4.10 Noise

4.10.1 Introduction

This section identifies the existing setting and evaluates potential impacts related to noise and vibration that could result from development under the Project. This section analyzes potential impacts on the ambient noise environment caused by construction and operation of development of the Project. This analysis focuses on noise and vibration impacts on humans and structures; noise and related effects on wildlife are addressed in Section 4.3, *Biological Resources*.

4.10.2 Environmental Setting

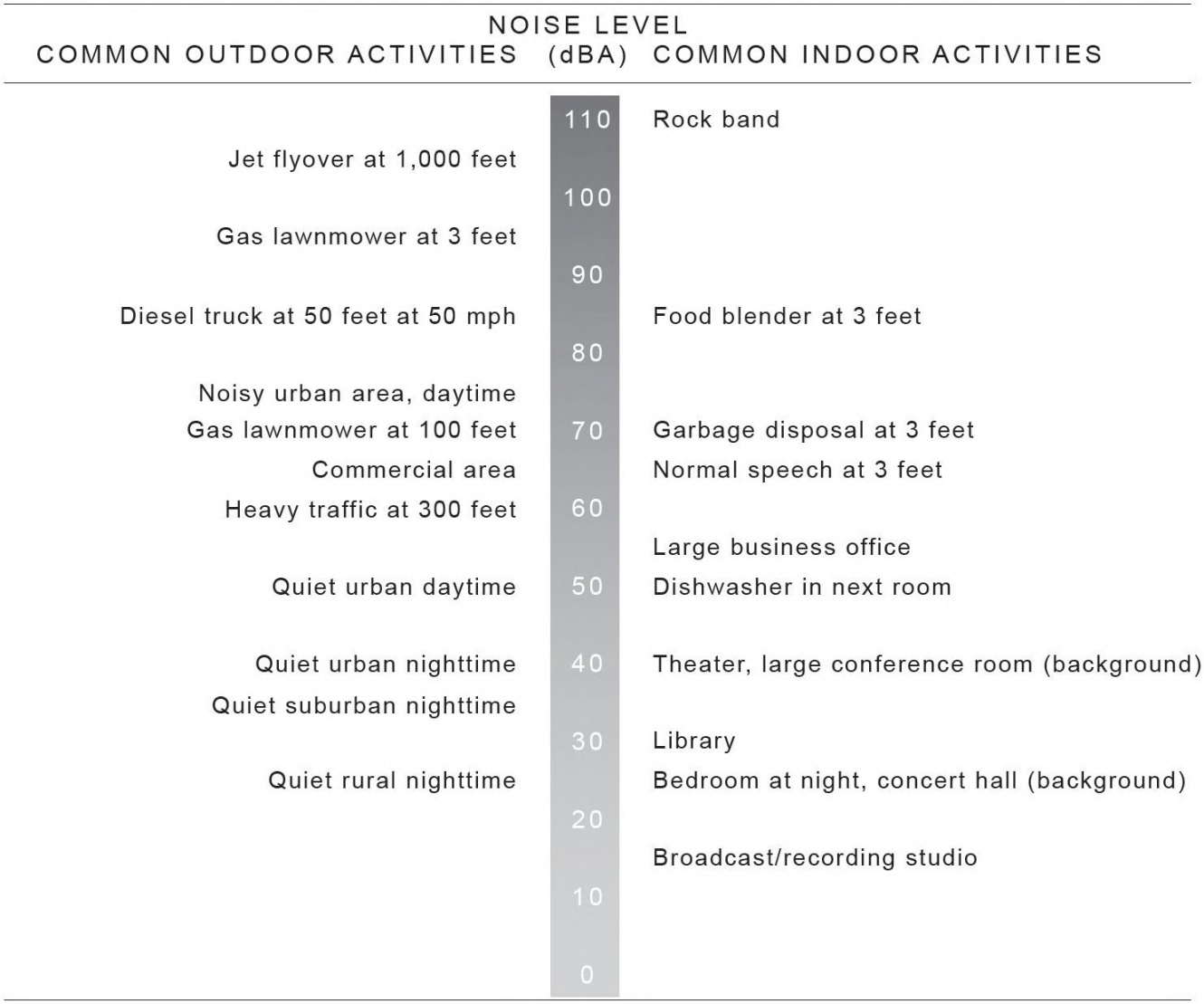
Noise Background

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise can be generally defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in **Figure 4.10-1**.

Noise exposure is a measure of noise over a period of time. Noise level is a measure of noise at a given instant in time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. Community noise varies constantly throughout the day due not only to slowly changing background noise but



SOURCE: Caltrans, 2013

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Figure 4.10-1
Typical Noise Levels

also to the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual receptor. These successive additions of sound to the community noise environment vary the community noise level from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts.

This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

L_{eq}: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The L_{eq} is the constant sound level, which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

L_{max}: the instantaneous maximum noise level for a specified period of time.

L_{min}: the instantaneous minimum noise level for a specified period of time.

L_{dn}: also abbreviated DNL, it is a 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dB to take into account the greater annoyance of nighttime noises.

CNEL: similar to L_{dn}, the Community Noise Equivalent Level (CNEL) adds a 5-dB "penalty" for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dB penalty between the hours of 10:00 p.m. and 7:00 a.m.

As a general rule, in areas where the noise environment is dominated by traffic, the L_{eq} during the peak-hour is generally within one to two decibels of the L_{dn} at that location (Caltrans, 2013).

