Noise Impact Assessment

Oakmont Park Tributary Rehabilitation Project

Redlands, California

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LIST OF ACRONYMS AND ABBREVIATIONS

City	City of Redlands
CNEL	Community Noise Equivalent Level
dB	Decibel
dBA	Decibel is A-weighted
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HDR	High Density Residential
Hz	Hertz
L_{dn}	Day/Night noise level
L_{eq}	Equivalent noise level
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
PPV	Peak particle velocity
Project	Oakmont Park Tributary Rehabilitation Project

LIST OF ACRONYMS AND ABBREVIATIONS

RMS	Root mean square
WEAL	Western Electro-Acoustic Laboratory, Inc.

1.0 INTRODUCTION

This report documents the results of a Noise Impact Assessment completed for the Oakmont Park Tributary Rehabilitation Project (Project), which includes proposing drainage and erosion control improvements in the Live Oak Canyon Creek located in Redlands, California. This report was prepared as a comparison of predicted Project noise levels to noise standards promulgated by the City of Redlands (City) General Plan Healthy Community Chapter and the City's Municipal Code. The purpose of this report is to estimate Project-generated noise and to determine the level of impact the Project would have on the environment.

1.1 Project Location and Description

The Project site is located in Live Oak Canyon Creek adjacent to Sutherland Drive and the Oak Ridge Trail parking lot in the City of Redlands. The Project consists of drainage and erosion control improvements on approximately 600 linear feet of creek bank that has slowly eroded over time. The proposed improvements would close the gap between the creek bed and Live Oak Canyon Road, protect the existing trail system and recreational areas of Oakmont Park, improve bank stability, and protect native vegetation. The Project site is bounded by Sutherland Drive to the north with residences beyond, undeveloped land to the east and south, and the Oak Ridge Trail parking lot to the west with residences beyond.

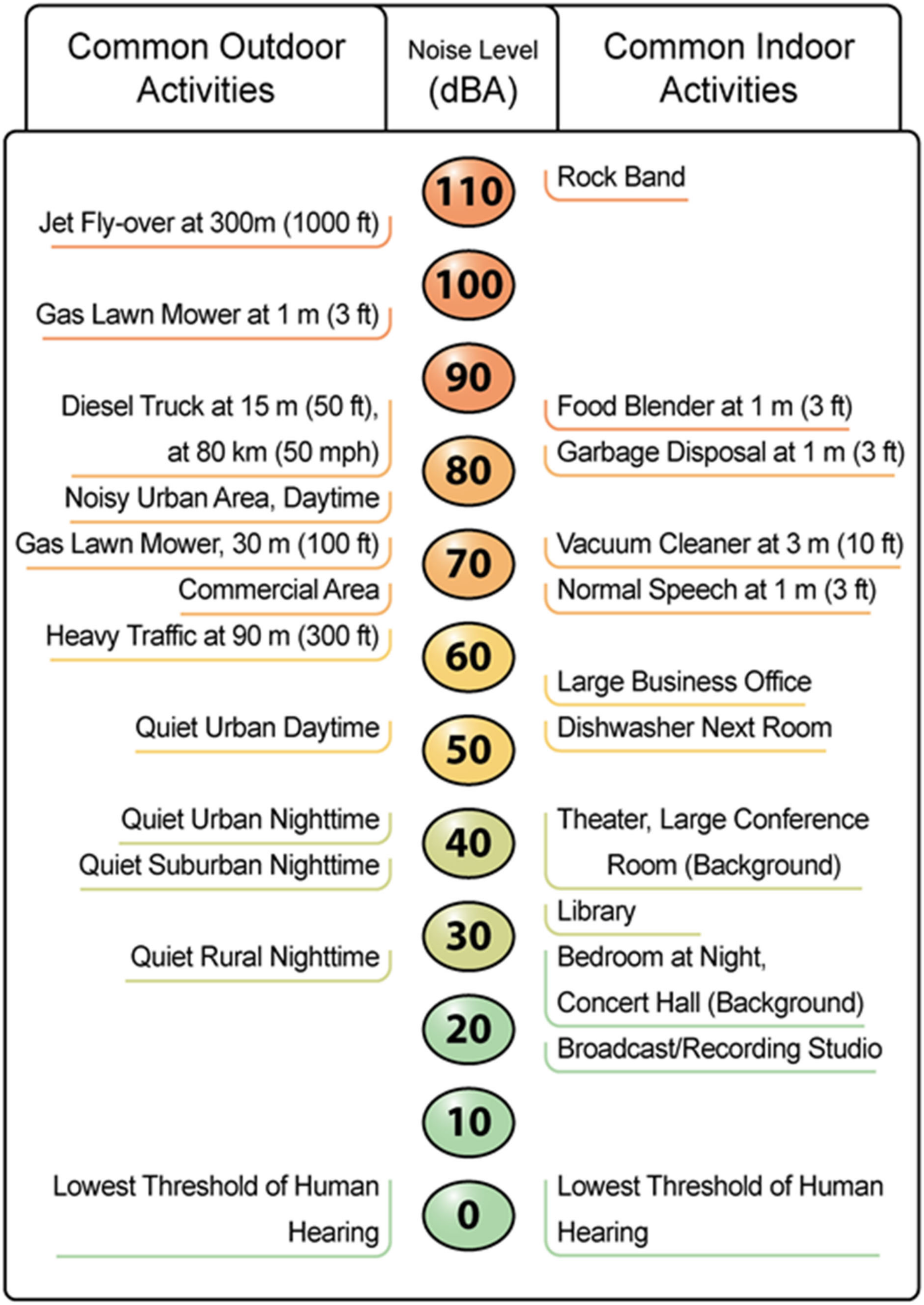
2.0 ENVIRONMENTAL NOISE AND GROUNDBORNE VIBRATION ANALYSIS

2.1 Fundamentals of Noise and Environmental Sound

2.1.1 Addition of Decibels

The decibel (dB) scale is logarithmic, not linear; therefore, sound levels cannot be added or subtracted through ordinary arithmetic. Two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted (dBA), an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound and twice as loud as a 60-dBA sound. When two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be three dB higher than one source under the same conditions (Federal Transit Administration [FTA] 2018). For example, a 65-dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by three dB). Under the decibel scale, three sources of equal loudness together would produce an increase of five dB.

Typical noise levels associated with common noise sources are depicted on Figure 1. *Common Noise Levels*.



Source: California Department of Transportation (Caltrans) 2020a

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Figure 1. Common Noise Levels
Oakmont Park Tributary Rehabilitation

2.1.2 Sound Propagation and Attenuation

Noise can be generated by a number of sources including mobile sources such as automobiles, trucks, and airplanes, and stationary sources such as construction sites, machinery, and industrial operations. Sound spreads (propagates) uniformly outward in a spherical pattern, and the sound level decreases (attenuates) at a rate of approximately six dB for each doubling of distance from a stationary or point source. Sound from a line source, such as a highway, propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately three dB for each doubling of distance from a line source, such as a roadway, depending on ground surface characteristics (Federal Highway Administration [FHWA] 2011). No excess attenuation is assumed for hard surfaces like a parking lot or a body of water. Soft surfaces, such as soft dirt or grass, can absorb sound, so an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. For line sources, an overall attenuation rate of three dB per doubling of distance is assumed (FHWA 2011).

