4.7 NOISE

4.7.1 INTRODUCTION

This section presents existing noise conditions in the project area, including the project site, and analyzes the potential noise impacts, both temporary (i.e., construction) and long term (i.e., operational), from the implementation of the proposed Green Valley II project ("proposed project"). Data used to prepare this section was taken from various sources, including technical analyses conducted for the project by Impact Sciences Inc. and J.C. Brennan & Associates (**Appendix 4.7**).

4.7.2 ENVIRONMENTAL SETTING

Fundamentals of Sound and Environmental Noise

Sound is technically described in terms of amplitude (loudness) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). The decibel scale is a logarithmic scale that describes the physical intensity of the pressure vibrations that make up any sound. The pitch of the sound is related to the frequency of the pressure vibration. Since the human ear is not equally sensitive to a given sound level at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) provides this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Noise, on the other hand, is typically defined as unwanted sound. A typical noise environment consists of a base of steady ambient noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this background noise is the sound from individual local sources. These can vary from an occasional aircraft or train passing by to virtually continuous noise from, for example, traffic on a major highway. **Table 4.7-1, Representative Environmental Noise Levels**, below, illustrates representative noise levels for the environment.

Several rating scales have been developed to analyze the adverse effect of community noise on people. Since environmental noise fluctuates over time, these scales consider that the effect of noise upon people is largely dependent upon the total acoustical energy content of the noise, as well as the time of day when the noise occurs. Those that are applicable to this analysis are as follows:

- Equivalent Noise Level: L_{eq} represents the average noise level on an energy basis for a specific time period. For example, the L_{eq} for one hour is the energy average noise level during that hour. The average noise level is based on the energy content (acoustic energy) of sound. L_{eq} can be thought of as

a continuous noise level of a certain period equivalent in energy content to a fluctuating noise level of that same period. L_{eq} is expressed in units of dBA.

Table 4.7-1
Representative Environmental Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Threshold of Pain	—140—	Threshold of Pain
Jet Take-off at 300 feet	—125—	
	—110—	Rock Band
Jet Fly-over at 100 feet		
	—100—	
Jackhammer at 45 feet		
Gas Lawnmower at 3 feet		
	—90—	
		Food Blender at 3 feet
Diesel Truck going 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime		
Gas Lawnmower at 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 Area during Daytime	—50—	Dishwasher in Next Room
Quiet Urban Area during Nighttime	—40—	Theater, Large Conference Room (background)
Quiet Suburban Area during Nighttime		
	—30—	Library
Quiet Rural Area during Nighttime		Bedroom at Night, Concert Hall (background)
	—20—	
		Broadcast/Recording Studio
	—10—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

Source: United States Occupational Safety & Health Administration, Noise and Hearing Conservation Technical Manual, 1999, California Department of Transportation, 1998.

- L_{max} – The maximum instantaneous noise level experienced during a given period of time.
- L_{min} – The minimum instantaneous noise level experienced during a given period of time.

- Community Noise Equivalent Level: CNEL is an adjusted noise measurement scale of average sound level during a 24-hour period. Due to increased noise sensitivities during evening and night hours, human reaction to sound between 7:00 P.M. and 10:00 P.M. is as if it were actually 5 dBA higher than had it occurred between 7:00 A.M. and 7:00 P.M. From 10:00 P.M. to 7:00 A.M., humans perceive sound as if it were 10 dBA higher. To account for these sensitivities, CNEL is obtained by adding an additional 5 dBA to evening noise levels between 7:00 P.M. and 10:00 P.M. and 10 dBA to nighttime noise levels between 10:00 P.M. and 7:00 A.M. Because of this, 24-hour CNEL figures are always higher than their corresponding actual 24-hour averages.

- The day-night average sound level (L_{dn}) is another average noise level over a 24-hour period. Noise levels occurring between the hours of 10:00 PM and 7:00 AM are increased by 10 decibels (dB). This noise is weighted to take into account the decrease in community background noise of 10 dBA during this period. Noise levels measured using the Ldn scale are typically similar to CNEL measurements.

Effects of Noise

The degree to which noise can impact an environment ranges from levels that interfere with speech and sleep to levels that can cause adverse health effects. However, human response to noise is subjective and can vary from person to person. Factors that influence individual responses include the intensity, frequency, and pattern of noise; the amount of background noise present before any additional noise; and the nature of work or human activity exposed to the source noise.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day, night, or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL is below 45 dBA, moderate in the 45–60 dBA range, and high above 60 dBA. According to the National Institute of Health (NIH), extended or repeated exposure to sounds at or above 85 decibels can cause hearing loss (NIDCD 2017). Examples of low daytime levels are isolated natural settings with noise levels as low as 20 dBA and quiet suburban residential streets with noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate level noise environments are urban residential or semi-commercial areas (typically 55–60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with more noisy urban residential or residential-commercial areas (60–75 dBA) or dense urban or industrial areas (65–80 dBA).