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- Subjective effects of annoyance, nuisance, dissatisfaction;
- Interference with activities such as speech, sleep, learning; and
- Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants generally experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. A wide variation exists in the individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Therefore, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise

level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur (Caltrans, 2013):

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived;
- Outside of the laboratory, a 3 dB change is considered a just-perceivable difference;
- A change in level of at least 5 dB is required before any noticeable change in human response would be expected; and
- A 10 dB change is subjectively heard as approximately a doubling in loudness and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but instead combine logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. When combining sound levels, the relationships presented in **Table 4.10-1** may be used as an approximation.

TABLE 4.10-1
DECIBEL ADDITION RELATIONSHIPS

When Two Decibel Values Differ by:	Add This Amount to the Higher Value:	Example:
0 or 1 dB	3 dB	70 + 69 = 73 dBA
2 or 3 dB	2 dB	74 + 71 = 76 dBA
4 to 9 dB	1 dB	66 + 60 = 67 dBA
10 dB or more	0 dB	65 + 55 = 65 dBA

SOURCE: Caltrans, 2013

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate, or lessen, at a rate of 6 to 7.5 dB per doubling of distance from the source, depending on the topography of the area and environmental conditions (i.e., atmospheric conditions and noise barriers, either vegetative or manufactured, etc.). Widely distributed noise, such as a large industrial facility spread over many acres or a street with moving vehicles, would typically attenuate at a lower rate, approximately 3 to 4.5 dB per doubling of distance from a linear source, such as a roadway.

Health Effects of Environmental Noise

The World Health Organization (WHO) is a source of current knowledge regarding the health effects of noise impacts. According to the WHO, sleep disturbance can occur when continuous indoor noise levels exceed 30 dBA or when intermittent interior noise levels reach 45 dBA,

particularly if background noise is low. With a bedroom window slightly open (a reduction from outside to inside of 15 dB), the WHO criteria suggest that exterior continuous (ambient) nighttime noise levels should be 45 dBA or below, and short-term events should not generate noise in excess of 60 dBA. The WHO also notes that maintaining noise levels within the recommended levels during the first part of the night is believed to be effective for the ability of people to initially fall asleep (WHO, 1999).

Other potential health effects of noise identified by the WHO include decreased performance for complex cognitive tasks, such as reading, attention span, problem solving, and memorization; physiological effects such as hypertension and heart disease (after many years of constant exposure, often by workers, to high noise levels); and hearing impairment (again, generally after long-term occupational exposure, although shorter-term exposure to very high noise levels, for example, exposure several times a year to concert noise at 100 dBA, can also damage hearing). Finally, noise can cause annoyance and can trigger emotional reactions like anger, depression, and anxiety. The WHO reports that, during daytime hours, few people are seriously annoyed by activities with noise levels below 55 dBA or moderately annoyed with noise levels below 50 dBA.

Vehicle traffic and continuous sources of machinery and mechanical noise contribute to ambient noise levels. Short-term noise sources, such as truck backup beepers, the crashing of material being loaded or unloaded, and car doors slamming contribute very little to 24-hour noise levels but are capable of causing sleep disturbance and severe annoyance. The importance of noise to receptors depends on both time and context. For example, long-term high noise levels from large traffic volumes can make conversation at a normal voice level difficult or impossible, while short-term peak noise levels, if they occur at night, can disturb sleep.

Vibration

As described in the FTA's *Transit Noise and Vibration Impact Assessment*, ground-borne vibration can be a concern for nearby neighbors, causing buildings to shake and rumbling sounds to be heard (FTA, 2006). In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses and heavy trucks on rough roads, construction activities such as blasting, sheet pile-driving and operation of heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to express RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration assessment include structures (especially older masonry structures), people

who spend a lot of time indoors (especially residents, students, the elderly and sick), and vibration sensitive equipment such as hospital analytical equipment and equipment used in computer chip manufacturing.

The effects of ground-borne vibration include movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls and rumbling sounds. In extreme cases, vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance can be well below the damage threshold for normal buildings.

Existing Ambient Noise Environment at the Project Site

The major noise sources in the vicinity of the Project site are traffic on I-680, train activity along the Burlington Northern Santa Fe Railroad (BNSF) tracks abutting the southern border of the site, aircraft overflights from Buchanan Field Airport which is located approximately 1mile south of the site, and truck activity associated with the waste transfer station at Acme landfill located north/northeast of the site.

An environmental noise assessment of the Project site was conducted in November, 2017. Since that time the state-wide shelter-in-place order has resulted in a reduction in traffic and rail sources compared to "normal" conditions. Consequently, although monitoring occurred three years prior, the data points are considered to be more reflective of that occurring under non-pandemic conditions. As part of the assessment, two long-term measurements were collected at two locations nearest adjacent off-site sensitive land uses. The measurement locations are shown in **Figure 4.10-2**. The monitored data consistently showed that daytime noise levels typically range from 45 to 60 dBA. The DNL at the measurement locations were 56 dBA near Central Avenue to 63 dBA at the southern portion of the project site. A summary of the measured noise levels and the noise sources affecting the measurements at different locations is shown in **Table 4.10-2**.