Noise levels may also be reduced by intervening structures; generally, a single row of detached buildings between the receptor and the noise source reduces the noise level by about five dBA (FHWA 2008), while a solid wall or berm generally reduces noise levels by 10 to 20 dBA (FHWA 2011). However, noise barriers or enclosures specifically designed to reduce site-specific construction noise can provide a sound reduction of 35 dBA or greater (Western Electro-Acoustic Laboratory, Inc. [WEAL] 2000). To achieve the most potent noise-reducing effect, a noise enclosure/barrier must physically fit in the available space, must completely break the "line of sight" between the noise source and the receptors, must be free of degrading holes or gaps, and must not be flanked by nearby reflective surfaces. Noise barriers must be sizable enough to cover the entire noise source and extend lengthwise and vertically as far as feasibly possible to be most effective. The limiting factor for a noise barrier is not the component of noise transmitted through the material, but rather the amount of noise flanking around and over the barrier. In general, barriers contribute to decreasing noise levels only when the structure breaks the line of sight between the source and the receiver.

The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows (Caltrans 2002). The exterior-to-interior reduction of newer residential units is generally 30 dBA or more (Harris Miller, Miller & Hanson Inc. [HMMH] 2006). Generally, in exterior noise environments ranging from 60 dBA Community Noise Equivalent Level (CNEL) to 65 dBA CNEL, interior noise levels can typically be maintained below 45 dBA, a typically residential interior noise standard, with the incorporation of an adequate forced air mechanical ventilation system in each residential building, and standard thermal-pane residential windows/doors with a minimum rating of Sound Transmission Class (STC) 28. (STC is an integer rating of how well a building partition attenuates airborne sound. In the U.S., it is widely used to rate interior partitions, ceilings, floors, doors, windows, and exterior wall configurations.) In exterior noise environments of 65 dBA CNEL or greater, a combination of forced-air mechanical ventilation and sound-rated construction methods is often required to meet the interior noise level limit. Attaining the necessary noise reduction from exterior to interior spaces is readily achievable in noise environments less than 75 dBA CNEL with proper wall construction techniques following California Building Code methods, the selections of proper windows and doors, and the incorporation of forced-air mechanical ventilation systems.

2.1.3 Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise include the average hourly noise level (in L_{eq}) and the average daily noise levels/community noise equivalent level (in L_{dn}/CNEL). The L_{eq} is a measure of ambient noise, while the L_{dn} and Community Noise Equivalent Level (CNEL) is a measurement of community noise. Each is applicable to this analysis and defined as follows:

- **Equivalent Noise Level (L_{eq})** is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- **Day-Night Average (L_{dn})** is a 24-hour average L_{eq} with a 10-dBA "weighting" added to noise during the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
- **Community Noise Equivalent Level (CNEL)** is a 24-hour average L_{eq} with a 5-dBA weighting during the hours of 7:00 pm to 10:00 pm and a 10-dBA weighting added to noise during the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the evening and nighttime, respectively.

Table 2-1 provides a list of other common acoustical descriptors.

Table 2-1. Common Acoustical Descriptors

Descriptor	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micropascals (or 20 micronewtons per square meter), where one pascal is the pressure resulting from a force of one newton exerted over an area of one square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micropascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded one percent, 10 percent, 50 percent, and 90 percent of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	A 24-hour average L_{eq} with a 10 dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
Community Noise Equivalent Level, CNEL	A 24-hour average L_{eq} with a five dBA "weighting" during the hours of 7:00 p.m. to 10:00 p.m. and a 10 dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.7 dBA CNEL.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.

The dBA sound level scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about ± one dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends on the distance between the receptor and the noise source. Close to the noise source, the models are accurate to within about ± one to two dBA.

2.1.4 Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day or night or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA. 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 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with noisier urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA). Regarding increases in dBA noise levels, the following relationships should be noted in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of one dBA cannot be perceived by humans.
- Outside of the laboratory, a three-dBA change is considered a just-perceivable difference.
- A change in level of at least five dBA is required before any noticeable change in community response would be expected. An increase of five dBA is typically considered substantial.
- A 10-dBA change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

2.1.5 Effects of Noise on People

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard that is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources.

2.2 Fundamentals of Environmental Groundborne Vibration

2.2.1 Vibration Sources and Characteristics

Sources of earthborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or manmade causes (explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions).

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the peak particle velocity (PPV), another is the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration.

Table 2-2 displays the reactions of people and the effects on buildings produced by continuous vibration levels. The annoyance levels shown in the table should be interpreted with care since vibration may be found to be annoying at much lower levels than those listed, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high-noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Ground vibration can be a concern in instances where buildings shake and substantial rumblings occur. However, it is unusual for vibration from typical urban sources such as buses and heavy trucks to be perceptible. For instance, heavy-duty trucks generally generate groundborne vibration velocity levels of 0.006 PPV at 50 feet under typical circumstances, which as identified in Table 2-2 is considered very unlikely to cause damage to buildings of any type. Common sources for groundborne vibration are planes, trains, and construction activities such as earth moving, which requires the use of heavy-duty earthmoving equipment.

Table 2-2. Human Reaction and Damage to Buildings for Continuous or Frequent Intermittent Vibration Levels

PPV (inches/second)	Approximate Vibration Velocity Level (VdB)	Human Reaction	Effect on Buildings
0.006–0.019	64–74	Range of threshold of perception	Vibrations unlikely to cause damage of any type
0.08	87	Vibrations readily perceptible	Recommended upper level to which ruins and ancient monuments should be subjected
0.1	92	Level at which continuous vibrations may begin to annoy people, particularly those involved in vibration sensitive activities	Virtually no risk of architectural damage to normal buildings
0.2	94	Vibrations may begin to annoy people in buildings	Threshold at which there is a risk of architectural damage to normal dwellings
0.4–0.6	98–104	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Architectural damage and possibly minor structural damage

Source: Caltrans 2020b

For the purposes of this analysis, a PPV descriptor with units of inches per second is used to evaluate construction-generated vibration for building damage and human complaints.

3.0 EXISTING ENVIRONMENTAL NOISE SETTING

3.1 Noise Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as hospitals, historic sites, cemeteries, and certain recreation areas are considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

As stated previously, the Project is proposing drainage and erosion control improvements on a segment of stream bank in Live Oak Canyon Creek. The nearest noise-sensitive receptors to the Project site are residences located on Sutherland Drive with the closest being approximately 70 feet distant from the northern Project site boundary.

3.2 Existing Ambient Noise Environment

Redlands is impacted by various noise sources. It is subject to typical urban noise such as noise generated by traffic, heavy machinery, and day-to-day outdoor activities. Mobile sources of noise, especially cars and trucks, are the most common source of noise in the community. Other sources of noise are the various land uses (i.e., residential, commercial, institutional, and recreational and park activities) throughout the city that generate stationary-source noise. The Redlands Municipal Airport is located approximately 5 miles north of the Project site.

As previously described, the Project site is located within a segment of Live Oak Canyon Creek. The site is generally bounded by Sutherland Drive to the north with residences beyond, undeveloped land to the east and south, and the Oak Ridge Trail parking lot to the west with residences beyond. In order to quantify existing ambient noise levels in the Project area, ECORP Consulting, Inc. conducted four short-term noise measurements on April 29, 2021. The noise measurement sites were representative of typical existing noise exposure within and immediately adjacent to the Project site (see Attachment A). The 10-minute measurements were taken between 11:40 a.m. and 12:59 p.m. Short-term (L_{eq}) measurements are considered generally representative of the noise levels throughout the daytime. The average noise levels and sources of noise measured at each location are listed in Table 3-1.

