TTM 20577 - Noise

Noise Impact Study

San Bernardino County, CA

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Date: 4/9/2025

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF EXHIBITS

LIST OF TABLES

1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate the potential noise impacts for the project study area and to recommend noise mitigation measures, if necessary, to minimize the potential noise impacts. The assessment was conducted and compared to the noise standards set forth by the Federal, State and Local agencies. Consistent with the County's Noise Guidelines, the project must demonstrate compliance to the applicable noise criterion as outlined within the County's Hazards Element and Development Code.

The following is provided in this report:

- A description of the study area and the proposed project
- Information regarding the fundamentals of noise
- A description of the local noise guidelines and standards
- An analysis of traffic noise impacts to and from the project site
- An analysis of construction noise impacts

1.2 Site Location and Study Area

The project site is located along Sunburst Street, between Sunflower Road and Golden Street in the Joshua Tree area, within unincorporated San Bernardino County, California, as shown in Exhibit A. The site is currently zoned as Joshua Tree rural living use within vacant rural living use.

1.3 Proposed Project Description

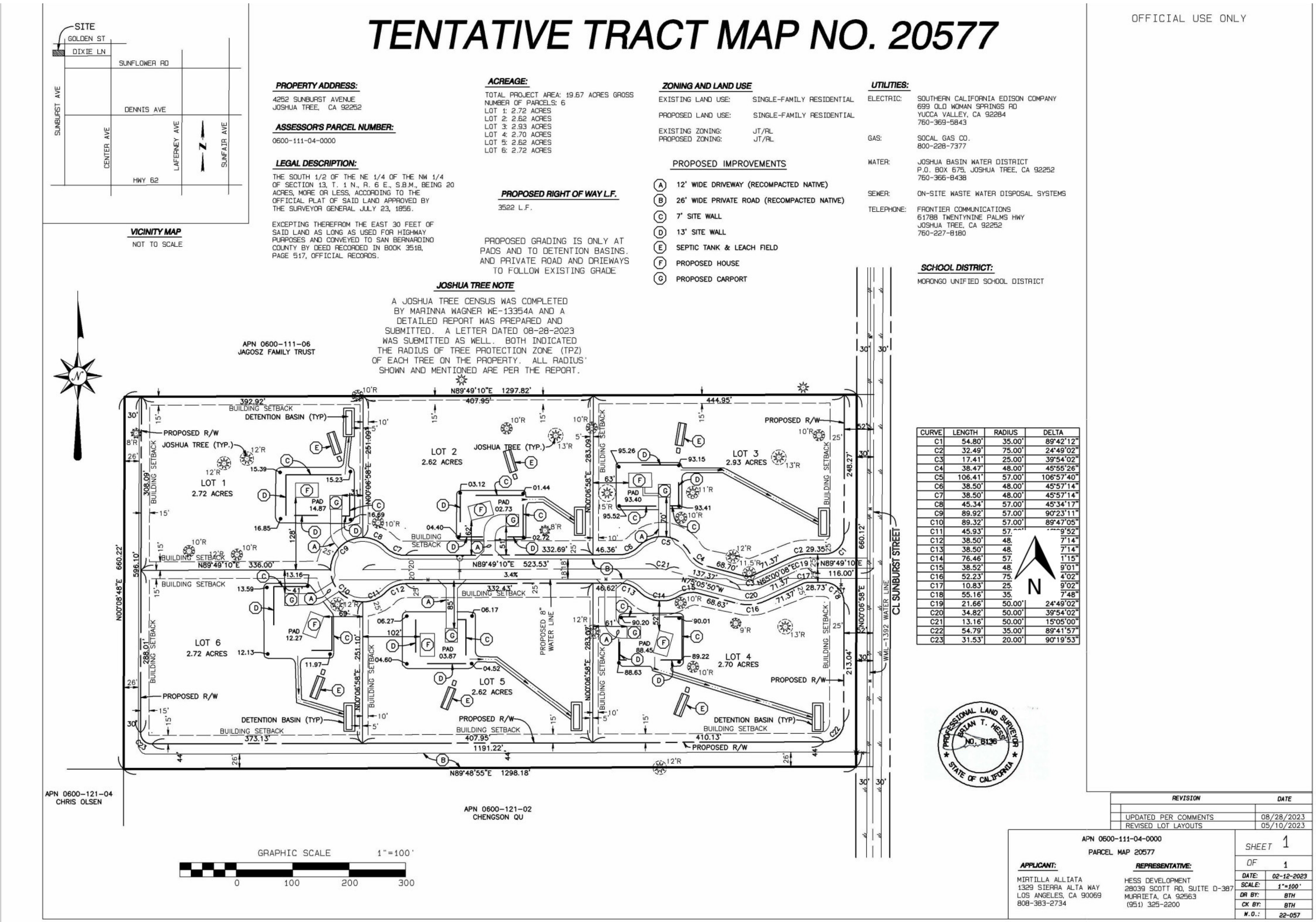
The Project proposes a residential-use development consisting of 6 lots, single-family residential dwelling units, on 19.67 acres. As a worst-case scenario, this assessment assumes the project is built-out in one (1) complete phase. Construction activities within the Project area will consist of on-site grading, building, paving, and architectural coating.

This study assesses both the traffic and short-term stationary noise to and from the project site and compares the results to the applicable County noise limits. The primary source of traffic noise propagates from Sunburst Street. The primary source of short-term stationary noise propagates from construction equipment to be deployed in the area for construction activities. The site plan used for this is illustrated in Exhibit B.

Exhibit A

Location Map

Exhibit B
Site Plan



2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

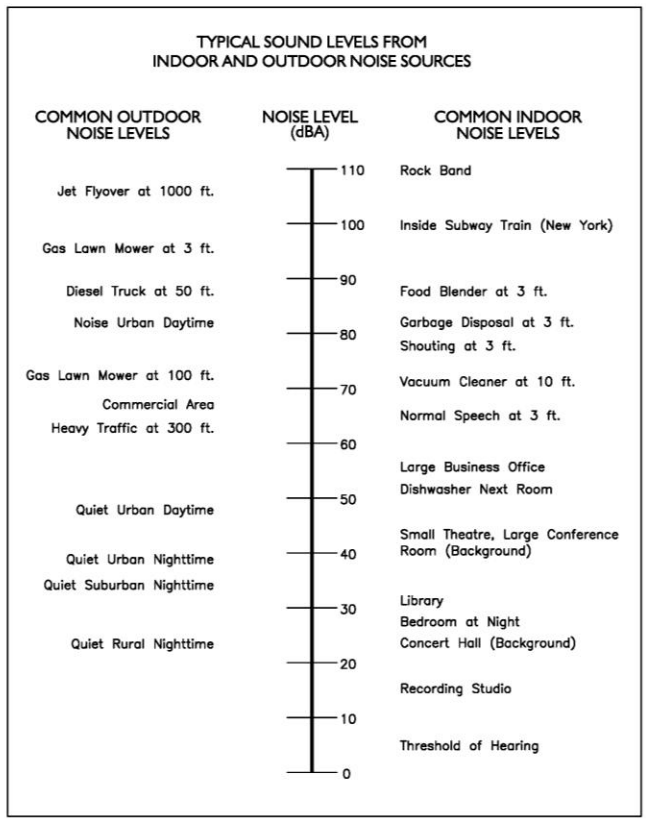
2.1 Sound, Noise and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic, or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.

2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding) and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting out at 20 Hz all the way to the high pitch of 20,000 Hz.

Exhibit C: Typical A-Weighted Noise Levels



2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines it loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measure in units of micro-Newton per square inch meter (N/m2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels abbreviated dB. Exhibit C illustrates references sound levels for different noise sources.

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, (A-weighted scale) and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive the change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g. doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

2.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted 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 response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a 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, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly L50, L90 and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

2.7 Traffic Noise Prediction

Noise levels associated with traffic depends on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2–3 axle) and heavy truck percentage (4 axle and greater), and sound propagation. The greater the volume of traffic, higher speeds and truck percentages equate to a louder volume in noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.8 Sound Propagation

As sound propagates from a source it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity and turbulence can further impact have far sound can travel.