TABLE 4.10-2
AMBIENT NOISE LEVELS IN THE STUDY AREA

Measurement Location	Duration	DNL, dBA	Hourly Leq Range, dBA	Hourly Lmax Range, dBA	Sources
LT-1	24 hours	56	41.6 – 54.3	50.7 – 78.6	Distant railroad activity, intermittent service vehicles, wind, birds and other natural sources
LT-2	24 hours	63	47.2 - 64.3	61.6 - 91.1	Railroad activity, distant traffic on I-680, wind, birds and other natural sources

SOURCE: ESA, 2017

NORTH

SOURCE: Google Earth; ESA

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Figure 4.10-2
Noise Monitoring Locations

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others because of the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved for those uses. Residences, schools, rest homes, hospitals, and churches are generally more sensitive to noise than commercial and industrial land uses. The Project site is located in an open space area surrounded by residential, and industrial land uses. The area to the northwest of the site and east of the freeway is characterized by a cluster of single-family homes. The closest existing sensitive receptors are residences located approximately 50 feet from the Project site's northernmost boundary.

4.10.3 Regulatory Setting

Noise issues are addressed in Title 24 of the *California Code of Regulations* (for new multifamily residential developments), local general plan policies, and local noise ordinance standards and codes. Federal, State, and local agencies regulate different aspects of environmental noise.

Federal

Truck Operations

Federal regulations establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 Code of Federal Regulations, Part 205, Subpart B. The federal truck pass-by noise standard is 80 dBA at 15 meters (approximately 50 feet) from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

Vibration Impacts (Federal Transit Administration)

The FTA has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. The vibration damage criteria adopted by the FTA are shown in **Table 4.10-3**.

TABLE 4.10-3
CONSTRUCTION VIBRATION DAMAGE CRITERIA

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

SOURCE: FTA, 2006

In addition, the FTA has also adopted standards associated with human annoyance for ground-borne vibration impacts for the following three land-use categories: Vibration Category 1 – High

Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional. The FTA defines Category 1 as buildings where vibration would interfere with operations within the building, including vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. Vibration-sensitive equipment includes, but is not limited to, electron microscopes, high-resolution lithographic equipment, and normal optical microscopes. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment but still have the potential for activity interference. The vibration thresholds associated with human annoyance for these three land-use categories are shown in **Table 4.10-4**. No thresholds have been adopted or recommended for commercial and office uses. Because the Project-induced vibration would be from construction activities, the impact thresholds for this Project would be based on Infrequent Events as defined in Table 4.10-4.

TABLE 4.10-4
GROUND-BORNE VIBRATION IMPACT CRITERIA FOR GENERAL ASSESSMENT

Land Use Category	Frequent Events[a]	Occasional Events[b]	Infrequent Events[c]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[d]	65 VdB[d]	65 VdB[d]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

NOTES:

a "Frequent Events" is defined as more than 70 vibration events of the same source per day.
b "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
c "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.
d This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.

SOURCE: FTA, 2006

State of California

State regulations include requirements for the construction of new hotels, motels, apartment houses, and dwellings (other than detached single-family dwellings) that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are collectively known as the California Noise Insulation Standards and are found in *California Code of Regulations*, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. There are no comparable noise standards for office or other commercial structures.

Vehicle Operations

The State of California establishes noise limits for vehicles licensed to operate on public roads. The pass-by standard for heavy trucks is consistent with the federal limit of 80 dBA. The pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80

dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanctions on vehicle operators by State and local law enforcement officials.

Noise Insulation Standard

The California Noise Insulation Standards found in CCR, Title 24 establish requirements for new multi-family residential units, hotels, and motels that may be subject to relatively high levels of transportation noise. In this case, the noise insulation criterion is 45 dBA L_{dn}/CNEL inside noise-sensitive spaces. For developments with exterior transportation noise exposure exceeding 60 dBA L_{dn}/CNEL, an acoustical analysis and mitigation (if required) must be provided showing compliance with the 45 dBA L_{dn}/CNEL interior noise exposure limit.

Local Plans and Regulations

Contra Costa County General Plan

The Noise Element of the *General Plan* (Contra Costa County, 2010) sets various goals and policies that apply to all development projects in the County. Most of these policies address land use compatibility standards for evaluating new projects. Applicable policies and, where particularly relevant to the proposed Project, implementation measures, of the Noise Element include:

- *Goal 11-E:* To recognize citizen concerns regarding excessive noise levels, and to utilize measures through which the concerns can be identified and mitigated.
- *Policy 11-1:* New projects shall be required to meet acceptable exterior noise level standards as established in the Noise and Land Use Compatibility Guidelines contained in Figure 11-6 [reproduced here as Table 4.10-5]. These guidelines, along with the future noise levels shown in the future noise contour maps, should be used by the County as a guide for evaluating the compatibility of "noise-sensitive" projects in potentially noisy areas.
- *Policy 11-2:* The standard for outdoor noise levels in residential areas is a DNL of 60 dB. However, a DNL of 60 dB or less may not be achievable in all residential areas due to economic or aesthetic constraints. One example is small balconies associated with multi-family housing. In this case, second and third story balconies may be difficult to control to the goal. A common outdoor use area that meets the goal can be provided as an alternative.