Table 3-1. Existing (Baseline) Noise Measurements

Location Number	Location	L_{eq} dBA	L_{min} dBA	L_{max} dBA	Time
1	North of Live Oak Canyon Road on road shoulder.	**62.6**	29.7	81.8	11:52 a.m. – 12:02 p.m.
2	North of Live Oak Canyon Road on road shoulder.	**65.9**	36.2	84.0	11:40 a.m.- 11:50 a.m.
3	Approximately 1,500 feet north of Live Oak Canyon Road south of the Project site.	**39.5**	30.3	49.9	12:13 p.m. – 12:23 p.m.
4	Southern part of Sutherland Drive adjacent to the Project site.	**39.9**	29.0	56.7	12:49 p.m. – 12:59 p.m.

Source: Measurements were taken by ECORP with a Larson Davis SoundExpert LxT precision sound level meter, which satisfies the American National Standards Institute for general environmental noise measurement instrumentation. Prior to the measurements, the SoundExpert LxT sound level meter was calibrated according to manufacturer specifications with a Larson Davis CAL200 Class I Calibrator. See Attachment A for noise measurement outputs

As shown in Table 3-1, the ambient recorded noise levels ranged from 39.5 dBA to 65.9 dBA in the vicinity of the Project site (see Attachment A). The noise most commonly in the Project vicinity is produced by automotive vehicles (cars, trucks, buses, motorcycles) traveling on area roadways that surround the Project site such as Live Oak Canyon Road and Sutherland Drive. Traffic moving along streets produces a sound level that remains relatively constant and is part of the Project area's minimum ambient noise level. Vehicular noise varies with the volume, speed, and type of traffic. Slower traffic produces less noise than fast moving traffic. Trucks typically generate more noise than cars. Infrequent or intermittent noise also is associated with vehicles, including sirens, vehicle alarms, slamming of doors, garbage, and honking of horns. These noises add to urban noise and are regulated by a variety of agencies.

4.0 REGULATORY FRAMEWORK

4.1 Federal

4.1.1 Occupational Safety and Health Act (OSHA) of 1970

OSHA regulates onsite noise levels and protects workers from occupational noise exposure. To protect hearing, worker noise exposure is limited to 90 dB with A-weighting (dBA) over an eight-hour work shift (29 Code of Federal Regulations 1910.95). Employers are required to develop a hearing conservation program when employees are exposed to noise levels exceeding 85 dBA. These programs include provision of hearing protection devices and testing employees for hearing loss on a periodic basis.

4.2 State

4.2.1 State of California General Plan Guidelines

The State of California regulates vehicular and freeway noise affecting classrooms, sets standards for sound transmission and occupational noise control, and identifies noise insulation standards and airport noise/land-use compatibility criteria. The State of California General Plan Guidelines (State of California 2003), published by the Governor's Office of Planning and Research (OPR), also provides guidance for the acceptability of projects within specific CNEL contours. The guidelines also present adjustment factors that may be used in order to arrive at noise acceptability standards that reflect the noise-control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

4.2.2 State Office of Planning and Research Noise Element Guidelines

The State OPR Noise Element Guidelines include recommended exterior and interior noise level standards for local jurisdictions to identify and prevent the creation of incompatible land uses due to noise. The Noise Element Guidelines contain a land-use compatibility table that describes the compatibility of various land uses with a range of environmental noise levels in terms of the CNEL.

4.3 Local

4.3.1 City of Redlands General Plan Public Healthy Community Chapter

The Healthy Community Chapter of the City's General Plan provides policy direction for minimizing noise impacts on the community and for coordinating with surrounding jurisdictions and other entities regarding noise control. By identifying noise-sensitive land uses and establishing compatibility guidelines for land use and noise, noise considerations will influence the general distribution, location, and intensity of future land use. The result is that effective land use planning and mitigation can alleviate the majority of noise problems.

The most basic planning strategy to minimize adverse impacts on new land uses due to noise is to avoid designating certain land uses at locations within the city that would negatively affect noise-sensitive land uses. Uses such as schools, hospitals, child care, senior care, congregate care, churches, and all types of residential use should be located outside of any area anticipated to exceed acceptable noise levels as defined by the Noise and Land Use Compatibility Guidelines, or should be protected from noise through sound attenuation measures such as site and architectural design and sound walls. The City has adopted these guidelines in a modified form as a basis for planning decisions based on noise considerations. These guidelines are shown in Table 5. In the case that the noise levels identified at a proposed project site fall within levels considered normally acceptable, the project is considered compatible with the existing noise environment.

Table 4-1. Land Use Compatibility for Community Noise Environments – City of Redlands

Land Use Category		Community Noise Exposure (CNEL)			
Categories	**Uses**	**Clearly Compatible (A)**	**Normally Compatible (B)**	**Normally Incompatible (C)**	**Clearly Incompatible (D)**
Residential	Single Family, Duplex Multiple Family	< 60	N/A	61 - 75	76 >
Residential	Mobile Homes	< 60	N/A	61 - 75	76 >
Commercial (Regional District)	Hotel, Motel, Transient Lodging	< 65	66 - 75	76 - 85	86 >
Commercial (Regional, Village District, Special)	Commercial Retail, Bank, Restaurant, Movie Theater	< 75	76 - 85	86 >	N/A
Commercial (Industrial Institutional)	Office Building, Research & Dev., Professional Offices, City Office Building	< 70	71 - 80	81 - 85	86 >
Commercial (Recreation) Institutional (Civic Center)	Amphitheater, Concert Hall, Auditorium, Meeting Hall	N/A	< 65	66 - 75	76 >
Commercial (Recreation)	Children's Amusement Park, Minatare Golf Course, Go-cart Track, Equestrian Center, Sports Club	< 75	76 >	N/A	N/A
Commercial (General, Special) Industrial, Institutional	Automobile Service Station, Auto Dealership, Manufacturing Warehouse, Wholesale, Utilities	< 75	76 >	N/A	N/A
Institutional (General)	Hospital, Church, Library, Schools Classroom	< 65	66 - 70	71- 80	81 >
Open Space	Parks	< 70	71 - 75	76 - 80	81 >
Open Space	Golf Course, Cemeteries, Nature Centers, Wildlife Reserves, Wildlife Habitat	< 75	76 - 80	81 >	N/A
Agriculture	Agriculture	N/A	N/A	N/A	N/A

Source: City of Redlands 2017

Notes:

NA: Not Applicable

Clearly Compatible – *Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.*

Normally Compatible – *New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice. Outdoor environment will seem noisy.*

Normally Incompatible – *New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.*

Clearly Incompatible – *New construction or development should generally not be undertaken. Construction costs to make the indoor environment acceptable would be prohibitive and the outdoor environment would not be usable.*

Table 4-2 shows the interior and exterior noise standards for the various land uses in Redlands.

Table 4-2. Interior and Exterior Noise Standards – City of Redlands

Land Use Categories	Interior[1] CNEL	Exterior[2] CNEL
Residential		
Single Family, Duplex, Multiple Family	45[3]	60
Mobile Home	---	60[4]
Commercial, Industrial, Institutional		
Hotel, Motel, Transit Lodging	45	65[3]
Commercial Retail, Bank, Restaurant	50	---
Office Building, Research & Development, Professional Offices, City Office Building	50	---
Amphitheater, Concert Hall, Auditorium, Meeting Hall	45	---
Gymnasium (Multipurpose)	50	---
Sports Club	55	---
Manufacturing, Warehousing, Wholesale, Utilities	60	---
Movie Theaters	45	---
Institutional		
Hospitals, Schools classrooms	45	60
Open Space		
Parks	---	60

Source: City of Redlands 2017
Notes:
1. Indoor environment excludes bathrooms, toilets, closets, corridors.
2. Outdoor environment limited to private yard of single family as measures at property line; multifamily private patio or balcony that is served by means of exit from inside; mobile home park; hospital patio; park picnic area; school playground; hotel and recreational area.
3. Noise level requirement with open window, if they are used to meet natural ventilation requirements.
4. Exterior noise levels should be such that interior level will not exceed 45 CNEL.
5. Expect those areas affected by aircraft noise.