Audible Noise Changes

Noise metrics provide a means for quantifying public or community response to various noise exposure levels, including but not limited to annoyance or distress (see Table 4.7-1). People with normal hearing

sensitivity can recognize small perceptible changes in sound levels of approximately 3 dBA. Changes of at least 5 dBA can be readily noticeable. Sound level increases of 10 dBA or greater are perceived as a doubling in loudness (FTA 2006).

Noise is most audible when traveling by direct line-of-sight, i.e., an unobstructed visual path between noise source and receptor. Barriers that break line-of-sight between sources and receivers, such as walls and buildings, can greatly reduce source noise levels by allowing noise to reach receivers by diffraction only. Other factors such as the weather and reflecting or shielding also intensify or reduce the noise level at any given location.

In addition, noise levels from a particular source generally decline as distance to the receptor increases. Noise from stationary or point sources is reduced by about 6 dBA for every doubling of distance. Noise levels decrease as the distance from noise source to receiver increases. For each doubling of distance, noise from stationary sources ("point sources") can decrease by approximately 6 dBA over hard surfaces (i.e., reflective surfaces such as parking lots) and 7.5 dBA over soft surfaces (i.e., absorptive surfaces such as soft dirt and grass). For example, if a point source produces a noise level of 89 dBA at a reference distance of 50 feet, the noise level would be approximately 83 dBA at a distance of 100 feet, 77 dBA at 200 feet, etc. Noise generated by mobile sources can decrease by approximately 3 dBA over hard surfaces and 4.5 dBA over soft surfaces for each doubling of distance.

Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA. The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 dBA with closed windows. The exterior-to-interior reduction of newer homes is generally 30 dBA or more.

Fundamentals of Vibration

Characteristics of Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, and acceleration. Unlike noise, vibration is not a common environmental problem, as it is unusual for vibration from vehicular sources to be perceptible. Common sources of vibration include trains, buses, and construction activities.

Vibration Definitions

Peak particle velocity (PPV) can be used to describe vibration impacts to both buildings and humans. PPV represents the maximum instantaneous peak of a vibration signal, and it is usually measured in inches per second (Caltrans 2013a).

Root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on land uses. RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (VdB) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration (FTA 2006).

Effects of Vibration

High levels of vibration may cause physical personal injury or damage to buildings. However, ground-borne vibration levels rarely affect human health. Instead, most people consider ground-borne vibration to be an annoyance that can affect concentration or disturb sleep. Ground-borne vibration can also interfere with certain types of highly sensitive equipment or machines, especially imaging devices used in medical laboratories.

Perceptible Vibration Changes

Unlike noise, ground-borne vibration is not an environmental issue that most people experience every day. Background vibration levels in residential areas are usually well below the threshold of perception for humans, which is around 0.01 inches per second (FTA 2006). Perceptible indoor vibrations are most often caused by sources within buildings themselves, such as slamming doors. Typical outdoor sources of ground-borne vibration include construction equipment, trains, and traffic on rough roads. Traffic vibration from smooth and well-maintained roads is typically not perceptible.

Existing Noise Environment

Vehicular traffic is the dominant source of noise in the vicinity of the project site. J.C. Brennan conducted a continuous 24-hour noise level measurement at the project site on April 4th, 2017. The daytime average was recorded as 57 dBA L_{eq}, and the 24-hour L_{dn} was 62 dBA.[1]

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1 In May 2016 a noise study was prepared for the Rockville Springs development to the east of the project site. The ambient noise monitoring results ranged from approximately 57-63 dBA L_{eq} and between 64-66 dBA L_{dn}. Because the results of the Rockville Springs study and the Green Valley Study consistent, the noise level presented above is considered applicable to the study area in general. Illingworth & Rodkin, Inc. 2016. *Rockville Springs Noise and Vibration Assessment*. May.

Roadway Noise

According to the noise study prepared for the proposed project, the primary noise source to the project vicinity is roadway noise from the Interstate 80 (J.C. Brennan 2018). Other adjacent roadways and light industrial uses were not found to be a contributing factor to the overall noise environment.

Stationary and Area Sources

Stationary and area noise sources include parking lots, mechanical equipment, such as air conditioners and ventilation systems, and landscape maintenance. These noise sources result in environmental effects when they are in proximity of land uses where people are likely to be sensitive to noise.