TABLE 4.10-5
CONTRA COSTA COUNTY LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS

LAND USE CATEGORY	COMMUNITY NOISE EXPOSURE - L_{dn} or CNEL (db)							
	50	55	60	65	70	75	80	
Residential - Low Density Single Family, Duplex, Mobile Homes								
Residential – Multiple Family								
Transient Lodging – Motels, Hotels								
Schools, Libraries, Churches, Hospitals, Nursing Homes								
Auditoriums, Concert Halls, Amphitheaters								
Sports Arena, Outdoor Spectator Sports								
Playgrounds, Neighborhood Parks								
Golf Courses, Riding Stables, Water Recreation, Cemeteries								
Office Buildings, Business, Commercial, Professional								
Industrial, Manufacturing, Utilities, Agriculture								

	Normally Acceptable	Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
	Conditionally Acceptable	New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design.
	Normally Unacceptable	New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirement must be made and needed noise insulation features included in the design.
	Clearly Unacceptable	New construction or development generally should not be undertaken.

NOTE: For lands within 3 miles of Buchanan Field and the East Contra Costa County Airports noise compatibility shall be adjusted to those of the ALUC which are roughly 5 CNEL lower than shown on this table.

SOURCE: Contra Costa County General Plan, Noise Element – Figure 11-6, 2010.

- *Policy 11-3:* If the primary noise source is train passbys, then the standard for outdoor noise levels in residential areas is a DNL of 70 dB. A higher DNL is allowable since the DNL is controlled by a relatively few number of train passbys that are disruptive outdoors only for short periods. Even though the DNL may be high, during the majority of the time the noise level will be acceptable.
- *Policy 11-5:* In developing residential areas exposed to a DNL in excess of 65 dB due to single events such as train operation, indoor noise levels due to these single events shall not exceed a maximum A-weighted noise level of 50 dB in bedrooms and 55 dB in other habitable rooms. Single event indoor residential noise levels from airport related causes will be 45 dB CNEL.
- *Policy 11-6:* If an area is currently below the maximum "normally acceptable" noise level, an increase in noise up the maximum should not be allowed necessarily.
- *Policy 11-8:* Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours to provide relative quiet during the more sensitive evening and early morning periods.
- *Policy 11-9:* Sensitive land use shall be encouraged to be located away from noise areas, or the impacts of noise on these uses shall be mitigated. If residential areas are planned adjacent to industrial noise sources, then a noise study shall be performed to determine the extent of any noise impacts and recommend appropriate noise mitigation measures.
- *Policy 11-11:* Noise impacts upon the natural environment, including impacts on wildlife, shall be evaluated and considered in review of development projects.
- *Implementation Measure 11-b:* Evaluate the noise impacts of a project upon existing land uses in terms of applicable Federal, State, and local codes, and the potential for adverse community response, based on a significant increase in existing noise levels.
- *Implementation Measure 11-c:* Encourage use of the following mitigation measures to minimize noise impacts of proposed development projects:

    1) Site planning. Proper site planning is the first mitigation measure that should be investigated to reduce noise impacts. By taking advantage of the natural shape and terrain of a site, it often is possible to arrange the buildings and other uses in a manner that will reduce and possibly eliminate noise impact. Specific site planning techniques include:

        a) Increasing the distance between the noise source and the receiver;

        b) Placing non-noise-sensitive land uses such as parking lots, maintenance facilities, and utility areas between the source and the receiver;

        c) Using non-noise-sensitive structures such as garages to shield noise-sensitive areas; and

        d) Orienting buildings to shield outdoor spaces from a noise source.

    2) Architectural layout of buildings. In many cases, noise reduction can be attained by careful layout of noise-sensitive spaces. Bedrooms, for example, should be placed away from freeways. Quiet outdoor spaces can be provided next to a noisy highway by creating a U-shaped development which faces away from the highway.

3) Noise Barriers: Noise barriers or walls are commonly used to reduce noise levels from ground transportation noise sources and industrial sources. While serving a dual purpose in that they can reduce noise level both outdoors and indoors, to be effective, a barrier must interrupt the line of sight between the noise source and the receiver. A barrier should provide at least 5 dB of noise reduction to achieve a noticeable change in noise levels.

4) Construction modifications: If site planning, architectural layout, noise barriers, or a combination of these measures does not achieve the required noise reduction, then construction modification to walls, roofs, ceilings, doors, windows, and other penetrations may be necessary.

- *Implementation Measure 11-e:* Noise mitigation features shall be incorporated into the design and construction of new projects or be required as conditions of project approval.

Table 4.10-5 indicates ranges for acceptable, conditionally acceptable, and unacceptable noise exposure levels for different land uses in Contra Costa County pursuant to Policy 11-1 (Contra Costa County, 2010).

The Noise Element also discusses how noise increases are perceived by people (Contra Costa County, 2010):

> An important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise level exceeds the prior existing level, the less acceptable it is. Therefore, a new noise source will be judged more annoying in a quiet area than it would be in a noisier location.
>
> Knowledge of the following relationships is helpful in understanding how changes in noise and noise exposure are perceived.
>
> - Except under special conditions, a change in sound level of 1 dB cannot be perceived;
> - Outside of the laboratory, a 3 dB change is considered a just-noticeable difference;
> - A change in level of at least 5 dB is required before any noticeable change in community response would be expected; and
> - A 10 dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response.

Contra Costa County Code

The County's Code does not contain quantitative standards for regulating noise from mechanical equipment. However, Section 716-8.1004 of the County Code addresses hours of operation for excavation and grading activities. If operations under the permit are within five hundred feet of residential or commercial occupancies, except as otherwise provided by conditions of approval for the Project, grading operations shall be limited to weekdays and to the hours, between 7:30 a.m. and 5:30 p.m., except that maintenance and service work on equipment may be performed at any time.