3.0 Ground-Borne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV) which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

3.3 Vibration Perception

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

3.3 Ground-borne Noise and Vibration

Vibration travels from the source through the adjacent ground, creating vibration waves that propagate through soil layers and rock strata to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the building structure. The vibration of the building structure and room surfaces can radiate a low-frequency rumble called ground-borne noise. The annoyance potential of ground-borne noise is typically characterized with the A-weighted sound level. Although the A-weighted sound level is typically used to characterize community noise, characterizing low-frequency noise using A-weighting can be challenging because the non-linearity of human hearing causes sounds dominated by low-frequency components to seem louder than broadband sounds (sounds consisting of many frequency components, with no dominant frequencies) that have the same A-weighted level. The result is that ground-borne noise with a level of 40 dBA sounds louder than 40 dBA broadband noise. Because ground-borne noise sounds louder than broadband noise at the same noise level, the limits for ground-borne noise are lower (i.e., stricter) than would be the case for broadband noise.

Ground-borne vibration can be a concern for nearby neighbors of a transit system route or maintenance facility. However, in contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. This section discusses common sources of ground-borne vibration and noise. Most perceptible indoor vibration is caused by sources within buildings such as the operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of vibration waves that propagate through the ground and create perceptible ground-borne vibration in nearby buildings include construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is fairly smooth, the vibration from rubber-tired traffic is rarely perceptible. Building damage due to vibration is also rare for typical transportation projects; but in extreme cases, such as during blasting or pile-driving during construction, vibration could cause damage to buildings.

Ground-borne noise is typically only assessed at locations with subway or tunnel operations where there is no airborne noise path, or for buildings with substantial sound insulation such as a recording studio. For typical buildings with at-grade or elevated vibration sources, the interior airborne noise levels are often higher than the ground-borne noise levels.

4.0 Regulatory Setting

The proposed project is located in the Joshua Tree Community within the San Bernardino County, California and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible to regulate noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible to regulate noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdiction use their land use regulatory authority to arrange new development in such a way that “noise sensitive” uses are either prohibited from being constructed adjacent to a highway or, or alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

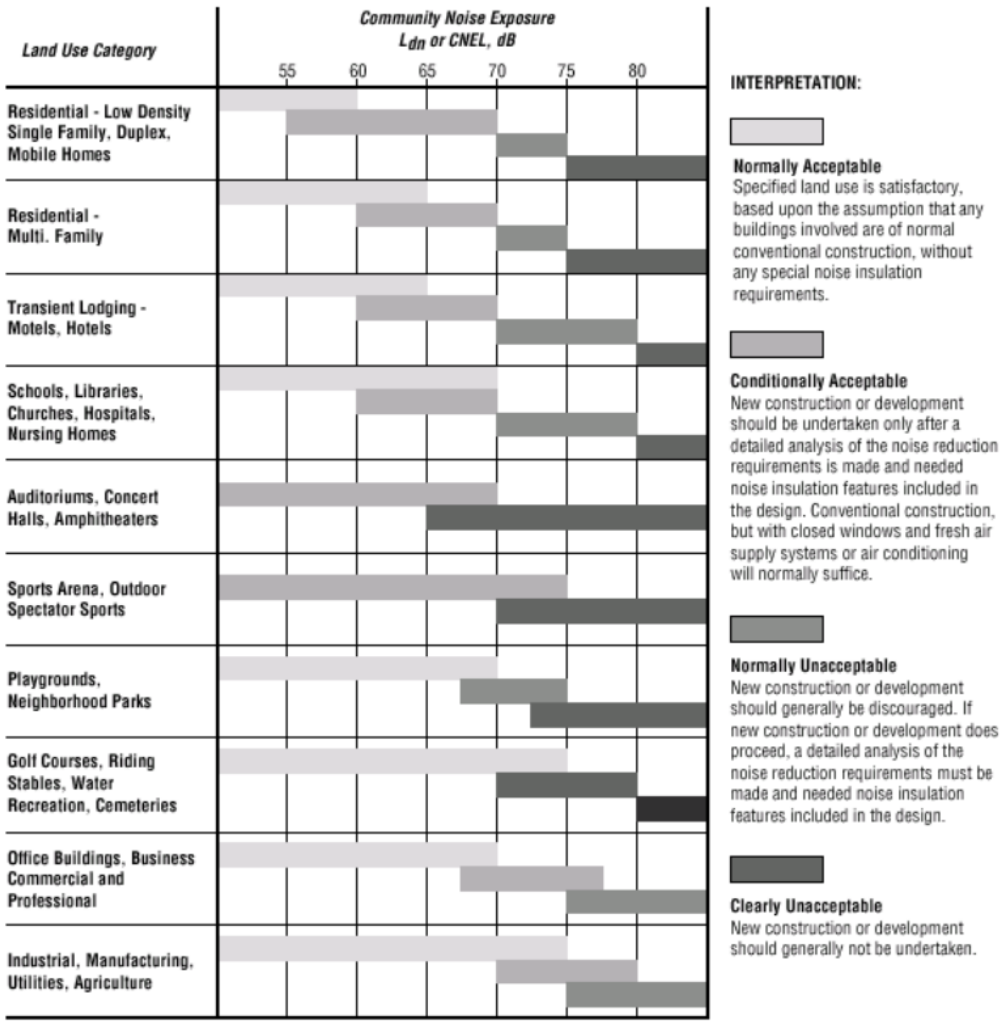
Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the city is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix.” The matrix allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24 and the Uniform Building Code (UBC) which in some cases requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable as illustrated in Exhibit D.

Exhibit D: Land Use Compatibility Guidelines



4.3 San Bernardino County Noise Regulations

San Bernardino County outlines its noise regulations and standards in the Countywide Policy Plan, Hazards Element from the General Plan, and the Noise Ordinance from the Development Code.

San Bernardino County Countywide Policy Plan

Applicable policies and standards governing environmental noise in the County are set forth in the Countywide Policy Plan. Section Safety and Security, in its goal HZ-2 Human-generated Hazards, outlines the noise policies within the county.

The County has outlined goals, policies, and implementation measures to reduce potential noise impacts and are presented below:

Goals, Policies, and Implementation Measures

Policies, goals and implementation program measures from the Policy Plan that would mitigate potential impacts on noise include the following.

Goal HZ-2 Human-generated Hazards: People and the natural environment protected from exposure to hazardous materials, excessive noise, and other human-generated hazards.

Policy HZ-2.6: Coordination with transportation authorities. We collaborate with airport owners, FAA[1], Caltran[2], SBCTA[3], SCAG[4], neighboring jurisdictions, and other transportation providers in the preparation and maintenance of, updates to transportation-related plans and projects to minimize noise impacts and provide appropriate mitigation measures.

Policy HZ-2.7: Truck delivery areas. We encourage truck delivery areas to be located away from residential properties and require associated noise impacts to be mitigated.

Policy HZ-2.8: Proximity to noise generating uses. We limit or restrict new noise sensitive land uses in proximity to existing conforming noise generating uses and planned industrial areas.

Policy HZ-2.9: Control sound at the source. We prioritize noise mitigation measures that control sound at the source before buffers, soundwalls, and other perimeter measures.

Policy HZ-2.10: Agricultural operations. We require new development adjacent to existing conforming agricultural operations to provide adequate buffers to reduce the exposure of new development to operational noise, odor, and the storage or application of pesticides or other hazardous materials.

[1] Federal Aviation Administration
[2] California Department of Transportation
[3] San Bernardino County Transportation Authority
[4] Southern California Association of Governments

San Bernardino County – Noise Ordinance/Development Code

Chapter 83.01 General Performance Standards of the County's Development Code outlines the County's noise ordinance.

Section 83.01.080 –Noise

This Section establishes standards concerning acceptable noise levels for both noise-sensitive land uses and for noise-generating land uses.