The Healthy Community Chapter also contains principles and implementation policies that are used to guide decisions concerning land uses that are common sources of excessive noise levels. The following relevant and applicable principles and implementation policies from the City's Healthy Community Chapter have been identified for the Project.

Principle 7-P.40: Protect public health and welfare by eliminating existing noise problems where feasible and by preventing significant degradation of the future acoustic environment.

Principle 7-P.41: Ensure that new development is compatible with the noise environment by continuing to use potential noise exposure as a criterion in land use planning.

Police 9.0e: Use the criteria specified in the General Plan (Table 4-1) to assess the compatibility of proposed land uses with the projected noise environment and apply the noise standards in the General Plan (Table 4-2), which prescribe interior and exterior noise standards in relation to specific land uses. Do not approve projects that would not comply with the standards in the General Plan (Table 4-2).

Police 9.0i: Require construction of noise barriers to mitigate sound emissions where necessary or when feasible, and encourage the use of walls and berms to protect residential or other noise sensitive land uses that are adjacent to major roads, commercial or industrial areas.

Police 9.0s: Require mitigation to ensure that indoor noise levels for residential living spaces not exceed 45 dB L_{dn}/CNEL due to the combined effects of all exterior noise sources.

4.3.2 City of Redlands Municipal Code

The City's regulations with respect to noise are included in Title 8 of the Health and Safety Code, specifically Chapter 8.06, Community Noise Control. The Noise Control provides noise standards within the city and the following references are those portions of the Noise Control that may be applicable to the Project.

Section 8.06.070 provides exterior noise limits for various land uses within the city and is presented in Table 4-3. As shown, the maximum permissible sound levels at the exterior of a single-family residential district is 60 dBA during the daytime and 50 dBA during the nighttime.

Table 4-3. Maximum Permissible Sound Levels by Receiving Land Use – City of Redlands

Receiving Land Use Category	Time Period	Noise Level-dBA
Single-family residential district	10:00 p.m. - 7:00 a.m.	50
	7:00 a.m. - 10:00 p.m.	60
Multi-family residential districts; public space; industrial	10:00 p.m. - 7:00 a.m.	50
	7:00 a.m. - 10:00 p.m.	60
Commercial	10:00 p.m. - 7:00 a.m.	60
	7:00 a.m. - 10:00 p.m.	65
Industrial	Anytime	75

Source: City of Redlands Municipal Code, 2019

Section 8.06.080 provides interior noise limits for various land uses within the city and is presented in Table 4-4.

Table 4-4. Maximum Permissible Interior Sound Levels by Receiving Land Use – City of Redlands

Receiving Land Use Category	Time Period	Noise Level-dBA
Single-family residential district	Anytime	45
Multi-family residential districts, institutional, hotels	Anytime	45
Commercial	Anytime	50
Industrial	Anytime	60

Source: City of Redlands Municipal Code, 2019

Additionally, Section 8.06.120 states that the noise standards shall not apply to noise sources associated with new construction, remodeling, rehabilitation or grading of any private property, provided such activities take place between the hours of 7:00 a.m. and 8:00 p.m. on weekdays, including Saturdays, with no activity taking place at any time on Sundays or federal holidays. All motorized equipment used in such activities shall be equipped with functioning mufflers.

5.0 IMPACT ASSESSMENT

5.1 Thresholds of Significance

The impact analysis provided below is based on the following California Environmental Quality Act Guidelines Appendix G thresholds of significance. The Project would result in a significant noise-related impact if it would produce the following:

1) 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.

2) Generation of excessive groundborne vibration or groundborne noise levels.

3) 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.

5.2 Methodology

This analysis of the existing and future noise environments is based on noise prediction modeling and empirical observations. In order to estimate the worst-case construction noise levels that may occur at the nearest noise-sensitive receptors in the Project vicinity, predicted construction noise levels were calculated utilizing the FHWA's Roadway Construction Model (2006). Stationary noise sources are addressed qualitatively. Groundborne vibration levels associated with construction-related activities were evaluated utilizing typical groundborne vibration levels associated with construction equipment based on the Caltrans guidelines set forth above. Potential groundborne vibration impacts related to structural damage and human annoyance are evaluated, taking into account the distance from construction activities to nearby land uses.

5.3 Impact Analysis

5.3.1 Project Construction/ Implementation Noise

Would the Project Result in Short-Term Construction-Generated Noise in Excess of Standards?

Onsite Construction Noise

Construction noise associated with the proposed Project would be temporary and would vary depending on the nature of the activities being performed. Noise generated would primarily be associated with the operation of off-road equipment for onsite construction activities as well as construction vehicle traffic on area roadways. Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g., grading, drilling, paving). Noise generated by construction equipment, including earthmovers, material handlers, and portable generators, can reach high levels. Typical operating cycles for these types of construction equipment may involve one or two minutes of full-power operation followed by three to four minutes at lower power settings. Other primary sources of acoustical disturbance would be random incidents, which would last less than one minute (such as dropping large pieces of equipment or the hydraulic movement of machinery lifts). During construction, exterior noise levels could negatively affect sensitive receptors in the vicinity of the construction site.

Nearby noise-sensitive land uses consist of residences located on Sutherland Drive with the closest being approximately 70 feet distant from the northern Project site boundary. As previously described, Section 8.06.120 of the City's Municipal Code states that the noise standards shall not apply to noise sources associated with new construction, remodeling, rehabilitation, or grading of any private property provided such activities take place between the hours of 7:00 a.m. and 8:00 p.m. on weekdays, including Saturdays, with no activity taking place at any time on Sundays or federal holidays.

To estimate the worst-case onsite construction noise levels that may occur at the nearest noise-sensitive receptors in the Project vicinity in order to evaluate the potential health-related effects (physical damage to the ear) from construction noise, , the construction equipment noise levels were calculated using the Roadway Noise Construction Model for the construction process and compared against the construction-related noise level threshold established in the Criteria for a Recommended Standard: Occupational Noise Exposure prepared in 1998 by National Institute for Occupational Safety and Health (NIOSH). A division of the US Department of Health and Human Services, NIOSH identifies a noise level threshold based on the duration of exposure to the source. The NIOSH construction-related noise level threshold starts at 85 dBA for more than 8 hours per day; for every 3-dBA increase, the exposure time is cut in half. This reduction results in noise level thresholds of 88 dBA for more than 4 hours per day, 92 dBA for more than 1 hour per day, 96 dBA for more than 30 minutes per day, and up to 100 dBA for more than 15 minutes per day. For the purposes of this analysis, the lowest, more conservative threshold of 85 dBA L_{eq} is used as an acceptable threshold for construction noise at the nearby existing and future planned sensitive receptors.

The anticipated short-term construction related noise levels generated for the necessary construction equipment are presented in Table 5-1.