State Model Community Noise Control Ordinance

Contra Costa County does not have a quantitative noise ordinance for regulating noise from mechanical equipment or construction. However, a Model Community Noise Control Ordinance was created by the State of California (California Department of Health, 1977) to provide guidance for communities to develop their own noise ordinances. The Model Noise Ordinance has not been adopted by Contra Costa County and is not enforced by the State of California, but is discussed in this analysis to help provide context for the potential noise impacts of the Project.

The exterior noise level limits recommended by the Model Community Noise Control Ordinance are shown in **Table 4.10-6** below and correspond to the median noise level (L_{50})[1]. These limits are not to be exceeded at the receiving land use for more than 30 minutes in an hour. The limits are to be adjusted based on the duration of the source, the level of the ambient noise, the character of the sound, and the location of the measurement.

TABLE 4.10-6
MODEL COMMUNITY NOISE CONTROL ORDINANCE EXTERIOR NOISE LIMITS
(LEVELS NOT TO BE EXCEEDED MORE THAN 30 MINUTES IN ANY HOUR)

		Noise Level (dBA)		
		Noise Zone Classification [a]		
Receiving Land Use Category	Time Period	Rural Suburban	Suburban	Urban
One and Two Family Dwellings	10 p.m. – 7 a.m.	40	45	50
	7 a.m. – 10 p.m.	50	55	60
Multiple Dwelling Residential Public Space	10 p.m. – 7 a.m.	45	50	55
	7 a.m. – 10 p.m.	50	55	60
Limited Commercial Some Multiple Dwellings	10 p.m. – 7 a.m.	55		
	7 a.m. – 10 p.m.	60		
Commercial	10 p.m. – 7 a.m.	60		
	7 a.m. – 10 p.m.	65		
Light Industrial	Any time	70		
Heavy Industrial	Any time	75		

NOTES:

a = The classification of different areas of the community in terms of environmental noise zones shall be determined by the Noise Control Office(r), based upon assessment of community noise survey data. Additional area classifications should be used as appropriate to reflect both lower and higher existing ambient levels than those shown. Industrial noise limits are intended primarily for use at the boundary of industrial ones rather than for noise reduction within the zone.

SOURCE: California Department of Health, 1977.

In addition, the Model Community Noise Control Ordinance includes a noise limit of DNL 80 dB for short-term or intermittent construction activities (mobile equipment) adjacent to multi-family residential properties, and DNL 75 dB at single-family residential properties. Though the Model Community Noise Control Ordinance has not been adopted into the County Code, this reference

[1] L_{50} is the sound level in dBA that is met or exceeded fifty percent of the time.

is provided as a context for assessing noise that could be generated during construction of the Project. Some activity or equipment noise cannot meet this standard (such as back-up alarms, which are required by State safety regulations).

Contra Costa County Airport Land Use Compatibility Plan (ALUP)

The Project site would be located within the airport influence area of Buchanan Field Airport. New single-family, duplex and mobile homes are considered normally acceptable at aircraft noise exposures up to 55 dBA, CNEL and marginally acceptable at exposures between 55 and 65 dBA, CNEL. The ALUP also considers a maximum, aircraft-related interior noise level of 45 dBA, CNEL to be acceptable for living and sleeping areas of single and multi-family residences with the airport influence area. This interior noise standard would be achieved if residential uses are located outside an airport's 60 dB contour. The Project site is located outside the 60 dB noise contour area for Buchanan Field Airport (Contra Costa County Airport Land Use Commission, 2000).

4.10.4 Significance Criteria

Consistent with Appendix G of the State CEQA *Guidelines*, the Project would cause significant adverse impacts with respect to noise and/or ground-borne vibration if it would result in:

a) Generation of a substantial permanent increase in ambient noise levels in the Project vicinity in excess of standards established in the general plan or noise ordinance, or applicable standards of other agencies above levels existing without the Project;

b) For a project within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels; or

c) Generation of excessive ground-borne vibration or ground-borne noise levels.

Analysis Methodology

A significant noise impact would result if, as a result of Project, noise levels increase substantially at existing noise-sensitive land uses (e.g., residences) or construction-related vibrations would cause building damage to adjacent structures or cause annoyance to a substantial number of receptors over an extended time period.

Construction Noise

Construction noise is treated differently than long-term traffic noise because it is temporary and intermittent. Significant noise impacts would result from construction if noise levels were sufficiently high to interfere with speech, sleep, or normal residential activities. The Project would result in a significant construction impact if construction activity would occur outside of the daytime hours permitted by the noise policies established in the *General Plan* and/or result in noise levels substantially greater than existing noise levels at nearby sensitive receptors. Construction-

related noise that exceeds a maximum level of 75 dBA L_{max} at single-family residences would constitute a substantial temporary or periodic increase in ambient noise levels.

Traffic Noise

A change in noise levels of less than 3 dBA is not discernible to the general population; an increase in average noise levels of 3 dBA is considered barely perceptible, while an increase of 5 dBA is considered readily perceptible to most people (Caltrans, 2013). Therefore, traffic noise would be considered significant if the Project would increase ambient noise levels along roadways in the vicinity of the Project site above existing ambient noise levels by greater than 5 dBA and if the resultant noise level would be inconsistent with the standards in the General Plan land use/noise compatibility matrix (shown in Table 4.10-5).