Noise Sensitive Land Uses

For purposes of this analysis, noise sensitive receptors include residences, places of worship, schools, hospitals, parks, and businesses where there is an expectation of quiet. Sensitive receptors which are at a distance greater than 1,000 feet from the proposed project site are not anticipated to experience increased ambient noise levels resulting from construction or stationary noise sources. The nearest noise sensitive receptors within 1,000 feet of the proposed project are:

- Single-family residences located approximately 260 feet to the northeast of the project site.
- Medical offices located approximately 270 feet to the west of the project site.
- Single-family residences located approximately 730 feet to the northwest of the project site.
- Rockville Terrace senior living facility located approximately 1,000 feet to the southwest of the project site.

4.7.3 REGULATORY FRAMEWORK

4.7.3.1 Federal Laws and Regulations

Currently, no federal noise standards regulate environmental noise associated with short-term construction or the long-term operations of development projects.

Federal Transit Administration

The Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, non-engineered timber and mason buildings can be exposed to ground-borne vibration levels of 0.2 inches per second without experiencing structural damage, while reinforced-

concrete, steel, or timber buildings can be exposed to ground-borne vibration levels of 0.5 inches per second (FTA 2006).

The FTA has also set standard that address the effect of long-term vibration on human annoyance. Ground-borne vibration levels rarely affect human health. Instead, most people consider ground-borne vibration to be an annoyance that may affect concentration or disturb sleep. The 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 measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration. For residential land uses which experience occasional events of ground-borne vibration or noise, the FTA has established a threshold of 75 VdB (FTA 2006). Some commercial buildings, such as auditoriums and theaters have additional vibration and noise annoyance criteria.

4.7.3.2 State Laws and Regulations

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles, sound transmission through buildings, occupational noise exposure, and noise insulation.

The *State of California General Plan Guidelines 2017*, published by the Governor's Office of Planning and Research (2017), provide guidance for the compatibility of projects within areas of specific noise exposure. Acceptable and unacceptable community noise exposure limits for various land use categories have been determined to help guide new land use decisions in California communities (OPR 2017). In many local jurisdictions, these guidelines are used to derive local noise standards and guidance.

California Department of Transportation Vibration Standard

In 2013, the California Department of Transportation (Caltrans) published the Transportation and Construction Vibration Guidance Manual to aid in the estimation and analysis of vibration impacts. Typically, potential building and structural damages are the foremost concern when considering the impacts construction-related vibrations. **Table 4.7-2, Building Damage Vibration Guidelines,** summarizes Caltrans' vibration guidelines for building and structural damage.

Table 4.7-2
Building Damage Vibration Guidelines (PPV)

Structure and Condition	Significance Thresholds (in/sec PPV)	
	Transient Sources	Continuous/Frequent/Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New Residential Structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: California Department of Transportation, 2013

This same manual also contains vibration guidelines for human annoyance potential, summarized in **Table 4.7-3, Human Annoyance Vibration Guidelines (PPV).**

Table 4.7-3
Human Annoyance Vibration Guidelines (PPV)

Human Response	Significance Thresholds (in/sec PPV)	
	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

Source: California Department of Transportation, 2013

4.7.3.3 Local Plans and Policies

City of Fairfield General Plan

The following presents guiding and implementing policies from the current City of Fairfield General Plan relevant to noise and contained within the Health and Safety Element (2013).

Objective HS 9 Protect the citizens of Fairfield from the harmful and annoying effects of excessive noise and protect the City's economic base by preventing incompatible land uses from encroaching upon existing or planned noise producing uses.

Policy HS 9.1 Ground transportation noise: The compatibility of proposed projects with existing and future noise levels due to ground transportation noise sources shall be evaluated by comparison to Table HS-1 [**Table 4.7-4**] where the existing or future noise level from ground transportation noise sources is determined to exceed the standards of Table HS-1. Noise levels in outdoor activity areas and interior spaces shall be mitigated to the levels shown in Table HS-1.

Table 4.7-4
Maximum Allowable Noise Exposure to Ground Transportation Noise Sources

Land Use	Outdoor Activity Areas[1] L_{dn}/CNEL, dB	Interior Spaces L_{dn}/CNEL, dB	Interior Spaces L_{eq}, dB[2]
Residential	60[3]	45	--
Transient Lodging	60[3]	45	--
Hospitals and Nursing Homes	60[3]	45	--
Theaters, Auditoriums and Music Halls	--	--	35
Churches and Meeting Halls	60[3]	--	40
Office Buildings	--	--	45
Schools, Libraries and Museums	--	--	45
Playgrounds and Neighborhood Parks	70	--	--

Source: City of Fairfield General Plan, Health and Safety Element, Table HS-1, 2004.
1. Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.
2 As determined for a typical worst-case hour during periods of use.
3 Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Policy HS 9.4 Non-transportation noise: New development of noise sensitive land uses shall not be allowed where the noise level due to non-transportation noise sources will exceed the standards of Table HS-2 [**Table 4.7-5**]. Where noise sensitive land uses are proposed in areas exposed to existing or projected exterior non-transportation noise levels exceeding the performance standards of Table HS-2, an acoustical analysis shall be required so that noise mitigation may be included in the project design.