(a) *Noise Measurement*. Noise shall be measured:
  (1) At the property line of the nearest site that is occupied by, and/or zoned or designated to allow the development of noise-sensitive land uses;
  (2) With a sound level meter that meets the standards of the American National Standards Institute (ANSI § SI4 1979, Type 1 or Type 2);
  (3) Using the "A" weighted sound pressure level scale in decibels (ref. pressure = 20 micronewtons per meter squared). The unit of measure shall be designated as dB(A).

(b) *Noise Impacted Areas*. Areas within the County shall be designated as "noise-impacted" if exposed to existing or projected future exterior noise levels from mobile or stationary sources exceeding the standards listed in Subdivision (d) (Noise Standards for Stationary Noise Sources) and Subdivision (e) (Noise Standards for Adjacent Mobile Noise Sources), below. New development of residential or other noise-sensitive land uses shall not be allowed in noise-impacted areas unless effective mitigation measures are incorporated into the project design to reduce noise levels to these standards. Noise-sensitive land uses shall include residential uses, schools, hospitals, nursing homes, religious institutions, libraries, and similar uses.

(c) *Noise Standards for Stationary Noise Sources*.

  (1) *Noise Standards*. Table 83-2 (Noise Standards for Stationary Noise Sources) describes the noise standard for emanations from a stationary noise source, as it affects adjacent properties:

Table 1: Noise Standards for Stationary Noise Sources (Table 83-2)

Table 83-2		
Noise Standards for Stationary Noise Sources		
Affected Land Uses (Receiving Noise)	***7:00 a.m. – 10 p.m. Leq***	***10:00 p.m. – 7 a.m. Leq***
Residential	55 dB(A)	45 dB(A)
Professional Services	55 dB(A)	55 dB(A)
Other Commercial	60 dB(A)	60 dB(A)
Industrial	70 dB(A)	70 dB(A)
Leq = (Equivalent Energy Level). The sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period, typically one, eight or 24 hours.		
dB(A) = (A-weighted Sound Pressure Level). 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, placing greater emphasis on those frequencies within the sensitivity range of the human ear.		

(2) Noise Limit Categories. No person shall operate or cause to be operated a source of sound at a location or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by the person, which causes the noise level, when measured on another property, either incorporated or unincorporated, to exceed any one of the following:

(a) The noise standard for the receiving land use as specified in Subdivision (b) (Noise-Impacted Areas), above, for a cumulative period of more than 30 minutes in any hour.

(b) The noise standard plus five dB(A) for a cumulative period of more than 15 minutes in any hour.

(c) The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour.

(d) The noise standard plus 15 dB(A) for a cumulative period of more than one minute in any hour.

(e) The noise standard plus 20 dB(A) for any period of time.

(d) Noise Standards for Adjacent Mobile Noise Sources. Noise from mobile sources may affect adjacent properties adversely. When it does, the noise shall be mitigated for any new development to a level that shall not exceed the standards described in the following Table 83-3 (Noise Standards for Adjacent Mobile Noise Sources).

Table 2: Noise Standards for Adjacent Mobile Noise Sources (Table 83-3)

Table 83-3			
Noise Standards for Adjacent Mobile Noise Sources			
Land Use		***Ldn (or CNEL) dB(A)***	
Categories	***Uses***	***Interior***(1)	***Exterior***(2)
Residential	Single and multi-family, duplex, mobile homes	45	60(3)
Commercial	Hotel, motel, transient housing	45	60(3)
	Commercial retail, bank, restaurant	50	N/A
	Office building, research and development, professional offices	45	65
	Amphitheater, concert hall, auditorium, movie theater	45	N/A
Institutional/Public	Hospital, nursing home, school classroom, religious institution, library	45	65
Open Space	Park	N/A	65
Notes:			
(1) The indoor environment shall exclude bathrooms, kitchens, toilets, closets and corridors.			
(2) The outdoor environment shall be limited to: • Hospital/office building patios • Hotel and motel recreation areas • Mobile home parks • Multi-family private patios or balconies • Park picnic areas • Private yard of single-family dwellings • School playgrounds			
(3) An exterior noise level of up to 65 dB(A) (or CNEL) shall be allowed provided exterior noise levels have been substantially mitigated through a reasonable application of the best available noise reduction technology, and interior noise exposure does not exceed 45 dB(A) (or CNEL) with windows and doors closed. Requiring that windows and doors remain closed to achieve an acceptable interior noise level shall necessitate the use of air conditioning or mechanical ventilation.			
CNEL = (Community Noise Equivalent Level). The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night from 10:00 p.m. to 7:00 a.m.			

(e) *Increases in Allowable* Noise Levels. If the measured ambient level exceeds any of the first four noise limit categories in Subdivision (d)(2), above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category in Subdivision (d)(2), above, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.
(f) *Reduction in Allowable Noise Levels.* If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in Table 83-2 (Noise Standards for Stationary Noise Sources) shall be reduced by five dB(A).
(g) *Exempt Noise.* The following sources of noise shall be exempt from the regulations of this Section:
   (1) Motor vehicles not under the control of the commercial or industrial use.
   (2) Emergency equipment, vehicles, and devices.
   (3) Temporary construction, maintenance, repair, or demolition activities between 7:00 a.m. and 7:00 p.m., except Sundays and Federal holidays.
(h) Noise Standards for Other Structures. All other structures shall be sound attenuated against the combined input of all present and projected exterior noise to not exceed the criteria.

Per the table above outlined above, the City's noise limit for residential uses is 55 dBA during the hours of 7:00 AM to 6:00 PM, 50 dBA during the hours of 6:00 PM to 10:00 PM, 45 dBA during the hours of 10:00 PM to 7:00 AM.

Table 3: Noise Standards for Other Structures (Table 83-3)

Table 83-4	
Noise Standards for Other Structures	
Typical Uses	**12-Hour Equivalent Sound Level (Interior) in dBA Ldn**
Educational, institutions, libraries, meeting facilities, etc.	45
General office, reception, etc.	50
Retail stores, restaurants, etc.	55
Other areas for manufacturing, assembly, testing, warehousing, etc.	65

In addition, the average of the maximum levels on the loudest of intrusive sounds occurring during a 24-hour period shall not exceed 65 dBA interior.

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as the first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance to the County's and Caltrans (TeNS) technical noise specifications. All measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). The following gives a brief description of the Caltrans Technical Noise Supplement procedures for sound level measurements:

- Microphones for sound level meters were placed 5-feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of equipment, a windscreen was placed over the microphone
- Frequency weighting was set on "A" and slow response
- Results of the long-term noise measurements were recorded on field data sheets
- During any short-term noise measurements, any noise contaminations such as barking dogs, local traffic, lawn mowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Locations

Noise monitoring location was selected based on the nearest noise source relative to the proposed project site. One (1) long-term 24-hour noise measurement was conducted at or near the project site and is illustrated in Exhibit E. Appendix A includes photos, field sheet, and measured noise data.

5.3 FHWA Traffic Noise Prediction Model

Traffic noise from vehicular traffic was projected using a computer program that replicates the FHWA Traffic Noise Prediction Model (FHWA-RD-77-108). The FHWA model arrives at the predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). Roadway volumes and percentages correspond to the two-lane primary arterial projection shown in the Circulation Element of the Joshua Tree's Community Plan (adopted March 13, 2007) Table 4 (volume numbers taken from Sunburst Ave 2030 projection). The project trip generation was obtained from the 4252 Sunburst Street Trip Generation Analysis and VMT Screening prepared by TJW Engineering, Inc.

The referenced traffic data was applied to the model and is in Appendix B. The following outlines the key adjustments made to the REMEL for the roadway inputs:

- Roadway classification – (e.g. freeway, major arterial, arterial, secondary, collector, etc),
- Roadway Active Width – (distance between the center of the outer most travel lanes on each side of the roadway)
- Average Daily Traffic Volumes (ADT), Travel Speeds, Percentages of automobiles, medium trucks and heavy trucks
- Roadway grade and angle of view
- Site Conditions (e.g. soft vs. hard)
- Percentage of total ADT which flows each hour through-out a 24-hour period

Table 4 indicates the roadway parameters and vehicle distribution utilized for this study.