Stationary Noise Sources

Contra Costa County does not have a quantitative noise ordinance for regulating noise from mechanical equipment. Therefore, this analysis applies the standards presented in Table 4.10-6 for suburban single-family dwellings of 45 dBA during nighttime hours and 55 dBA during daytime hours which is adapted from the Model Community Noise Control Ordinance was created by the State of California.

Vibration

Caltrans uses a vibration limit of 0.5 inches per second, PPV for structurally sound buildings designed to modern engineering standards (Caltrans, 2013). A conservative vibration limit of 0.25 inches/sec PPV has been used for buildings that are found to be structurally sound but for which structural damage is a major concern. The County has not adopted significance thresholds specific to groundborne vibration.

Cumulative

Cumulative traffic noise level significance is determined by a two-step process. First, a comparison is made of the increase in noise levels for cumulative conditions with the Project site and existing conditions. If roadside noise levels would increase by 5 dB between the existing and Project conditions, a cumulative noise impact would occur. However, buildout of the Project would only be considered to result in a significant cumulative roadside noise impact if its contribution to an increase of 5 dB or more were to be cumulatively considerable. Consequently, the second step of the cumulative noise analysis (if a cumulative noise impact is predicted) is to evaluate if the contribution of the Project to roadside noise levels is cumulatively considerable. This second procedure (if necessary) involves assessing whether the Project contribution to roadside noise levels (i.e., the difference between cumulative conditions and cumulative plus Project conditions) would result in an increase of 3 dB or more, which Caltrans recognizes as a barely perceptible increase (Caltrans, 2013).

Topics with No Impact or Otherwise Not Addressed in this EIR

Review and comparison of the setting circumstances and proposed Project with each of the six significance criteria stated above clearly show that no impacts associated with noise would result for one significance criterion. The Project site would not result in an impact related to exposure of people residing or working in the area to excessive noise levels due to location within the vicinity of a private airstrip (**Criterion e**). The Project site is not located within the vicinity of a private airstrip. Therefore, the potential for this impact is not discussed further.

4.10.5 Impact Analysis

Impact NOI-1: Construction of the Project would result in a temporary increase in ambient noise levels. (Criterion a) (*Potentially Significant prior to Mitigation*)

The Project includes the development of 144 single-family homes and associated internal roadways and a park area, and preservation of open space areas. The Project would retain a hilltop as undeveloped land. Project construction is expected to occur over a one to three years depending on weather conditions and Project phasing. Construction staging would occur primarily on the site and the Project applicant also owns adjacent parcels along Palms Drive and Central Avenue, and will use these parcels for staging during the final stages of construction.

Construction, although typically short-term, can be a significant source of noise. Construction is most significant when it takes place near sensitive land uses, occurs at night, or in early morning hours. Local governments typically regulate noise associated with construction equipment and activities through enforcement of noise ordinance standards, implementation of general plan policies and imposition of conditions of approval for building or grading permits.

Construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips made and types of vehicles used. It is anticipated that temporary construction vehicle access to the Project site during construction would occur along Pacheco Boulevard, Arthur Road, Central Avenue and Palms Drive, subject to the County's approval of a *Construction Management and Traffic Control Plan* to be prepared by the Project applicant. **Table 4.10-7** shows typical noise levels produced by various types of construction equipment.

Pile driving is not anticipated to be used as part of Project construction. Therefore, as shown in Table 4.10-3, excavation and grading form the noisiest phases of construction for the Project. To support the development of 144 housing lots and associated internal roadway system, the Project's grading plan proposes to substantially alter the existing topography of the Project site. The Project is estimated to require approximately 900,000 cubic yards (CY) of grading with soil removed from the hillside to be used as fill on-site. The main noise sources associated with excavation and grading are the operations of excavators removing material and trucks hauling excavated materials to other locations on the site that would need to be filled.

TABLE 4.10-7
TYPICAL NOISE LEVELS FROM DEMOLITION/ CONSTRUCTION EQUIPMENT OPERATIONS

Construction Equipment	Noise Exposure Level, dBA @ 50 Feet
Air Compressor	81
Backhoe	80
Compactor	82
Concrete Mixer (Truck)	85
Concrete Pump (Truck)	82
Concrete Vibrator	76
Crane-Derrick	88
Crane-Mobile	83
Dozer	85
Generator	81
Grader	85
Loader	85
Paver	89
Pump	76
Roller	74
Saw	76
Scraper	89
Heavy Diesel Truck	88

SOURCES: Federal Transit Administration, 2006.

The main noise sources associated with exterior finishing would be operation of concrete mixers and pumps for application of stucco material to the building exterior. The nearest existing residential receptors located 50 feet to the north on Central Avenue would experience exterior noise levels of up to 88 dBA when grading activities are nearest to these existing residences, which could be expected to last up to two months. These noise levels would be substantially greater than the existing ambient noise environment at the receptors for this geographic area and time period. With respect to the broader scope of construction activities, these activities will take place on the opposite side of Vine Hill, and more than 750 feet from sensitive receptors. On the premise that noise dissipates at a rate of 6 to 7.5 dB per doubling of distance from the source, construction noise impacts would generally range from 73 dBA to 56 dBA, which is below applicable standards. Please note that even this estimate is conservative, and does not account for intervening topography.

