENV-4, which states that, although not anticipated, any noise sensitive land uses within the 60 dBA contour for the airport shall incorporate adequate noise attenuation into the design and site planning of the project in order to achieve an interior noise level of not more than 45 dBA CNEL. Policy P-ENV-10 from the INP would also help to ensure annoyance from aircraft noise would be minimized to the extent practicable, by increasing resident awareness of their proximity to the Livermore Municipal Airport. The policy states that this can be done by sending annual reminders to residents about the proximity of the airport, providing information on the City's website about the APA overlay

zone and Airport Land Use Compatibility Plan, and by proactively advising potential home buyers in the overlay zone that their property may be subject to aircraft noise. Although potential impacts related to aircraft noise would be less than significant without implementation of these policies, these policies would help to further reduce potential aircraft-related noise annoyance in the INP area.

Table 3.6-16. Noise Compatibility Criteria for the Livermore Municipal Airport

Land Use Category[1]	*Exterior Noise Exposure (dB CNEL)*			
	<55	*55-59*	*60-64*	*>65*
Agricultural, Recreational, and Animal-Related				
Outdoor amphitheaters	P	P	P	X
Zoos; animal shelters; neighborhood parks; playgrounds	P	P	P	X
Regional parks; athletic fields; golf courses; outdoor spectator sports; water recreation facilities	P	P	P	C
Nature preserves; wildlife preserves; livestock breeding or farming	P	P	P	X
Agriculture (except residences and livestock); fishing	P	P	P	P
Residential, Lodging, and Care				
Residential, (including single-family and mobile homes)	P	P	C	X
Residential, (multi-family; retirement homes; residential; residential hotels)	P	P	P	X
Residential hotels; retirement homes; hospitals; nursing homes; intermediate care facilities	P	P	P	X
Hotels; motels; other transient lodging	P	P	P	X
Public				
Schools; libraries	P	P	P	C
Auditoriums; concert halls; indoor arenas; places of worship; cemeteries	P	P	P	P
Commercial and Industrial				
Office buildings; office areas of industrial facilities; medical clinics; clinical laboratories; commercial - retail; shopping centers; restaurants; movie theaters	P	P	P	C
Commercial - wholesale; research and development	P	P	P	C
Industrial; manufacturing; utilities; public rights-of-way	P	P	P	C

Table 3.6-16. Noise Compatibility Criteria for the Livermore Municipal Airport

Land Use Category[1]		*Exterior Noise Exposure (dB CNEL)*			
		<55	*55-59*	*60-64*	*>65*
Land Use	**Acceptability**	**Interpretation/Comments**			
P	Permitted	Indoor Uses: Standard construction methods will sufficiently attenuate exterior noise to an acceptable indoor community noise equivalent level (CNEL). Outdoor Uses: Activities associated with the land use may be carried out with essentially no interference from aircraft noise.			
C	Conditional	Indoor Uses: Building structure must be capable of attenuating exterior noise to the indoor CNEL indicated by the number; standard construction methods will normally suffice. Outdoor Uses: CNEL is acceptable for outdoor activities, although some noise interference may occur; caution should be exercised with regard to noise-sensitive uses.			
X	Incompatible	Indoor Uses: Unacceptable noise interference if windows are open; at exposures above 65 dB CNEL, extensive mitigation techniques are required to make the indoor environment acceptable for performance of activities. Outdoor Uses: Severe noise interference makes outdoor activities unacceptable.			

Note:

1. Land uses not specifically listed shall be evaluated using the criteria for similar uses.

Source: Alameda County Airport Land Use Commission. 2012. Livermore Executive Airport – Airport Land Use Compatibility Plan. August. Available: https://www.acgov.org/cda/planning/generalplans/airportlandplans.htm. Accessed: November 17, 2017.

Table 3.6-17. Airport Noise Compatibility for proposed INP Land Uses

Airport Noise Contour (CNEL)	*Proposed INP Land Uses Located within Contour*	*Permitted Land Uses Within Contour*	*INP Land Uses Located in Compatible Areas?*
55	Business, commercial, school, open space, and residential land uses	All land uses from Table 3.4-17	Yes
60	Business park, open space, and general commercial land uses	All land uses from Table 3.4-17	Yes
65	Business park or open space land uses.	All land uses from Table 3.4-17 except residential land uses (which are conditional)	Yes

Source: Dyett & Bhatia, 2018.

Mitigation Measures

None Required.

Impact 3.6-6 The proposed Plan would not be located in the vicinity of a private airstrip or expose people residing or working in the project area to excessive noise levels. (*No impact*)

The closest private airstrip to the Planning Area is the Meadowlark Field Airport. This small private airport has only six aircraft based at the field, and is located over 6 miles southeast of the Planning Area. At this distance, and based on the size of this private airstrip, no noise effects would occur in the Planning Area as a result of aircraft operating at this airstrip. There would be no impact related to noise from private airstrips.

Mitigation Measures

None required.