Table 4: Roadway Parameters and Vehicle Distribution

Roadway	**Segment**	**Existing ADT[1]**	**Existing Plus Project ADT**	**Speed (MPH)**	**Site Conditions**
Sunburst Ave	Sunflower Rd to Golden St	2,948	3,005	55	Hard
Secondary and Collector Vehicle Distribution (Truck Mix)[2]					
Motor-Vehicle Type		**Daytime % (7AM to 7 PM)**	**Evening % (7 PM to 10 PM)**	**Night % (10 PM to 7 AM)**	**Total % of Traffic Flow**
Automobiles		75.5	14.0	10.5	97.42
Medium Trucks		48.9	2.2	48.9	1.84
Heavy Trucks		47.3	5.4	47.3	0.74

Notes:
[1] Per Joshua Tree Community Plan (Section 3 Circulation and Infrastructure, County of San Bernardino, CA – 04/2007) 2030 projection.
[2] Vehicle distribution data is based on Riverside County Mix data for collectors and secondary roadways.

The following outlines key adjustments to the REMEL for project site parameter inputs:

- Vertical and horizontal distances (Sensitive receptor distance from noise source)
- Noise barrier vertical and horizontal distances (Noise barrier distance from sound source and receptor).
- Traffic noise source spectra
- Topography

MD projected the traffic noise levels to the on-site receptors. The project noise calculation worksheet outputs are located in Appendix B.

5.4 FHWA Roadway Construction Noise Model

The construction noise analysis utilizes the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RNCM), together with several key construction parameters. Key inputs include distance to the sensitive receiver, equipment usage, % usage factor, and baseline parameters for the project site.

The project was analyzed based on the different construction phases. Construction noise is expected to be loudest during the grading, concrete and building phases of construction. The construction noise calculation output worksheet is located in Appendix C. The following assumptions relevant to short-term construction noise impacts were used:

- It is estimated that construction will occur over a 8 to 10-month time period. Construction noise is expected to be the loudest during the grading, concrete, and building phases.

5.5 Stationary Noise Modeling

SoundPLAN (SP) acoustical modeling software was utilized to model future worst-case stationary noise impacts to the adjacent land uses. SP is capable of evaluating multiple stationary noise source impacts at various receiver locations. SP's software utilizes algorithms (based on the inverse square law and reference equipment noise level data) to calculate noise level projections. The software allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations.

The future worst-case noise level projections were modeled using referenced sound level data for the various stationary on-site sources (mechanical equipment close to the buildings). The model includes mechanical equipment located next to the residential buildings. The worst-case scenario considers the mechanical equipment working continuously. The reference sound level data is 68 dBA at 3 feet, the cutsheet is provided in Appendix D.

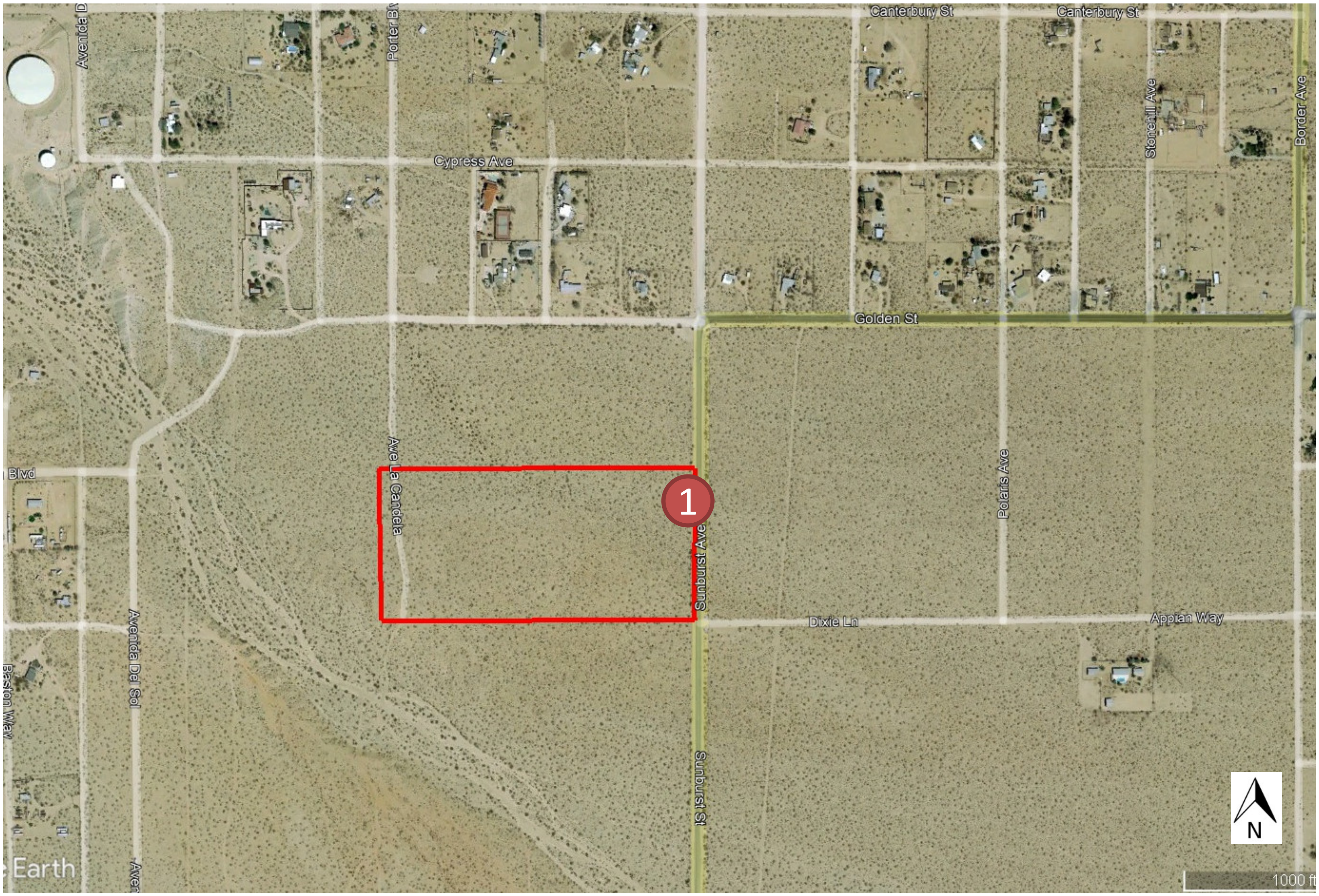
The SP model assumes that all noise sources are operating simultaneously (worst-case scenario), when in actuality the noise will be intermittent and lower in noise level. SP modeling inputs and outputs are provided in Appendix D.

Finally, the emergency generators operation was not considered in the model since the operation of said equipment is projected for an emergency situation, and according to County's Municipal Code Section 83.01.080 (g), noise from emergency generators should be exempt.

Exhibit E

Measurement Locations

= Long-Term Monitoring Location



6.0 Existing Noise Environment

One (1) 24-hour ambient noise measurement was conducted at the property site. The noise measurement was taken to determine the existing ambient noise levels. Noise data indicates that traffic along Sunburst Avenue is the primary source of noise impacting the site and the adjacent uses. This assessment utilizes the ambient noise data as a basis and compares project operational levels to said data.

6.1 Long-Term Noise Measurement Results

The results of the long-term noise data are presented in Table 5.