The project would result in a violation of the City's noise standards if construction activity would occur outside of the allowable daytime hours specified by the City noise ordinance. Specifically, construction noise is exempted from the noise standards provided grading activities within 500 feet of residences are limited to between the hours of 7:30 am and 5:30 pm Monday through Friday.

Although construction activities associated with the Project would be temporary in nature, and the maximum noise levels discussed above would be short-term, noise generated during Project construction would temporarily elevate ambient noise levels in discrete locations at the edge of the Project area above the threshold of 75 dBA L_{max}, namely various residences located near the Project site along Central Avenue. Consequently, **Mitigation Measure NOI-1** is identified to address this significant construction-related noise impact.

With implementation of Mitigation Measure NOI-1 this impact would be reduced to less than significant.

> **Mitigation Measure NOI-1:** The applicant shall create and implement a development-specific noise reduction plan to reduce noise at sensitive receptors along Central Avenue to below 75 dBA L_{max}, which shall be enforced via contract specifications. Contractors may elect any combination of legal, non-polluting methods to maintain or reduce construction-related noise to threshold levels or lower, as long as those methods do not result in other significant environmental impacts or create a substantial public nuisance. Examples of measures that can effectively reduce noise impacts include locating equipment in shielded and/or less noise-sensitive areas, selection of equipment that emits low noise levels, and/or installation of noise barriers such as enclosures to block the line of sight between the noise source and the nearest receptors. Other feasible controls could include, but shall not be limited to, fan silencers, enclosures, and mechanical equipment screen walls. In addition, the applicant shall require contractors to limit construction activities in the northernmost 500 feet of the project site to daytime hours between 7:30 am and 5:30 pm Monday through Friday The plan for attenuating construction-related noises shall be implemented prior to the initiation of any work that triggers the need for such a plan.

Significance after Mitigation: Less than Significant.

Impact NOI-2: Project operations could cause a long-term increase in ambient noise levels in the Project site vicinity. (Criterion a) (*Less Than Significant, No Mitigation Required*)

Most of the noise generated once the Project is constructed and occupied would primarily be traffic-generated noise. The Project would contribute to an increase in local traffic volumes, resulting in higher noise levels along local roadways. Peak hour traffic noise projections were made using the California Vehicle Noise Reference Energy Mean Emission Levels (Calveno) and traffic data for the project for those road segments that would experience the greatest increase in traffic volume and that would pass through residential areas. According to Caltrans' *Technical Noise Supplement to the Traffic Noise Analysis Protocol* (Caltrans, 2013), peak hour traffic noise levels are approximately equal to the CNEL/Ldn. The segments analyzed and results of the modeling are shown in **Table 4.10-8** for Existing Conditions, Existing plus Project, Cumulative, and Cumulative plus Project development conditions.

As shown in Table 4.10-8, when project traffic is added to existing traffic levels, the greatest effect on ambient traffic noise levels would occur along the project's entrance road, Central

Avenue, where traffic noise would increase by 1.9 dBA. This and all other roadways analyzed are predicted to experience a traffic noise increase of less than 3 dBA.[2] Therefore, the project-level increase in traffic would be a less than significant impact.

Mitigation: None required.

TABLE 4.10-8
TRAFFIC ROADSIDE NOISE LEVELS IN THE PROJECT SITE VICINITY

Roadway Segment	(A)	(B)	(B-A)	(C)	Cumulative Plus Project (2040) (D)	Difference between Cumulative Plus Project and 2018 Baseline (D-A)	Difference between Cumulative Plus Project and Cumulative No Project (D-C)
Central Avenue							
between Arthur Road and Project Site	55.4	57.3	1.9	55.4	57.3	1.9	1.9
Arthur Road							
Between Central Avenue and I-680	58.2	59.4	1.2	58.7	59.7	1.5	1.0
between I-680 and Pacheco Boulevard	63.0	63.6	0.6	65.7	66.1	3.1	0.4

NOTES:

Road center to receptor distance is 15 meters (approximately 50 feet) for all roadway segments. Noise levels were determined using the Federal Highway Administration (FHWA) Traffic Noise Prediction Model.

Impact NOI-3: Project construction could generate ground-borne vibration. (Criterion c) (*Less Than Significant, No Mitigation Required*)

Construction activities would include excavation, site preparation work, foundation work, and new building, framing, and finishing. Construction activities may generate perceptible vibration when heavy equipment or impact tools such as jackhammers or hoe rams are used. Pile driving can cause excessive vibration. However, pile driving would not be required during the construction of the Project which would either use mat foundations or drilled pier foundation (Engeo, 2003).

The Caltrans-based threshold for architectural damage for conventional sensitive structures is 0.5 in/sec PPV for new residential structures and modern commercial buildings and 0.25 in/sec PPV for historic and older buildings. As stated in Section 4.4, *Cultural and Tribal Cultural Resources*, of this EIR, there are no historic-era architectural or built environment resources are

[2] As discussed in the *Environmental Setting* (Existing Ambient Noise Environment at the Project Site), the current state-wide shelter-in-place order has resulted in a reduction in traffic and rail sources compared to "normal" conditions. Therefore, previous data points are considered to be more reflective of that occurring under non-pandemic conditions and used in this analysis.

located within the Project site. The closest structures to the Project site are non-historic single family homes located 50 feet to the north on Central Avenue.