Table 5-1. Construction Average (dBA) Noise Levels at Nearest Receptor

Equipment	Estimated Exterior Construction Noise Level @ 70 feet	Construction Noise Standards (dBA L_{eq})	Exceeds Standard at Nearest Sensitive Receptor?
Site Preparation (clearing and miscellaneous activates)			
Excavators (1)	73.8	*85*	**No**
Graders (1)	78.1	*85*	**No**
Tractors/Loaders/Backhoes (1)	77.1	*85*	**No**
Combined Site Preparation Equipment	**81.5**	*85*	**No**
Excavation			
Concrete/Industrial Saws (1)	79.7	*85*	**No**
Excavators (1)	73.8	*85*	**No**
Rubber Tired Dozers (1)	74.8	*85*	**No**
Tractors/Loaders/Backhoes (2)	77.1 (each)	*85*	**No**
Combined Excavation Equipment	**84.0**	*85*	**No**
Building Construction (headwall and gabion wall)			
Cranes (1)	69.7	*85*	**No**
Forklifts (2)	76.5 (each)	*85*	**No**
Tractors/Loaders/Backhoes (2)	77.1 (each)	*85*	**No**
Combined Building Construction Equipment	**83.0**	*85*	**No**
Site Finalization (removal of nonnative vegetation and replacement of landscaping)			
Graders (1)	78.1	*85*	**No**
Excavators (1)	73.8	*85*	**No**
Tractors/Loaders/Backhoes (2)	77.1 (each)	*85*	**No**
Combined Site Finalization Equipment	**82.8**	*85*	**No**

Source: Construction noise levels were calculated by ECORP Consulting, Inc. using the FHWA Roadway Noise Construction Model (FHWA 2006). Refer to Attachment B for Model Data Outputs.

Notes: Construction equipment used during construction derived from the CalEEMod 2016.3.2 modeling software. CalEEMod is designed to calculate air pollutant emissions from construction activity and contains default construction equipment and usage parameters for typical construction projects based on several construction surveys conducted in order to identify such parameters.

As shown in Table 5-1, no cumulative or individual piece of construction equipment would exceed 85 dBA NIOSH construction noise standard at the nearby noise- sensitive receptors and no health effects from construction noise would occur. It is noted that construction noise was modeled on a worst-case basis. It is very unlikely that all pieces of constriction equipment would be operating at the same time for the various phases of Project construction as well as at the point closest to residences.

Construction Worker Traffic Noise

Project construction would result in additional traffic on adjacent roadways over the period that construction occurs. According to the CalEEMod model, which is used to predict air pollutant emissions associated with Project construction, including those generated by worker commute trips, the maximum number of construction workers traveling to and from the Project site on a single day is not expected to exceed 25 trips in total (18 construction worker trips and 7 vendor trips). According to the California

Department of Transportation (Caltrans) *Technical Noise Supplement to the Traffic Noise Analysis Protocol* (2013), doubling of traffic on a roadway is required to result in an increase of 3 dB (outside of the laboratory, a 3-dBA change is considered a just-perceivable difference). The Project site is accessible from Sutherland Drive, which traverses a primarily residential neighborhood. In addition to accommodating traffic trips to the individual residences in the neighborhood, Sutherland Drive is used to access the Oak Ridge Trail, located directly adjacent to the Project site. There are nine residences fronting the segment of Sutherland Drive between the Oak Ridge Trail parking lot and Ashford Drive. According to the Institute of Transportation Engineers' 10th Edition Trip Generation Manual (2017), single family homes generate an average of 9.44 trips daily, and therefore these nine residences could be expected to contribute up to 85 traffic trips daily to this segment of Sutherland Drive (9.44 x 9 = 84.9). Additionally, the Oak Ridge Trail is an easily accessible hiking trail suited for all skill levels that is open daily to the public and offers scenic views of the San Bernardino Mountains. Due to the surrounding residential neighborhood and consistent trail usage along the Oak Ridge Trail, Sutherland Drive accommodates more than 25 vehicle trips daily. Thus, the Project construction would not result in a doubling of traffic, and therefore its contribution to existing traffic noise would not be perceptible.

5.3.2 Project Operational Noise

Would the Project Result in a Substantial Permanent Increase in Ambient Noise Levels in Excess of City Standards During Operations?

As previously described, noise-sensitive land uses are locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, places of worship, hospitals, guest lodging, libraries, and some passive recreation areas would each be considered noise sensitive and may warrant unique measures for protection from intruding noise. The nearest noise-sensitive land use consists of residences located on Sutherland Drive.

Project Operational Offsite Traffic Noise

The Project is proposing drainage and erosion control improvements on a segment of stream bank in Live Oak Canyon Creek. Once construction and implementation of those improvements is complete, no additional daily vehicle trips would be associated with the Project. Thus, the Project would not contribute to traffic noise levels.

Project Operations-Onsite Noise Sources

The Project is proposing drainage and erosion control improvements in Oak Canyon Creek. Upon completion of the proposed improvements, the Project site's noise environment would remain unchanged from its current state.

Would the Project Result in the Generation of Excessive Groundborne Vibration or Groundborne Noise Levels?

Construction-Generated Vibration

Excessive groundborne vibration impacts result from continuously occurring vibration levels. Increases in groundborne vibration levels attributable to the proposed Project would be primarily associated with short-term construction-related activities. Construction on the Project site would have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and the operations involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance.

Construction-related ground vibration is normally associated with impact equipment such as pile drivers, jackhammers, and the operation of some heavy-duty construction equipment, such as dozers and trucks. It is not anticipated that pile drivers would be necessary during Project construction. Vibration decreases rapidly with distance and it is acknowledged that construction activities would occur throughout the Project site and would not be concentrated at the point closest to sensitive receptors. Groundborne vibration levels associated with typical construction equipment are summarized in Table 5-2.

Table 5-2. Representative Vibration Source Levels for Construction Equipment

Equipment Type	PPV at 25 Feet (inches per second)
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Trucks	0.076
Hoe Ram	0.089
Jackhammer	0.035
Small Bulldozer/Tractor	0.003
Vibratory Roller	0.210

Source: FTA 2018; Caltrans 2020b

The City of Redlands does not regulate vibrations associated with construction. However, a discussion of construction vibration is included for full disclosure purposes. For comparison purposes, the Caltrans (2020b) recommended standard of 0.2 inch per second PPV with respect to the prevention of structural damage for older residential buildings is used as a threshold. This is also the level at which vibrations may begin to annoy people in buildings. The nearest structures of concern to the construction site is a residence located on Sutherland Drive approximately 70 feet distant of the Project site boundary.

Based on the representative vibration levels presented for various construction equipment types in Table 5-2 and the construction vibration assessment methodology published by the FTA (2018), it is possible to estimate the potential Project construction vibration levels. The FTA provides the following equation:

$$PPVequip = PPVref \times (25/D)^{1.5}$$

Table 5-3 presents the expected Project related vibration levels at a distance of 70 feet.

Table 5-3. Construction Vibration Levels at 70 Feet							
Receiver PPV Levels (in/sec)[1]					Peak Vibration	Threshold	Exceed Threshold
Small Bulldozer	Jackhammer	Loaded Trucks	Large Bulldozer, Caisson Drilling, and Hoe Ram	Vibratory Roller			
0.006	0.007	0.016	0.018	0.044	**0.044**	*0.2*	**No**

[1]Based on the Vibration Source Levels of Construction Equipment included on Table 5-2 (FTA 2018).

As shown, groundborne vibrations attenuate rapidly from the source due to geometric spreading and material damping. Geometric spreading occurs because the energy is radiated from the source and spreads over an increasingly large distance while material damping is a property of the friction loss which occurs during the passage of a vibration wave. As shown in Table 5-3, vibration as a result of construction activities would not exceed 0.2 PPV at the nearest structure. Thus, Project construction would not exceed the recommended threshold.

Operational Groundborne Vibration

Project operations would not include the use of any stationary equipment that would result in excessive groundborne vibration levels.

Would the Project Expose People Residing or Working in the Project Area to Excessive Airport Noise?

The Project site is located over 5 miles north of the Redlands Municipal Airport. The proposed Project is not located within an airport land use plan or within two miles of a public airport or public use airport that is currently in operations. Implementation of the proposed Project would not affect airport operations nor result in increased exposure of people working at the Project site to aircraft noise.