Table 5: Long-Term Noise Measurement Data[1]

Date	Time	1-Hour dB(A)							
		L_{EQ}	L_{MAX}	L_{MIN}	L_2	L_8	L_{25}	L_{50}	L_{90}
10/19/2023	12:00AM-1:00AM	57.7	79.1	20.9	67.8	63.2	51.0	39.7	24.9
10/19/2023	1:00AM-2:00AM	55.3	76.7	18.5	65.4	60.8	48.6	37.3	22.5
10/19/2023	2:00AM-3:00AM	54.1	75.5	17.3	64.2	59.6	47.4	36.1	21.3
10/19/2023	3:00AM-4:00AM	52.3	73.7	15.5	62.4	57.8	45.6	34.3	19.5
10/19/2023	4:00AM-5:00AM	53.3	74.7	16.5	63.4	58.8	46.6	35.3	20.5
10/19/2023	5:00AM-6:00AM	57.1	78.5	20.3	67.2	62.6	50.4	39.1	24.3
10/19/2023	6:00AM-7:00AM	63.5	84.9	26.7	73.6	69.0	56.8	45.5	30.7
10/19/2023	7:00AM-8:00AM	65.8	87.2	29.0	75.9	71.3	59.1	47.8	33.0
10/19/2023	8:00AM-9:00AM	63.9	85.3	27.1	74.0	69.4	57.2	45.9	31.1
10/19/2023	9:00AM-10:00AM	62.9	84.3	26.1	73.0	68.4	56.2	44.9	30.1
10/19/2023	10:00AM-11:00AM	62.8	84.2	26.0	72.9	68.3	56.1	44.8	30.0
10/19/2023	11:00AM-12:00PM	63.0	84.4	26.2	73.1	68.5	56.3	45.0	30.2
10/19/2023	12:00PM-1:00PM	63.1	84.5	26.3	73.2	68.6	56.4	45.1	30.3
10/19/2023	1:00PM-2:00PM	63.2	84.6	26.4	73.3	68.7	56.5	45.2	30.4
10/19/2023	2:00PM-3:00PM	63.4	84.8	26.6	73.5	68.9	56.7	45.4	30.6
10/19/2023	3:00PM-4:00PM	64.6	86.0	27.8	74.7	70.1	57.9	46.6	31.8
10/19/2023	4:00PM-5:00PM	66.1	87.5	29.3	76.2	71.6	59.4	48.1	33.3
10/19/2023	5:00PM-6:00PM	65.8	87.2	29.0	75.9	71.3	59.1	47.8	33.0
10/19/2023	6:00PM-7:00PM	64.1	85.5	27.3	74.2	69.6	57.4	46.1	31.3
10/19/2023	7:00PM-8:00PM	62.7	84.1	25.9	72.8	68.2	56.0	44.7	29.9
10/19/2023	8:00PM-9:00PM	61.6	83.0	24.8	71.7	67.1	54.9	43.6	28.8
10/19/2023	9:00PM-10:00PM	60.9	82.3	24.1	71.0	66.4	54.2	42.9	28.1
10/19/2023	10:00PM-11:00PM	59.9	81.3	23.1	70.0	65.4	53.2	41.9	27.1
10/19/2023	11:00PM-12:00AM	59.3	80.7	22.5	69.4	64.8	52.6	41.3	26.5
CNEL		66.5							

Notes:
1. Long-term noise monitoring location (LT1) is illustrated in Exhibit E.

Noise data indicates the ambient noise level average was 66.5 dBA CNEL at the project site. Maximum hourly levels reached 66.1 dBA at 4:00 p.m. as a result of traffic along Sunburst Avenue, and the quietest level was 52 dBA. Additional field notes and photographs are provided in Appendix A.

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts to and from the project and compares the results to the County's Noise Standards. The analysis details the estimated exterior noise levels associated with traffic from adjacent roadways.

7.1 Future Exterior Noise

The following outlines the exterior noise levels associated with the proposed project.

7.1.1 Noise Impacts to Off-Site Receptors Due to Project Generated Traffic

A worst-case project-generated traffic noise level was modeled utilizing the FHWA Traffic Noise Prediction Model - FHWA-RD-77-108. Traffic noise levels were calculated for the closest residential use in the property; this point was assumed to be 60 feet from the centerline of the analyzed roadway; this was made considering the roadway ROW and the setback described in the site plan. The trip generation for the 6 single-family residence project is 57. The modeling is theoretical and does not take into account any existing barriers, structures, and/or topographical features that may further reduce noise levels. Therefore, the levels are shown for comparative purposes only to show the difference in with and without project conditions. In addition, the noise contours for 60, 65 and 70 dBA CNEL were calculated. The potential off-site noise impacts caused by an increase of traffic from operation of the proposed project on the nearby roadways were calculated for the following scenarios:

Existing Year (without Project): This scenario refers to existing year traffic noise conditions.

Existing Year (Plus Project): This scenario refers to existing year + project traffic noise conditions.

Table 5 compares the without and with project scenario and shows the change in traffic noise levels as a result of the proposed project. It takes a change of 3 dB or more to hear a perceptible difference. As demonstrated in Table 5, the project is anticipated to not generate change in the noise CNEL level.

The change in noise level is less than significant as 0.1 dBA noise increase is projected. No further mitigation is required.

7.1.2 Noise Impacts to On-Site Receptors Due to Traffic

Traffic noise from the local roadway network was evaluated and compared to the County's noise ordinance. Per the County's noise ordinance Section 83.01.080, Table 83-3, note (3), single-family residential is normally acceptable up to 60 dBA CNEL, after noise mitigation has been provided. As shown in Table 6, Existing Plus Project traffic 70 dBA CNEL noise projections from Sunburst Avenue reach up to 20 feet from roadway centerline. Proposed residential structures are estimated to be approximately 350 feet away from roadway centerline and fall within the 60 to 55 dBA CNEL contour of the Roadway and are within the normally acceptable range for single-family residential (per County's Ordinance).

Standard construction will reduce the interior noise levels down to 45 dBA CNEL or less.

Table 6: Existing Scenario - Noise Levels Along Roadways (dBA CNEL)

Existing Without Project Exterior Noise Levels

Roadway	Segment	CNEL at 60 Ft (dBA)	Distance to Contour (Ft)			
			70 dBA CNEL	65 dBA CNEL	60 dBA CNEL	55 dBA CNEL
Sunburst Ave	Sunflower Rd to Golden St	65.1	20	62	196	620

Existing With Project Exterior Noise Levels

Roadway	Segment	CNEL at 60 Ft (dBA)	Distance to Contour (Ft)			
			70 dBA CNEL	65 dBA CNEL	60 dBA CNEL	55 dBA CNEL
Sunburst Ave	Sunflower Rd to Golden St	65.2	20	63	200	632

Change in Existing Noise Levels as a Result of Project

Roadway	Segment	CNEL at 60 Feet dBA[1,2]			
		Existing Without Project	Existing With Project	Change in Noise Level	Potential Significant Impact
Sunburst Ave	Sunflower Rd to Golden St	65.1	65.2	0.1	No

Notes:
[1] Exterior noise levels calculated at 5 feet above ground level.
[2] Noise levels calculated from centerline of subject roadway.

7.1.3 Noise Impacts to Off-Site Receptors Due to Operational Traffic

The nearest off-site sensitive uses along Sunburst Avenue are located to the south and are approximately 170 feet from the roadway centerline. The receiver distance is located between the 60 and 65 noise contour ranges, and it is not affected by the project's trip generated. Therefore, the project's operations will have less than significant impact on any off-site sensitive uses.

7.1.4 Noise Impacts to Off-Site Receptors Due to Stationary Sources

Due to the location of the proposed residential facilities, there are no existing receptors that may be affected by project operational noise. Since there are potential land uses that may be impacted in the vicinity area the noise contours for the operational impact are shown in Exhibit F. The worst-case stationary noise was modeled using SoundPLAN acoustical modeling software. The model utilizes reference noise levels from previous MD project data for the mechanical equipment specified within Section 5.5 of this report.

A total of three (3) receptor locations were modeled to evaluate the proposed project's operational noise impact on adjacent noise-sensitive land uses to the north, west, and south. All receivers were considered to be at the property line of each side. A receptor is denoted by a yellow dot in Exhibit F. All receptors represents the potential rural living uses adjoining the project site.

Project Operational Noise Levels

Exhibit F shows the "project only" operational noise levels at the property lines and/or sensitive receptor areas and illustrates how the noise will propagate at the site. Worst-case operational noise levels are anticipated to range between 24 to 29 dBA Leq at the receptor locations. The noise projections are below the County's noise limits as given in Section 83.01.080 of the Municipal Code.