Table 4.7-5
Maximum Allowable Noise Exposure to Non-Transportation Noise Sources

Land Use	Noise Level Descriptor	Exterior Noise Level		Interior Noise Level	
		Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Residential	Leq	50	45	40	35
	Lmax	70	65	60	55
Transient Lodging, Hospitals and Nursing Homes	Leq	--	--	40	35
	Lmax	--	--	60	55
Theaters, Auditoriums and Music Halls	Leq	--	--	35	35
Churches and Meeting Halls	Leq	--	--	40	40
Office Buildings	Leq	--	--	45	--
Schools, Libraries and Museums	Leq	--	--	45	--
Playgrounds and Parks	Leq	65	--	--	--

Source: City of Fairfield General Plan, Health and Safety Element, Table HS-2, 2004.
Notes: Each of the noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwelling).

Policy HS 9.5 All acoustical analyses required by the Noise Component of the Health and Safety Element shall:

- Be the responsibility of the applicant.
- Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.
- Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.
- Estimate existing and projected (20 years) noise levels in terms of Ldn and/or the standards of Table HS-2, and compare those levels to the policies of this Element.
- Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of this Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms in terms of possible sleep disturbance.
- Estimate noise exposure after the prescribed mitigation measures have been implemented.

- Describe a post-project assessment program which could be used to evaluate the effectiveness of the proposed mitigation measures.

Policy HS 9.6 The City shall utilize procedures for project review and issuance of building permits to ensure that noise mitigation measures identified in an acoustical analysis are implemented in the project design.

Policy HS 9.7 The City shall require monitoring of compliance with the standards of the Noise Element after completion of projects where noise mitigation measures have been required.

Policy HS 9.11 The City shall require all development projects to mitigate noise impacts associated with construction activities.

Policy HS 9.12 The City shall enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC).

City of Fairfield Municipal Code

The City of Fairfield Municipal Code provides the following standards related to noise that are applicable to the proposed project.

Section 25.1403 Noise Standards

It is unlawful for any person to create any noise at any location in the City of Fairfield that results in the exposure to other properties in the vicinity that exceeds the levels of Table 25.1401 (**Table 4.7-5**), except as otherwise provided for in this ordinance.

Section 25.1404 Specific Prohibitions

No person shall do, cause or suffer or permit to be done on any premises owned, occupied or controlled by such person, any of the following acts:

- Construction activities – Operating or permitting the operation of any tools or equipment used in construction, grading or demolition works between the hours of 10:00 p.m. and 7:00 a.m. except by written permission of the Director of Public Works.
- Large vehicle delivery and loading – The loading, unloading or delivery of goods, merchandise, vehicles or supplies by large trucks, tractor-trailers, or other similar vehicles between the hours of 10:00 p.m. and 7:00 a.m. adjacent to a residential use, where such activities would exceed the Lmax thresholds of Table 25.1401 [**Table 4.7-5**].

Section 25.1405 Exemptions

Sound or noise emanating from the following sources and activities are exempt from the provisions of this ordinance:

A. Sound sources typically associated with residential uses (e.g. children at play, air conditioning and similar equipment, but not including barking dogs).

B. Sound sources associated with property maintenance (e.g., lawn mowers, edgers, blowers, pool pumps, power tools, etc.) provided such activities take place between the hours of 7:00 a.m. and 10:00 p.m.

C. Safety, warning and alarm devices, including house and car alarms, and other warning devices that are designed to protect the health, safety and welfare, provided such devices are not negligently maintained or operated.

D. The normal operation of public and private schools typically consisting of classes and other school-sponsored activities, such as school bands and school athletic events.

E. Emergencies, involving the execution of the duties of duly authorized governmental personnel and others providing emergency response to the general public, including but not limited to sworn peace officers, emergency personnel, utility personnel, and the operation of emergency response vehicles and equipment.

F. Tree, park, and golf course maintenance activities conducted by the City or a City contractor.

G. Any activity related to the construction, development, manufacture, maintenance, testing or operation of any aircraft engine, or of any weapons system or subsystems which are owned, operated or under the jurisdiction of the United States.

H. Any other activity to the extent regulation thereof has been preempted by state or federal law or regulations.

Section 25.1407 Non-Transportation Noise

Noise created by new non-transportation noise sources shall be mitigated so as not to exceed the interior and exterior noise level standards of Table 25.1401 [**Table 4.7-5**]. Where a proposed project includes non-transportation noise sources that are likely to produce noise levels exceeding the performance standards of Table 25.1401 or where a proposed project is likely to be exposed to existing non-transportation noise sources exceeding the standards of Table 25.1401, an acoustical analysis shall be required so that noise mitigation may be included in the project design.