Would the Project Result in Cumulatively Considerable Noise Impacts?

Cumulative Construction Noise

Construction activities associated with the proposed Project and other construction projects in the area may overlap, resulting in construction noise in the area. However, construction noise impacts primarily affect the areas immediately adjacent to the construction site. Construction noise for the proposed Project was determined to be less than significant following compliance with the City's construction noise standards. Cumulative development in the vicinity of the Project site could result in elevated construction noise levels at sensitive receptors in the Project area. However, each project would be required to comply with the applicable noise limitations on construction. Therefore, the Project would not contribute to cumulative impacts during construction.

Cumulative Stationary Source Noise Impacts

There are no long-term stationary noise sources associated with the proposed Project. Once implementation of the proposed drainage and erosion control improvements is complete, the noise environment would remain unchanged. Therefore, the Project would not contribute to cumulative impacts during operations.

6.0 REFERENCES

Caltrans (California Department of Transportation). 2002. California Airport Land Use Planning Handbook.

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State of California OPR. 2003. California General Plan Guidelines.

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LIST OF ATTACHMENTS

Attachment A - Existing (Baseline) Noise Measurements – Project Site Vicinity

Attachment B - Roadway Construction Noise Model Outputs – Project Construction Noise

ATTACHMENT A

Existing (Baseline) Noise Measurements – Project Site Vicinity

Site Number: 1			
Recorded By: Lindsay Liegler			
Job Number: 2019-237			
Date: 4/29/2021			
Time: 11:52 a.m. – 12:02 p.m.			
Location: North of Live Okay Canyon Road on road shoulder.			
Source of Peak Noise: Vehicles on Live Oak Canon Road .			
Noise Data			
Leq (dB)	**Lmin (dB)**	**Lmax (dB)**	**Peak (dB)**
62.6	29.7	81.8	101.3

Equipment						
Category	**Type**	**Vendor**	**Model**	**Serial No.**	**Cert. Date**	**Note**
Sound	Sound Level Meter	**Larson Davis**	**LxT SE**	**0005120**	**9/14/2020**	
	Microphone	**Larson Davis**	**377B02**	**174464**	**9/14/2020**	
	Preamp	**Larson Davis**	**PRMLxT1L**	**042852**	**9/14/2020**	
	Calibrator	**Larson Davis**	**CAL200**	**14105**	**9/10/2020**	

Weather Data			
Est.	**Duration:** 10 minutes		**Sky:** Clear
	Note: dBA Offset = 0.71		**Sensor Height (ft):** 3 ft
	Wind Ave Speed (mph)	**Temperature (degrees Fahrenheit)**	**Barometer Pressure (hPa)**
	5	85	30.11

Photo of Measurement Location

Measurement Report

Report Summary

Meter's File Name	LxT_Data.365	Computer's File Name	SLM_0005120_LxT_Data_365.00.ldbin
Meter	LxT SE		
Firmware	2.404		
User	Lindsay Liegler	Location	
Description	2019-237		
Note			

Start Time	2021-04-29 11:53:44	Duration	0:10:00.3		
End Time	2021-04-29 12:03:44	Run Time	0:10:00.3	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	62.6 dB		
LAE	90.4 dB	SEA	--- dB
EA	121.7 µPa²h		
LZ_{peak}	101.3 dB	2021-04-29 11:58:35	
LAS_{max}	81.8 dB	2021-04-29 11:58:36	
LAS_{min}	29.7 dB	2021-04-29 12:03:44	
LA_{eq}	62.6 dB		
LC_{eq}	68.7 dB	LC_{eq} - LA_{eq}	6.1 dB
LAI_{eq}	65.3 dB	LAI_{eq} - LA_{eq}	2.7 dB

Exceedances

Exceedances	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpeak > 135.0 dB	0	0:00:00.0
LZpeak > 137.0 dB	0	0:00:00.0
LZpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight	
62.6 dB	62.6 dB	0.0 dB	
LDEN	**LDay**	**LEve**	**LNight**
62.6 dB	62.6 dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	62.6 dB		68.7 dB		--- dB	
$Ls_{(max)}$	81.8 dB	2021-04-29 11:58:36	--- dB		--- dB	
$LS_{(min)}$	29.7 dB	2021-04-29 12:03:44	--- dB		--- dB	
$L_{Peak(max)}$	--- dB		--- dB		101.3 dB	2021-04-29 11:58:35

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	2	0:00:09.1

Statistics

LAS 5.0	68.9 dB
LAS 10.0	66.3 dB
LAS 33.3	50.9 dB
LAS 50.0	42.8 dB
LAS 66.6	40.5 dB
LAS 90.0	37.9 dB

Site Number: 2
Recorded By: Lindsay Liegler
Job Number: 2019-237
Date: 4/29/2021
Time: 11:40 a.m.- 11:50 a.m.
Location: North of Live Okay Canyon Road on road shoulder.
Source of Peak Noise: Vehicles on Live Oak Canyon Road .

Noise Data			
Leq (dB)	**Lmin (dB)**	**Lmax (dB)**	**Peak (dB)**
65.9	36.2	84.0	105.9

Equipment						
Category	**Type**	**Vendor**	**Model**	**Serial No.**	**Cert. Date**	**Note**
Sound	Sound Level Meter	**Larson Davis**	**LxT SE**	**0005120**	**9/14/2020**	
	Microphone	**Larson Davis**	**377B02**	**174464**	**9/14/2020**	
	Preamp	**Larson Davis**	**PRMLxT1L**	**042852**	**9/14/2020**	
	Calibrator	**Larson Davis**	**CAL200**	**14105**	**9/10/2020**	
Weather Data						
Est.	**Duration:** 10 minutes		**Sky:** Clear			
	Note: dBA Offset = 0.71		**Sensor Height (ft):** 3 ft			
	Wind Ave Speed (mph)	**Temperature (degrees Fahrenheit)**	**Barometer Pressure (hPa)**			
	5	85	30.11			

Photo of Measurement Location

Measurement Report

Report Summary

Meter's File Name	LxT_Data.364	Computer's File Name	SLM_0005120_LxT_Data_364.00.ldbin
Meter	LxT SE		
Firmware	2.404		
User	Lindsay Liegler	Location	
Description	2019-237		
Note			

Start Time	2021-04-29 11:39:35	Duration	0:10:42.3		
End Time	2021-04-29 11:50:17	Run Time	0:10:42.3	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	65.9 dB		
LAE	94.0 dB	SEA	--- dB
EA	276.1 µPa²h		
LZ_{peak}	105.9 dB	2021-04-29 11:45:54	
LAS_{max}	84.0 dB	2021-04-29 11:45:54	
LAS_{min}	36.2 dB	2021-04-29 11:48:24	
LA_{eq}	65.9 dB		
LC_{eq}	71.1 dB	LC_{eq} - LA_{eq}	5.2 dB
LAI_{eq}	68.7 dB	LAI_{eq} - LA_{eq}	2.8 dB

Exceedances

Exceedances	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpeak > 135.0 dB	0	0:00:00.0
LZpeak > 137.0 dB	0	0:00:00.0
LZpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight	
65.9 dB	65.9 dB	0.0 dB	
LDEN	**LDay**	**LEve**	**LNight**
65.9 dB	65.9 dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	65.9 dB		71.1 dB		--- dB	
$Ls_{(max)}$	84.0 dB	2021-04-29 11:45:54	--- dB		--- dB	
$LS_{(min)}$	36.2 dB	2021-04-29 11:48:24	--- dB		--- dB	
$L_{Peak(max)}$	--- dB		--- dB		105.9 dB	2021-04-29 11:45:54