Project Plus Ambient Operational Noise Levels

Since receivers are located at different distances from Sunburst Avenue, the ambient noise level considered for each location corresponds to the traffic noise model calculated level and calibrated to the ambient level measured on site. Receiver R1 is 1,300 feet from the roadway, R2 and R3 are 170 feet from Sunburst Avenue. Table 7 demonstrates the project plus ambient noise levels. Project plus ambient noise level projections are anticipated to range between 43 to 50 dBA Leq at the sensitive receptors.

Table 7: Worst-case Predicted Operational Noise Levels (dBA)

Receptor[1]	Existing Ambient Noise Level (dBA, Leq)[2]	Project Noise Level (dBA, Leq)[3]	Total Combined Noise Level (dBA, Leq)	Limit Day/Night (dBA)	Exceeds Ordinance	Change in Noise Level as Result of Project
R1	44	24	44	55/45	NO[4]	0
R2	53	29	53	55/53	NO[4]	0
R3	53	25	53	55/53	NO[4]	0

Notes:
1. Receptor locations in Exhibit F. All receivers are vacant lot with rural living designation.
2. The night (quietest) Leq calculated using the TNM model and calibrated to the measured ambient level.
3. See Exhibit F for noise contours.
4 Limit adjusted to the ambient level according to Section 83.01.080 of the Municipal Code.

In addition, Table 7 provides the anticipated change in noise level as a result of the proposed project operational conditions. As already demonstrated, the project's maximum operational noise levels do not exceed the County's noise limit given by the Development Code. Table 8 provides the characteristics associated with changes in noise levels.

Table 8: Change in Noise Level Characteristics[1]

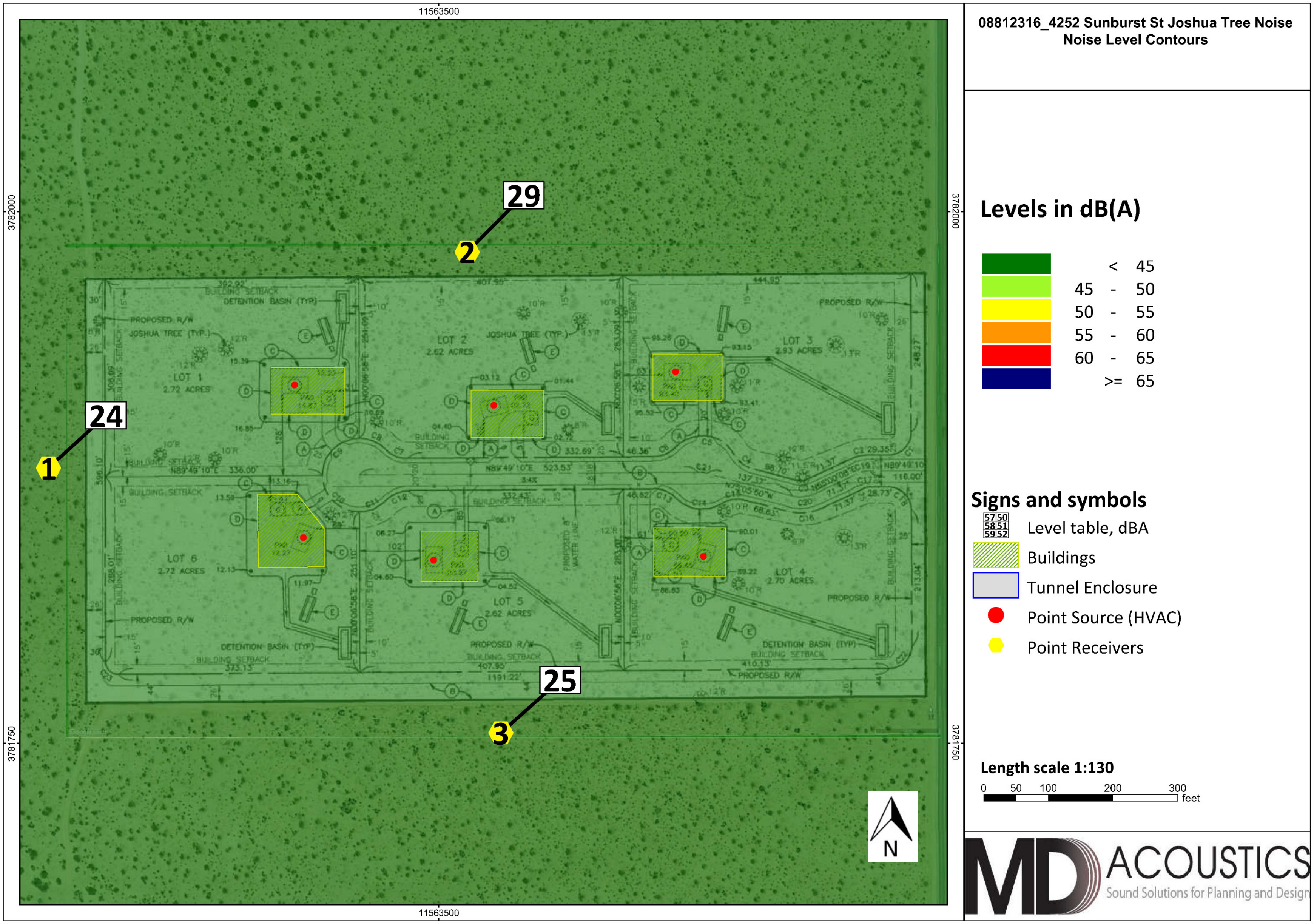
Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

The change in noise level would fall within the "Not Perceptible" acoustic characteristic; therefore, the impact is less than significant.

Exhibit F

Operational Noise Levels Contours Leq (h)



7.2 Summary of Recommendations

The following recommendations are provided:

R-1: The project shall achieve a minimum of 20 dBA noise reduction in the residential building shell design to meet the County's 45 dBA CNEL interior residential requirement.

R-2: The project shall consider a setback of at least 63 feet adjoining to roadways to meet the County's 65 dBA exterior conditional requirement.

8.0 Construction Noise Impact

The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. Noise levels associated with the construction will vary with the different phases of construction.

8.1 Construction Noise

The Environmental Protection Agency (EPA) has compiled data regarding the noise-generated characteristics of typical construction activities. The data is presented in Table 9.

Table 9: Typical Construction Noise Levels[1]

Equipment Powered by Internal Combustion Engines

Type	Noise Levels (dBA) at 50 Feet
Earth Moving	
Compactors (Rollers)	73 - 76
Front Loaders	73 - 84
Backhoes	73 - 92
Tractors	75 - 95
Scrapers, Graders	78 - 92
Pavers	85 - 87
Trucks	81 - 94
Materials Handling	
Concrete Mixers	72 - 87
Concrete Pumps	81 - 83
Cranes (Movable)	72 - 86
Cranes (Derrick)	85 - 87
Stationary	
Pumps	68 - 71
Generators	71 - 83
Compressors	75 - 86

Impact Equipment

Type	Noise Levels (dBA) at 50 Feet
Saws	71 - 82
Vibrators	68 - 82

Notes:
[1] Referenced Noise Levels from the Environmental Protection Agency (EPA) Report # NTID300.1

Construction noise is considered a short-term impact and would be considered significant if construction activities are taken outside the allowable times as described in the County's Municipal Code (Section 83.01.080(g)(3)). Construction is anticipated to occur during the permissible hours (7 am to 7 pm) according to the County's Municipal Code. Construction noise will have a temporary or periodic increase in the ambient noise level above the existing within the project vicinity. Furthermore, noise reduction measures are provided to further reduce construction noise. The impact is considered less than significant however construction noise level projections are provided.

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. Noise levels will be loudest during grading phase. A likely worst-case construction noise scenario during grading assumes the use of a grader, a dozer, and two (2) excavators, two (2) backhoes and two (2) scrapers operating at 1,100 feet from the nearest sensitive receptor (residence to the north, across Golden Street).