Section 25.1408 Ground Transportation

The compatibility of proposed projects with existing and future noise levels due to ground transportation noise sources shall be evaluated in comparison with Table 25.1402 [**Table 4.7-4**]. Where a proposed project is likely to be exposed to ground transportation noise sources exceeding the performance standards of Table 25.1402, an acoustical analysis shall be required so that noise mitigation may be included in the project design.

Section 25.1410 Special Standards for New Mixed Use Projects

Where a new development proposal includes a mix of residential and nonresidential uses within the same project, the exterior non-transportation daytime noise standard for the residential component of the project shall be increased by 5 decibels.

4.7.4 IMPACTS AND MITIGATION MEASURES

4.7.4.1 Significance Criteria

In accordance with Appendix G of the *California Environmental Quality Act (CEQA) Guidelines*, the impacts of the proposed project related to noise and vibration would be considered significant if the project would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Generation of excessive groundborne vibration or groundborne noise levels;
- For a project located 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 project area to excessive noise levels;

Vibration Thresholds

A significant vibration impact would occur if estimated vibration levels exceed the standards listed in **Table 4.7-2** or **4.7-3** during either construction or operation of the proposed project.

Operational Noise Thresholds

Operational noise thresholds consider both the City's transportation noise exposure limits identified in **Table 4.7-4** and non-transportation noise exposure limits for sensitive uses identified in **Table 4.7-5**, and

community response to changes in noise levels. Off-site noise-sensitive uses in the vicinity of the project site include residences and medical facilities.

Non-Transportation-related Noise

A significant non-transportation-related noise impact would occur if exterior locations at nearby residential uses were to experience non-transportation noise levels above 50 L_{eq} and 70 L_{max} between 7 AM and 10 PM and 45 L_{eq} and 65 L_{max} between 10 PM and 7 AM due to the proposed project.

Transportation-related Noise

Changes in noise levels of less than 3 dBA are typically not noticed by the human ear. Changes from 3 to 5 dBA would be noticed by some individuals who are sensitive to changes in noise. A 5 dBA increase is readily noticeable. Based on this information, the following thresholds were used in this EIR to evaluate the significance of the project-related transportation noise increases:

- An increase of 5 dBA or greater in noise level that occurs from project-related traffic would be considered significant where existing or projected future traffic noise levels are less than 60 dBA.
- An audible increase of 3 dBA or greater in noise level that occurs from project-related traffic would be considered significant where existing or projected future traffic noise levels are 60 dBA Ldn or greater.

Construction Noise Thresholds

The City of Fairfield Municipal Code exempts construction-generated noise that occurs between the hours of 7:00 a.m. to 10:00 p.m. from applicable noise standards. The City directs construction activities to avoid the more noise sensitive hours (e.g., evening, nighttime, early morning) and to ensure construction equipment is equipped with noise control devices. This helps reduce the level of disturbance attributable to construction noise. Regardless, noise levels from construction sources could cause substantial temporary increase in the ambient noise environment at nearby noise sensitive receptors. For the purpose of this analysis, construction activity which results in a readily noticeable ambient noise increase of 5 dBA or greater as compared to existing conditions would be considered a significant impact.

4.7.4.2 Methodology

Noise levels associated with project-related construction activities were calculated using the FHWA Roadway Construction Noise Model (RCNM) and combined with existing ambient noise level readings to determine new ambient noise levels with construction activities.

Noise from stationary sources includes noise generated by residential activity, such as heating, ventilation, and air conditioning (HVAC), and on-site parking noise. Average noise levels for such activities were compared to the daytime existing ambient sound level reading of 57 dBA L_{eq} (J.C. Brennan 2018) to provide a worst-case scenario sound level increase.

Traffic noise in the project area was modeled using average daily traffic (ADT) which was derived by averaging peak hour counts from the project's transportation impact assessment (Fehr & Peers 2019) and applying a growth multiplier of 10. These average daily traffic volumes were compared to existing conditions to determine whether traffic increased enough to result in an audible noise level increase.

4.7.4.3 Project Impacts and Mitigation Measures

Impact NOI-1: **The proposed project would generate increased traffic in the project vicinity but the increase in traffic would not generate a substantial permanent increase in ambient noise levels at off-site sensitive receptors in the project vicinity in excess of standards established in the local general plan or noise ordinance. (*Less than Significant*)**

Traffic Noise

Operation of proposed project would result in a traffic volume increase of approximately 15 percent over existing conditions during the existing plus project scenario at Business Center Drive, between NorthBay Driveway and Neitzel Road, which is the street segment most affected by operation of the proposed project. Future plus project traffic volumes would increase approximately 77 percent as compared to existing conditions and the future plus project traffic volumes would increase approximately three percent as compared to the cumulative baseline (without project).