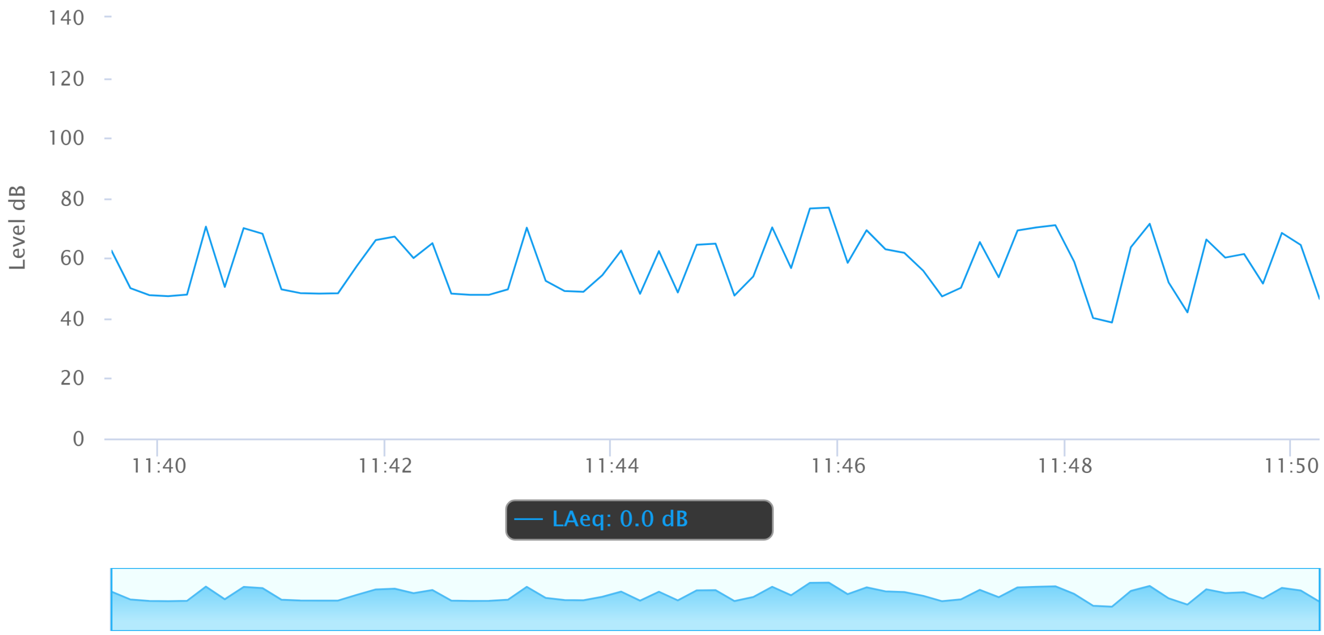
Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	16	0:00:47.6

Statistics

LAS 5.0	72.4 dB
LAS 10.0	69.7 dB
LAS 33.3	58.3 dB
LAS 50.0	52.5 dB
LAS 66.6	48.6 dB
LAS 90.0	47.2 dB

Time History



Site Number: 3
Recorded By: Lindsay Liegler
Job Number: 2019-237
Date: 4/29/2021
Time: 12:13 p.m. – 12:23 p.m.
Location: Approximately 1,500 feet north of Live Oak Canyon Road south of the Project site.
Source of Peak Noise: Birds chirping, rustling grass and vehicles in the distant on nearby roadways.

Noise Data			
Leq (dB)	**Lmin (dB)**	**Lmax (dB)**	**Peak (dB)**
39.5	30.3	49.9	89.1

Equipment						
Category	**Type**	**Vendor**	**Model**	**Serial No.**	**Cert. Date**	**Note**
Sound	Sound Level Meter	**Larson Davis**	**LxT SE**	**0005120**	**9/14/2020**	
	Microphone	**Larson Davis**	**377B02**	**174464**	**9/14/2020**	
	Preamp	**Larson Davis**	**PRMLxT1L**	**042852**	**9/14/2020**	
	Calibrator	**Larson Davis**	**CAL200**	**14105**	**9/10/2020**	

Weather Data			
Est.	**Duration:** 10 minutes		**Sky:** Clear
	Note: dBA Offset = 0.71		**Sensor Height (ft):** 3 ft
	Wind Ave Speed (mph)	**Temperature (degrees Fahrenheit)**	**Barometer Pressure (hPa)**
	5	85	30.11

Photo of Measurement Location

Measurement Report

Report Summary

Meter's File Name	LxT_Data.366	Computer's File Name	SLM_0005120_LxT_Data_366.00.ldbin
Meter	LxT SE		
Firmware	2.404		
User	Lindsay Liegler	Location	
Description	2019-237		
Note			

Start Time	2021-04-29 12:14:35	Duration	0:10:00.1		
End Time	2021-04-29 12:24:35	Run Time	0:10:00.1	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	39.5 dB		
LAE	67.3 dB	SEA	--- dB
EA	0.6 µPa²h		
LZ_{peak}	89.1 dB	2021-04-29 12:24:00	
LAS_{max}	49.9 dB	2021-04-29 12:23:03	
LAS_{min}	30.3 dB	2021-04-29 12:16:36	
LA_{eq}	39.5 dB		
LC_{eq}	50.7 dB	LC_{eq} - LA_{eq}	11.1 dB
LAI_{eq}	42.3 dB	LAI_{eq} - LA_{eq}	2.8 dB

Exceedances

Exceedances		Count	Duration
LAS >	85.0 dB	0	0:00:00.0
LAS >	115.0 dB	0	0:00:00.0
LZpeak >	135.0 dB	0	0:00:00.0
LZpeak >	137.0 dB	0	0:00:00.0
LZpeak >	140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight	
39.5 dB	39.5 dB	0.0 dB	
LDEN	**LDay**	**LEve**	**LNight**
39.5 dB	39.5 dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	39.5 dB		50.7 dB		--- dB	
$LS_{(max)}$	49.9 dB	2021-04-29 12:23:03	--- dB		--- dB	
$LS_{(min)}$	30.3 dB	2021-04-29 12:16:36	--- dB		--- dB	
$L_{Peak(max)}$	--- dB		--- dB		89.1 dB	2021-04-29 12:24:00

Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	0	0:00:00.0

Statistics

LAS 5.0	44.3 dB
LAS 10.0	43.1 dB
LAS 33.3	39.4 dB
LAS 50.0	37.6 dB
LAS 66.6	36.0 dB
LAS 90.0	33.3 dB

Site Number: 4			
Recorded By: Lindsay Liegler			
Job Number: 2019-237			
Date: 4/29/2021			
Time: 12:49 p.m. – 12:59 p.m.			
Location: Southern port of Southerland Drive adjacent to the Project site.			
Source of Peak Noise: Vehicles on Southerland Drive.			
Noise Data			
Leq (dB)	**Lmin (dB)**	**Lmax (dB)**	**Peak (dB)**
39.9	29.0	56.7	82.1

Equipment						
Category	**Type**	**Vendor**	**Model**	**Serial No.**	**Cert. Date**	**Note**
Sound	Sound Level Meter	**Larson Davis**	**LxT SE**	**0005120**	**9/14/2020**	
	Microphone	**Larson Davis**	**377B02**	**174464**	**9/14/2020**	
	Preamp	**Larson Davis**	**PRMLxT1L**	**042852**	**9/14/2020**	
	Calibrator	**Larson Davis**	**CAL200**	**14105**	**9/10/2020**	

Weather Data			
Est.	**Duration:** 10 minutes		**Sky:** Clear
	Note: dBA Offset = 0.71		**Sensor Height (ft):** 3 ft
	Wind Ave Speed (mph)	**Temperature (degrees Fahrenheit)**	**Barometer Pressure (hPa)**
	5	85	30.11