Assuming a usage factor of 40 percent for each piece of equipment, unmitigated noise levels at 1,100 feet have the potential to reach 57 dBA L_{eq} and 61 dBA L_{max} at the nearest sensitive receptors during grading. Noise levels for the other construction phases would be lower and range between 48 to 52 dBA.

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. The primary vibration source during construction may be from a bull dozer. A large bull dozer has a vibration impact of 0.089 inches per second peak particle velocity (PPV) at 25 feet which is perceptible but below any risk to architectural damage.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref}\ (100/D_{rec})^n$$

Where: PPV_{ref} = reference PPV at 100ft.
D_{rec} = distance from equipment to receiver in ft.
n = 1.1 (the value related to the attenuation rate through ground)

The thresholds from the Caltrans Transportation and Construction Induced Vibration Guidance Manual in Table 10 (below) provides general thresholds and guidelines as to the vibration damage potential from vibratory impacts.

Table 10: Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	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: Table 19, Transportation and Construction Vibration Guidance Manual, Caltrans, Sept. 2013.
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 11 gives approximate vibration levels for particular construction activities. This data provides a reasonable estimate for a wide range of soil conditions.

Table 11: Vibration Source Levels for Construction Equipment[1]

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Pile driver (impact)	1.518 (upper range)	112
	0.644 (typical)	104
Pile driver (sonic)	0.734 upper range	105
	0.170 typical	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill	0.008 in soil	66
(slurry wall)	0.017 in rock	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

[1] Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

At a distance of 1,100 feet (residence to the north, across Golden Street), a large bull dozer would yield a worst-case 0.001 PPV (in/sec) which below the threshold of perception and any risk of damage. The impact is less than significant and no mitigation is required.

8.3 Construction Noise Reduction Measures

Construction operations must follow the County's Noise Ordinance, which states that construction, repair or excavation work performed must occur within the permissible hours of 7 a.m. to 7 p.m. To further ensure that construction activities do not disrupt the adjacent land uses, the following measures should be taken:

1. Construction should occur during the permissible hours as defined in Section 83.01.080(6)(3).

2. During construction, the contractor shall ensure all construction equipment is equipped with appropriate noise attenuating devices such as mufflers.

3. The contractor should locate equipment staging areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.

4. Idling equipment should be turned off when not in use.

5. Equipment shall be maintained so that vehicles and their loads are secured from rattling and banging.

9.0 References

State of California General Plan Guidelines: 2017. Governor's Office of Planning and Research

County of San Bernardino: General Policy Plan Hazards Element. October 2020.

County of San Bernardino: Chapter 83.01, Section 83.01.080 Noise of the Municipal Code.

County of San Bernardino: Joshua Tree Community Plan, Section 3 Circulation and Infrastructure – Table 4 Mobility Statistics, April 2007.

Federal Highway Administration. Noise Barrier Design Handbook. June 2017.

Federal Transit Administration. Transit Noise and Vibration Impact Assessment Manual. September 2018

4252 Sunburst Street Trip Generation Analysis and VMT Screening, County of San Bernardino, prepared by TJW Engineering, Inc. October 6, 2023.

Appendix A:

Photographs Field Measurement Data

MD ACOUSTICS
Sound Solutions for Planning and Design
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AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

24-Hour Continuous Noise Measurement Datasheet

Project: TTM 20577 Joshua Tree Noise
Site Address/Location: 4252 Sunburst St, Joshua Tree, CA
Date: 10/19/2023
Field Tech/Engineer: Jason Schuyler/Francisco Irarrazabal

Site Observations: Meter was 60 ft from Sunburst Centerline. Road noise.

General Location: Eastern Property Line 60 ft from Sunburst CL
Sound Meter: NTi, XL2 **SN:** A2A-07095-E0
Settings: A-weighted, slow, 1-hour, 24-hour duration
Meteorological Con.: 100F winds 1-3MPH clear skies
Site ID: LT-1

Site Topo: Flat
Ground Type: Dirt and pavement

Noise Source(s) w/ Distance:
1 - 60' from Sunburst CL

Figure 1: LT Monitoring Locations

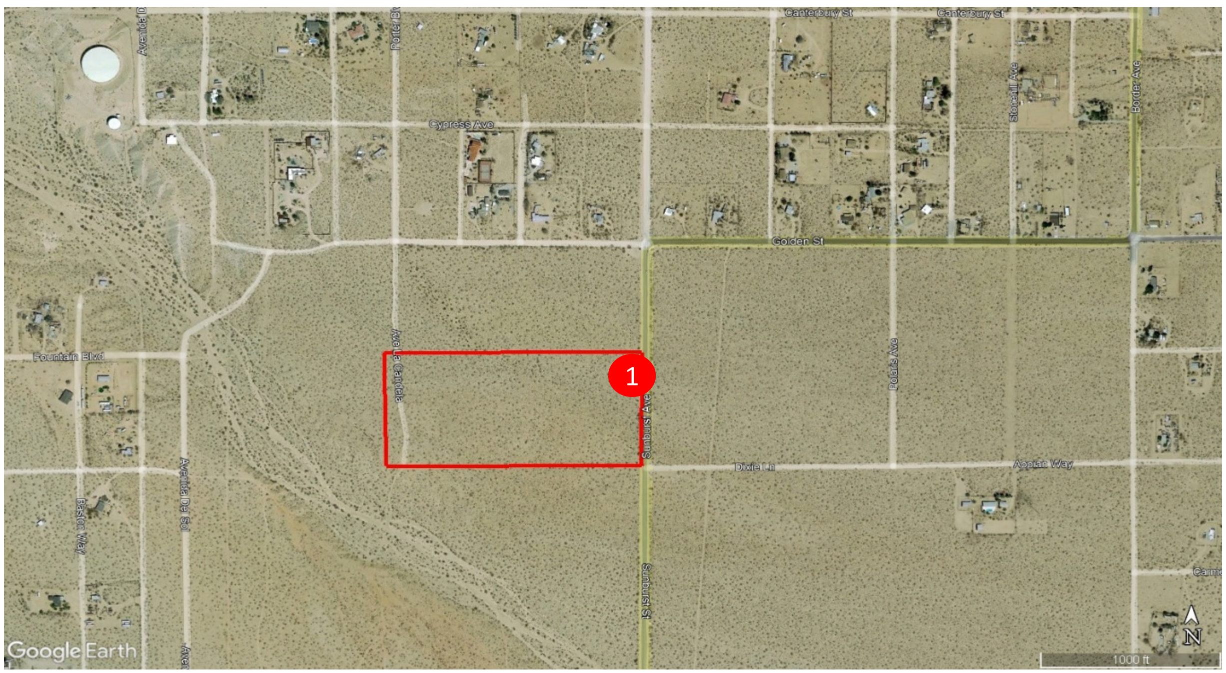

Figure 2: LT-1 Photo

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Simi Valley, CA 93065

24-Hour Noise Measurement Datasheet - Cont.

Project: TTM 20577 Joshua Tree Noise **Day:** 1 of 1
Site Address/Location: 4252 Sunburst St, Joshua Tree, CA
Site ID: LT-1