According to Caltrans, an audible increase in traffic noise (3 dBA) requires an approximate doubling of traffic volumes (Caltrans 2013b). Because traffic volumes are not anticipated to double under any scenario, it is not anticipated that there would be an audible increase in traffic noise. A significant increase in traffic noise in the project vicinity would be 3 dBA. Because the project would not result in a 3 dBA or greater increase in traffic noise, this impact is considered less than significant.

Mitigation Measures: No mitigation measures are required.

Impact NOI-2: **The proposed project would add new stationary and area noise sources to the project site but noise from these new noise sources would not generate a**

substantial permanent increase in ambient noise levels at off-site sensitive receptors in the project vicinity in excess of standards established in the local general plan or noise ordinance. (*Less than Significant)*

Heating, Ventilation, and Air Conditioning

HVAC systems would typically result in noise levels that average between 50 and 70 dBA L_{eq} at 50 feet from the equipment. Thus, the noise levels from these HVAC systems would result in noise levels of approximately 56 dBA Leq at the nearest off-site sensitive receptors located approximately 260 feet from the project site. As discussed above, ambient noise measurements at the project site show a daytime noise level of 57 dBA L_{eq}. When added to existing ambient noise levels, this results in a noise level increase of approximately 2.4 dBA L_{eq}. As a result, noise levels from the HVAC system operation is not anticipated to result in an audible increase in ambient noise levels. Additionally, as described above and in Section 25.1405 of the Fairfield Municipal Code, sound sources associated with residential uses, such as air conditioning and similar equipment, are exempt from provisions presented in the Fairfield Municipal Code. Because noise generated by HVAC systems would not exceed the ambient sound levels and is exempt from the standards presented in the Fairfield Municipal Code, this impact would be less than significant.

Mitigation Measures: No mitigation measures are required.

Impact NOI-3: **Implementation of the proposed project would generate a substantial temporary increase in ambient noise levels at off-site sensitive receptors in the project vicinity in excess of standards established in the local general plan or noise ordinance. (*Less than Significant with Mitigation Incorporated*)**

On-Site Construction Equipment and Activities

Construction, ground clearing, grading, structural, and other noise-generating activities would occur between 7:00 AM and 10:00 PM in accordance with the Fairfield Municipal Code. Construction activities would vary over several phases of development and would include off-road larger equipment such as tractors, loaders, and smaller equipment such as saws, hammers, and pneumatic tools. Construction of the both project alternatives are estimated to take place over approximately two years beginning in the winter of 2019 and continuing through the winter of 2021.

Land uses on the properties surrounding the project site include residential and medical uses. Construction noise would generally peak during site preparation and grading, where noise generating construction equipment could produce a cumulative 85 dBA at 50 feet of distance. As discussed above, sound typically attenuates by approximately 6 dBA for every doubling of distance. In the absence of mitigating sound attenuation measures, construction activities would generate maximum off-site noise levels of up to 73.9 dBA at the residences to the northeast of the project site, an increase of up to approximately 17 dBA.

Because construction activities would elevate ambient noise levels by more than 5 dBA at one or more of the adjacent sensitive receptors, mitigation measures **MM NOI-1** through **MM NOI-5** are required to reduce construction noise level increases to less than 5 dBA. Construction of the proposed project would result in a potentially significant construction noise impact related to on-site construction equipment noise.

Off-Site Haul Trucks

Trucks removing debris and soil or delivering construction materials to and from the project site during construction have the potential to generate increased noise levels at off-site sensitive receptors. However, because of the proximity of the project site to the Interstate 80 (I-80), haul trucks are not anticipated to pass nearby sensitive land uses prior to accessing I-80. As a result, nearby sensitive off-site land uses are not anticipated to be exposed to increased ambient noise levels due to passing haul trucks. This impact is considered less than significant.

Mitigation Measures: Mitigation measures **MM NOI-1** through **MM NOI-5** are required to reduce ambient noise levels during construction.

MM NOI-1 The construction contractor shall ensure that noise and groundborne vibration construction activities whose specific location on the site may be flexible (e.g., operation of compressors and generators, cement mixing, general truck idling) shall be conducted as far as possible from the nearest noise- and vibration-sensitive land uses, and natural and/or manmade barriers (e.g., intervening construction trailers) shall be used to screen propagation of noise from such activities towards these land uses . These activities shall be located in the southeast quadrant of the project site, as feasible.

MM NOI-2 The construction contractor shall ensure that barriers such as plywood structures or flexible sound control curtains shall be erected between the proposed project and adjacent sensitive receptors to minimize the amount of noise during construction. These temporary sound barriers shall be capable of achieving a sound attenuation of at least

12 dBA and block the line-of-sight between the project site and these adjacent land uses. This specification shall be included on all project plans.