Photo of Measurement Location

Measurement Report

Report Summary

Meter's File Name	LxT_Data.367	Computer's File Name	SLM_0005120_LxT_Data_367.00.ldbin
Meter	LxT SE		
Firmware	2.404		
User	Lindsay Liegler	Location	
Description	2019-237		
Note			

Start Time	2021-04-29 12:50:52	Duration	0:10:00.4		
End Time	2021-04-29 13:00:52	Run Time	0:10:00.4	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	39.9 dB		
LAE	67.7 dB	SEA	--- dB
EA	0.7 µPa²h		
LZ_{peak}	82.1 dB	2021-04-29 12:58:41	
LAS_{max}	56.7 dB	2021-04-29 12:52:25	
LAS_{min}	29.0 dB	2021-04-29 12:59:41	
LA_{eq}	39.9 dB		
LC_{eq}	48.2 dB	LC_{eq} - LA_{eq}	8.3 dB
LAI_{eq}	43.9 dB	LAI_{eq} - LA_{eq}	4.0 dB

Exceedances

Exceedances	Count	Duration
LAS > 85.0 dB	0	0:00:00.0
LAS > 115.0 dB	0	0:00:00.0
LZpeak > 135.0 dB	0	0:00:00.0
LZpeak > 137.0 dB	0	0:00:00.0
LZpeak > 140.0 dB	0	0:00:00.0

Community Noise

LDN	LDay	LNight	
39.9 dB	39.9 dB	0.0 dB	
LDEN	**LDay**	**LEve**	**LNight**
39.9 dB	39.9 dB	--- dB	--- dB

Any Data

	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	39.9 dB		48.2 dB		--- dB	
$LS_{(max)}$	56.7 dB	2021-04-29 12:52:25	--- dB		--- dB	
$LS_{(min)}$	29.0 dB	2021-04-29 12:59:41	--- dB		--- dB	
$L_{Peak(max)}$	--- dB		--- dB		82.1 dB	2021-04-29 12:58:41

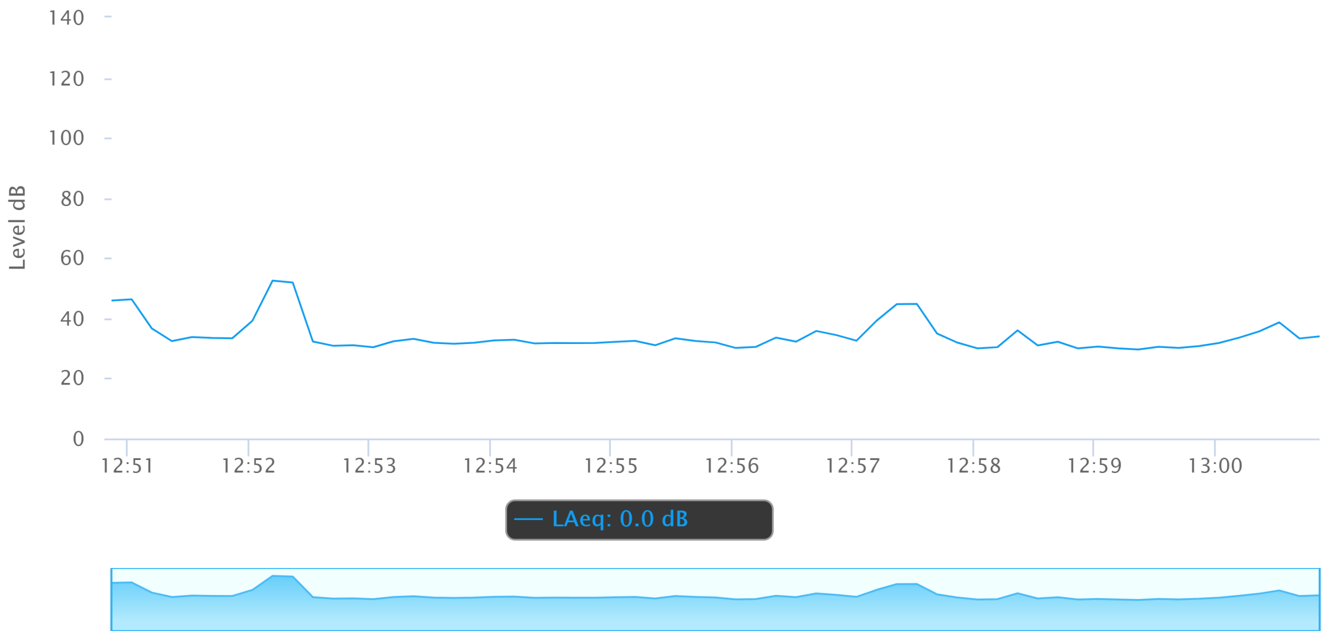
Overloads

Count	Duration	OBA Count	OBA Duration
0	0:00:00.0	0	0:00:00.0

Statistics

LAS 5.0	46.3 dB
LAS 10.0	39.6 dB
LAS 33.3	33.1 dB
LAS 50.0	32.2 dB
LAS 66.6	31.3 dB
LAS 90.0	30.1 dB

Time History



ATTACHMENT B

Roadway Construction Noise Model Outputs – Project Construction Noise

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2021
Case Description: Site Preparation (clearing and miscellaneous activates)

Description	**Affected Land Use**
Site Preparation	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Excavator	No	40		80.7	70
Grader	No	40	85		70
Tractors/Loaders/Backhoes	No	40	84		70

Calculated (dBA)

Equipment	***Lmax**	**Leq**
Excavator	77.8	73.8
Grader	82.1	78.1
Tractors/Loaders/Backhoes	81.1	77.1
Total	**82.1**	**81.5**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2021
Case Description: Excavation

Description	**Affected Land Use**
Excavation	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Concrete/Industrial Saws	No	20		89.6	70
Excavator	No	40		80.7	70
Rubber Tired Dozers	No	40		81.7	70
Tractors/Loaders/Backhoes	No	40	84		70
Tractors/Loaders/Backhoes	No	40	84		70

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Concrete/Industrial Saws		86.7	79.7
Excavator		77.8	73.8
Rubber Tired Dozers		78.7	74.8
Tractors/Loaders/Backhoes		81.1	77.1
Tractors/Loaders/Backhoes		81.1	77.1
	Total	**86.7**	**84**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2021
Case Description: Building Construction (headwall and gabion wall)

Description	**Affected Land Use**
Building Construction	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Crane	No	16		80.6	70
Forklifts	No	40		83.4	70
Forklifts	No	40		83.4	70
Tractors/Loaders/Backhoes	No	40	84		70
Tractors/Loaders/Backhoes	No	40	84		70

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Crane		77.6	69.7
Forklifts		80.5	76.5
Forklifts		80.5	76.5
Tractors/Loaders/Backhoes		81.1	77.1
Tractors/Loaders/Backhoes		81.1	77.1
	Total	**81.1**	**83**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 5/4/2021
Case Description: Site Finalization (removal of nonnative vegetation and replacement of landscaping)

Description	**Affected Land Use**
Site Finalization	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Grader	No	40	85		70
Excavator	No	40		80.7	70
Tractors/Loaders/Backhoes	No	40	84		70
Tractors/Loaders/Backhoes	No	40	84		70

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Grader		82.1	78.1
Excavator		77.8	73.8
Tractors/Loaders/Backhoes		81.1	77.1
Tractors/Loaders/Backhoes		81.1	77.1
	Total	**82.1**	**82.8**

*Calculated Lmax is the Loudest value.