The use of a vibratory roller for preparing roadway surfaces would be expected to generate the highest vibration levels during Project construction. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Vibratory rollers typically generate vibration levels of 0.210 in/sec PPV at a distance of 25 feet (FTA, 2006). The closest existing off-site structures (residences) are located 50 feet from where roadway construction activities would occur. At this distance, the closest structure would be exposed to a vibration level of approximately 0.07 in/sec PPV, which is substantially less than the Caltrans' vibration impact threshold. Consequently, the Project would have a less-than-significant impact with regard to ground-borne vibration.

Mitigation: None required.

Cumulative Impacts

Impact C-NOI-1: Project construction activities, in conjunction with construction noise from cumulative development noise in the vicinity of the Project site, could cause a substantial temporary or periodic increase in ambient noise levels in the Project site vicinity during construction. (Criterion a) (*Potentially Significant prior to Mitigation*)

Geographic Context

The geographic scope of analysis for cumulative noise and vibration impacts encompasses sensitive receptors within approximately 500 feet of the proposed Project site. Beyond 500 feet, the contributions of noise from other projects would be greatly attenuated through both distance and intervening structures, and their contribution would be expected to be minimal.

Impact Analysis

Construction

A cumulative impact arises when two or more individual projects, when considered together, are considerable or which compound or increase other environmental impacts. Cumulative impacts can result from individually minor but collectively significant impacts, meaning that the project's incremental effects must be viewed in connection with the effects of past, current and reasonably foreseeable projects. Notably, any project that would individually have a significant noise impact would also be considered to have a significant cumulative noise impact.

Section 4.0, *Introduction to the Environmental Analysis* (4.0.6, Cumulative Analysis) in this chapter summarizes reasonably foreseeable future projects in the vicinity of the Project site. Cumulative projects shown Table in 4.0-1, Cumulative Projects Near the Project Site, located near the Project site could contribute to cumulative construction noise. Most cumulative projects

presented in Table 4.0-1 are beyond 500 feet from the Project site and would not contribute to cumulative construction noise effects.

The exact phasing of construction activities for nearby cumulative projects is not known, but the only significant Project impacts that have the potential to cumulate are those Project construction activities affecting neighbors along Central Avenue. However, there are no foreseeable development projects that have the potential to cumulate. The Palms 10 Subdivision is a development proposed by the applicant, which has confirmed that construction for the two projects will not overlap, but instead would occur in sequence. Therefore, some homes in the Vine Hill neighborhood west of the Project site could be exposed to higher levels of construction noise. Because the exact timing of construction activities is unknown, this impact is conservatively determined to be potentially significant.

Implementation of **Mitigation Measure NOI-1**, identified above, would reduce the proposed Project's contribution to this potential cumulative construction noise impact to a less-than-significant level.

Mitigation: Implement Mitigation Measure NOI-1 (see under Impact NOI-1).

Operations

Impact C-NOI-2: Operation of the proposed Project, in conjunction with cumulative development, would not cause a substantial permanent increase in ambient noise levels in the Project vicinity. (Criterion a) (*Less Than Significant, No Mitigation Required*)

Operational noise impacts of the proposed Project would primarily result from increased traffic on the local roadway network. Cumulative plus Project traffic data was used to estimate the cumulative operational noise increases shown in Table 4.10-8, above.

Cumulative traffic noise level significance is determined by a two-step process. First, a comparison is made of the increase in noise levels between cumulative conditions with the Project and existing conditions to increments recognized by Caltrans as representing a readily perceptible increase in noise levels. If the roadside noise levels would increase by 5 dB, a cumulative noise impact would be considered to occur. However, the proposed Project would only result in a significant cumulative roadside noise impact if its contribution to an increase of 5 dB or more were to be cumulatively considerable. Consequently, the second step of the cumulative roadside noise analysis (if a cumulative noise impact is predicted) is to evaluate if the contribution of the Project to roadside noise levels is cumulatively considerable. This second procedure (if necessary) involves assessing whether the Project contribution to roadside noise levels (i.e., the difference between cumulative conditions and cumulative plus Project conditions) would result in an increase of 3 dB or more which Caltrans recognizes as a barely perceptible increase (Caltrans, 2013).

Noise from cumulative development in the area would primarily occur from increase in motor vehicle traffic. Table 4.10-8 shows that modeled 2040 noise levels (from cumulative and project traffic) would increase by less than 5 dBA over existing noise levels for all analyzed roadway

segments. Therefore, the contribution of project and cumulative traffic to noise levels along these segments would be less than significant. A change in noise level of 5 dBA is required before any noticeable change in human response would be expected. Therefore, the cumulative impact would be considered less than significant.

Mitigation: None required.

References – Noise

California Department of Health, 1977. *Model Community Noise Control Ordinance.* Office of Noise Control. April.

Contra Costa County Airport Land Use Commission, 2000. *Contra Costa County Airport Land Use Compatibility Plan*. Adopted by Contra Costa County Airport Land Use Commission. December 13.

Contra Costa County, 2010. Contra Costa County *General Plan 2005-2020. Noise Element.* Published January 18, 2005; reprinted July 2010.

Contra Costa County, 2017. *Contra Costa County Code Article 716-8.1004 Work Hours*. Available at https://library.municode.com/ca/contra_costa_county/codes/ordinance_code?nodeId=TIT7BURE_DIV716GR_CH716-8RE_716-8.1004WOHO. Accessed November 10, 2017.

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