MM NOI-3 The construction contractor shall ensure the use of power construction equipment with state-of-the-art noise shielding and muffling devices capable of attenuating sound by 3 dBA or more. This specification shall be included on all project plans.

MM NOI-4 The construction staging area shall be as far from sensitive receptors as possible. Staging shall occur in the southeast quadrant of the project site, as feasible.

MM NOI-5 The construction contractor shall ensure that no less than two weeks prior to commencement of construction, notification shall be provided to the off-site residential, school, and church uses within 500 feet of the project site that discloses the construction schedule, including the types of activities and equipment that would be used throughout the duration of the construction period. Contact information shall also be posted where readily visible to the public.

Significance after Mitigation: Less than significant

Impact NOI-4: Implementation of the proposed project would not generate excessive groundborne vibration or groundborne noise levels. (*Less than Significant*)

Construction Vibration

For construction-generated vibration to result in damage to buildings, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. A conservative vibration limit of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where damage to the structure is a major concern. For the purposes of this analysis, therefore, it was assumed that groundborne vibration levels exceeding the conservative 0.3 in/sec PPV limit would have the potential to result in cosmetic damage to standard buildings.

Project construction activities, such as the use of jackhammers and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. **Table 4.7-6, Vibration Levels for Construction Equipment**, presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet.

Table 4.7-6
Vibration Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_{vl} at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.518	112
	Typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	Typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Federal Transit Administration. May 2006. Transit Noise and Vibration Impact Assessment. Table 12-2.
Notes: L_v = Velocity Level

As shown in **Table 4.7-7, Vibration Source Levels for Construction Equipment**, vibration velocities could range from 0.003 to 0.644 inch/sec peak particle velocity (PPV) at 25 feet from the source activity, with corresponding vibration levels (VdB) ranging from 58 VdB to 104 VdB at 25 feet from the source activity, depending on the type of construction equipment in use.

Table 4.7-7
Vibration Source Levels for Construction Equipment

	Approximate PPV (in/sec)					Approximate RMS (VdB)				
Equipment	25 Feet	50 Feet	60 Feet	75 Feet	100 Feet	25 Feet	50 Feet	60 Feet	75 Feet	100 Feet
Impact Pile Driver	0.644	0.228	0.173	0.124	0.081	104	95	93	90	86
Sonic Pile Driver	0.170	0.060	0.046	0.033	0.021	93	84	82	79	75
Large Bulldozer	0.089	0.031	0.024	0.017	0.011	87	78	76	73	69
Caisson Drilling	0.089	0.031	0.024	0.017	0.011	87	78	76	73	69
Loaded Trucks	0.076	0.027	0.020	0.015	0.010	86	77	75	72	68
Jackhammer	0.035	0.012	0.009	0.007	0.004	79	70	68	65	61
Small Bulldozer	0.003	0.001	0.0008	0.0006	0.0004	58	49	47	44	40

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

As noted above, the nearest sensitive receptors to the project site are located approximately 260 feet to the northeast. At that distance, no construction equipment, including pile driving, would exceed the vibration limit of 0.3 in/sec PPV. As no impact pile driving is expected on the project site, vibration levels are also not expected to exceed the human annoyance threshold of 0.04 in/sec PPV. Therefore, implementation of the proposed project would not expose persons to or generate excessive groundborne vibration or groundborne noise levels, and this impact would be less than significant.

Operational Vibration

During operation of the proposed project, there would not be significant stationary sources of ground-borne vibration, such as heavy equipment operations. Operational ground-borne vibration in the project vicinity would be generated by vehicular travel on the local roadways. Vehicles traveling on paved roads rarely create enough groundborne vibration to be perceptible to humans unless the road surface is poorly maintained and there are potholes or bumps. If traffic, typically heavy trucks, induces perceptible vibration in buildings, such as window rattling or shaking of small loose items, then it is most likely an effect of low-frequency airborne noise or ground characteristics. Project-related traffic would expose residential land uses during long-term operation to a vibration levels that are unlikely to be perceptible to humans and would be considered less than significant.

Mitigation Measures: No mitigation measures are required.

4.7.4.4 Cumulative Impacts and Mitigation Measures

Cumulative Impact C-NOI-1: Cumulative development would generate increased traffic, these increases in traffic would not cause a substantial permanent increase in noise levels at off-site locations. (*Less than Significant)*

Traffic Noise

As discussed under **Impact NOI-1**, above, operation of proposed project would result in a traffic volume increase of approximately 77 percent during the future plus project scenario as compared to existing conditions. The future plus project traffic volumes would increase approximately three percent as compared to the cumulative baseline.

According to Caltrans, an audible increase in traffic noise (3 dBA) requires an approximate doubling of traffic volumes (Caltrans 2013b). Because traffic volumes are not anticipated to double under any scenario, it is not anticipated that there would be an audible increase in traffic noise. A significant

increase in traffic noise in the project vicinity would be 3 dBA. Because the project would not result in a 3 dBA or greater increase in traffic noise, this impact is considered less than significant.

HVAC Noise

Cumulative noise from on-site stationary HVAC equipment, when combined with HVAC equipment from nearby related project sites, may increase ambient noise to distinctly audible levels at nearby sensitive receptors. However, as described above and in Section 25.1405 of the Fairfield Municipal Code, sound sources associated with residential uses, such as air conditioning and similar equipment, are exempt from provisions presented in the Fairfield Municipal Code. Because noise generated by HVAC systems is exempt from the standards presented in the Fairfield Municipal Code, this impact would be less than significant.

On-Site Construction Noise

There is a proposed construction project located directly east of the proposed project. Both the Rockville Springs noise analysis (Illingworth & Rodkin, 2016) and also this analysis for the proposed project identify the same worst-case sensitive receptor located just to the northeast of the project site near the intersection of Business Center Drive and Lincoln Highway. This receptor is located approximately 260 feet from the proposed project and 140 feet from the related project to the east. This receptor would experience the worst-case cumulative construction noise levels.

If the proposed project construction occurs at the same time as the Rockville Springs project site, the combined noise level would be slightly elevated as compared to if each project occurred simultaneously. The Rockville Springs studies identifies a worst-case construction noise level of approximately 79 dBA L_{eq} and the proposed project would produce a worst-case construction noise level of approximately 74 dBA L_{eq}. Assuming that the worst-case sensitive receptor has an ambient noise level of approximately 57 dBA L_{eq}, the maximum combined noise level could reach up to approximately 80.2 dBA L_{eq}.

MM NOI-1 through **MM NOI-5**, above, represent the best available control measures to mitigate construction noise level impacts. The Rockville springs study identifies similar mitigation measures, including the construction of a sound attenuating wall. The study does not quantify the mitigation measures, however if it is assumed that the noise reduction would be similar to that of the proposed project, the ambient noise level during construction could reach levels of up to approximately 66 dBA L_{eq} with an increase of approximately 9 dBA L_{eq} as compared to existing conditions. This noise level would be exceed the standard above set at 5 dBA. However, both the project and the Rockville Springs project have identified the implementation of the best available mitigation which can be feasibly implemented. As a result, this impact is considered less than significant.

Off-Site Haul Trucks

Trucks removing debris and soil or delivering construction materials to and from the project site during construction have the potential to generate increased noise levels at off-site sensitive receptors. However, because of the proximity of the project site to the Interstate 80 (I-80), haul trucks are not anticipated to pass nearby sensitive land uses prior to accessing I-80. As a result, nearby sensitive off-site land uses are not anticipated to be exposed to increased ambient noise levels due to passing haul trucks. The nearest related project, Rockville Springs, is also located in near proximity to the I-80 and haul trucks are not anticipated to pass nearby sensitive receptors or land uses. This impact is considered less than significant.

Construction Vibration

As noted above, the nearest sensitive receptors to the project site are located approximately 260 feet to the northeast, and located approximately 140 feet from the Rockville Springs project site. At these distances, no construction equipment, including pile driving, would exceed the vibration limit of 0.3 in/sec PPV. As no impact pile driving is expected on the project site, vibration levels are also not expected to exceed the human annoyance threshold of 0.04 in/sec PPV. The Rockville Springs analysis has also determined that project construction would not generate significant vibration impacts Therefore, implementation of the proposed project, and nearby related projects, would not expose persons to or generate excessive groundborne vibration or groundborne noise levels, and this impact would be less than significant.

Operational Vibration

During operation of the proposed project and the nearest related project, Rockville Springs, there would not be significant stationary sources of ground-borne vibration, such as heavy equipment operations. Operational ground-borne vibration in the project vicinity would be generated by vehicular travel on the local roadways. Vehicles traveling on paved roads rarely create enough groundborne vibration to be perceptible to humans unless the road surface is poorly maintained and there are potholes or bumps. If traffic, typically heavy trucks, induces perceptible vibration in buildings, such as window rattling or shaking of small loose items, then it is most likely an effect of low-frequency airborne noise or ground characteristics. Cumulative traffic would expose residential land uses during long-term operation to a vibration levels that are unlikely to be perceptible to humans and would be considered less than significant.

Mitigation Measures: No mitigation measures are required.

4.7.5 REFERENCES

California Department of Transportation (Caltrans). 2013a. *Transportation and Construction Vibration Guidance Manual.* September.

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