Date	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
10/19/2023	12:00 AM	1:00 AM	57.7	79.1	20.9	67.8	63.2	51.0	39.7	24.9
10/19/2023	1:00 AM	2:00 AM	55.3	76.7	18.5	65.4	60.8	48.6	37.3	22.5
10/19/2023	2:00 AM	3:00 AM	54.1	75.5	17.3	64.2	59.6	47.4	36.1	21.3
10/19/2023	3:00 AM	4:00 AM	52.3	73.7	15.5	62.4	57.8	45.6	34.3	19.5
10/19/2023	4:00 AM	5:00 AM	53.3	74.7	16.5	63.4	58.8	46.6	35.3	20.5
10/19/2023	5:00 AM	6:00 AM	57.1	78.5	20.3	67.2	62.6	50.4	39.1	24.3
10/19/2023	6:00 AM	7:00 AM	63.5	84.9	26.7	73.6	69.0	56.8	45.5	30.7
10/19/2023	7:00 AM	8:00 AM	65.8	87.2	29.0	75.9	71.3	59.1	47.8	33.0
10/19/2023	8:00 AM	9:00 AM	63.9	85.3	27.1	74.0	69.4	57.2	45.9	31.1
10/19/2023	9:00 AM	10:00 AM	62.9	84.3	26.1	73.0	68.4	56.2	44.9	30.1
10/19/2023	10:00 AM	11:00 AM	62.8	84.2	26.0	72.9	68.3	56.1	44.8	30.0
10/19/2023	11:00 AM	12:00 PM	63.0	84.4	26.2	73.1	68.5	56.3	45.0	30.2
10/19/2023	12:00 PM	1:00 PM	63.1	84.5	26.3	73.2	68.6	56.4	45.1	30.3
10/19/2023	1:00 PM	2:00 PM	63.2	84.6	26.4	73.3	68.7	56.5	45.2	30.4
10/19/2023	2:00 PM	3:00 PM	63.4	84.8	26.6	73.5	68.9	56.7	45.4	30.6
10/19/2023	3:00 PM	4:00 PM	64.6	86.0	27.8	74.7	70.1	57.9	46.6	31.8
10/19/2023	4:00 PM	5:00 PM	66.1	87.5	29.3	76.2	71.6	59.4	48.1	33.3
10/19/2023	5:00 PM	6:00 PM	65.8	87.2	29.0	75.9	71.3	59.1	47.8	33.0
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10/19/2023	7:00 PM	8:00 PM	62.7	84.1	25.9	72.8	68.2	56.0	44.7	29.9
10/19/2023	8:00 PM	9:00 PM	61.6	83.0	24.8	71.7	67.1	54.9	43.6	28.8
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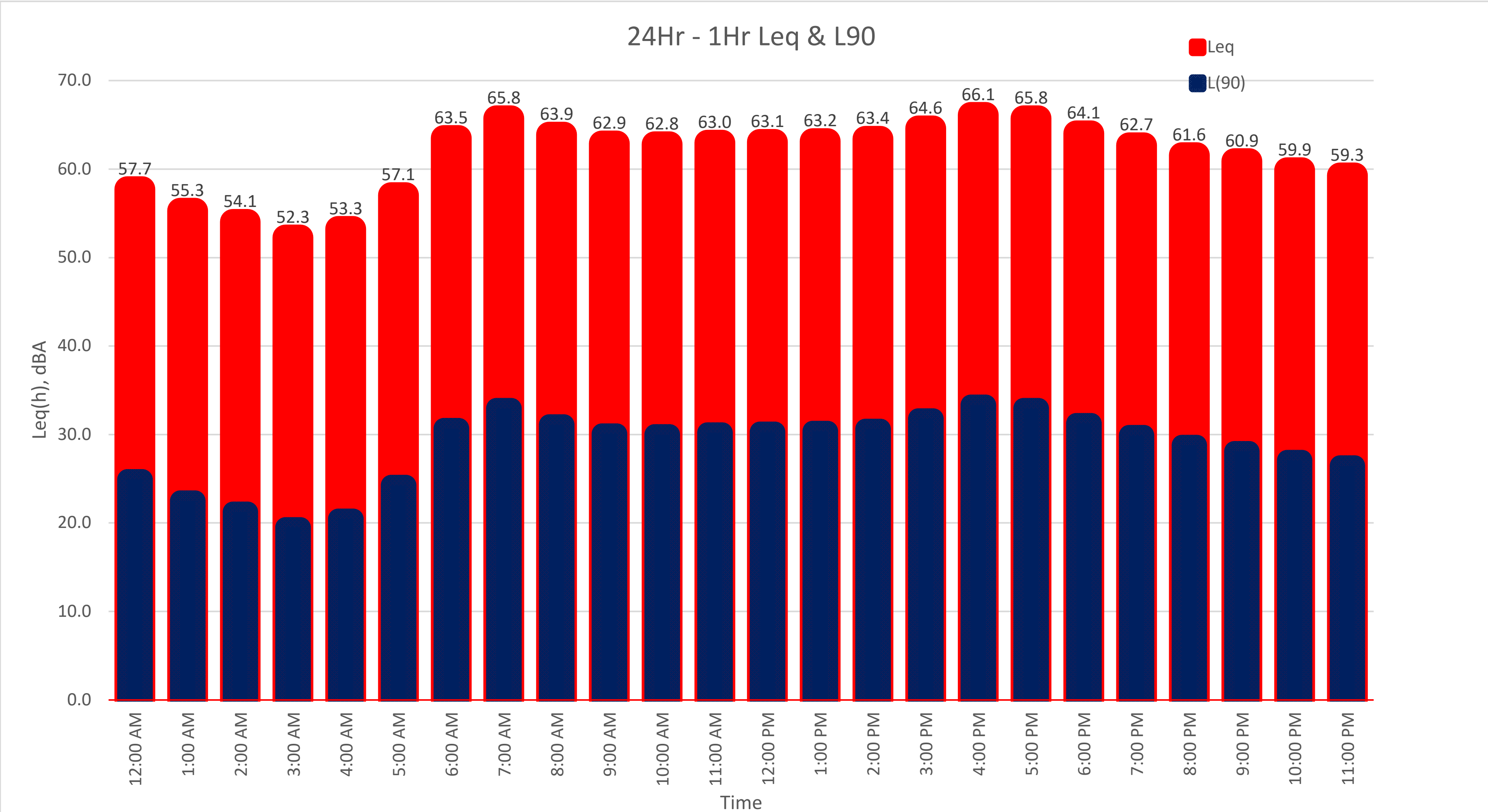
Site Address/Location: 4252 Sunburst St, Joshua Tree, CA
Site ID: LT-1



Appendix B:

Traffic FHWA Worksheets

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT:	TTM 20577	JOB #:	0881-23-16
ROADWAY:	Sunburst Ave	DATE:	20-Oct-23
LOCATION:	Joshua Tree, San Bernardino County, CA 92252	ENGINEER:	F. Irarrazabal

NOISE INPUT DATA Existing (2030) ADT

ROADWAY CONDITIONS

ADT =	2,948
SPEED =	55
PK HR % =	10
NEAR LANE/FAR LANE DIS	12
ROAD ELEVATION =	0.0
GRADE =	0.0 %
PK HR VOL =	295

RECEIVER INPUT DATA

RECEIVER DISTANCE =		60
DIST C/L TO WALL =		40
RECEIVER HEIGHT =		5.0
WALL DISTANCE FROM RECEIVER		20
PAD ELEVATION =		0.0
ROADWAY VIEW:	LF ANGLE=	-90
	RT ANGLE=	90
	DF ANGLE=	180

SITE CONDITIONS

AUTOMOBILES =	10
MEDIUM TRUCKS =	10
HEAVY TRUCKS =	10

(10 = HARD SITE, 15 = SOFT SITE)

WALL INFORMATION

HTH WALL:	0.0
AMBIENT=	0.0
BARRIER =	0 (0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.755	0.140	0.105	0.9742
MEDIUM TRUCK	0.489	0.022	0.489	0.0184
HEAVY TRUCKS	0.473	0.054	0.473	0.0074

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	59.77	- -
MEDIUM TRUCKS	4.0	59.71	- -
HEAVY TRUCKS	8.0	59.77	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	63.8	61.7	60.4	54.4	62.8	63.5
MEDIUM TRUCKS	53.6	49.7	42.3	51.0	57.2	57.2
HEAVY TRUCKS	53.6	49.6	46.2	50.9	57.1	57.1
NOISE LEVELS (dBA)	64.5	62.3	60.7	57.2	64.7	65.1

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	63.8	61.7	60.4	54.4	62.8	63.5
MEDIUM TRUCKS	53.6	49.7	42.3	51.0	57.2	57.2
HEAVY TRUCKS	53.6	49.6	46.2	50.9	57.1	57.1
NOISE LEVELS (dBA)	64.5	62.3	60.7	57.2	64.7	65.1

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	20	62	196	620
LDN	18	56	177	560

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT:	TTM 20577	JOB #:	0881-23-16
ROADWAY:	Sunburst Ave	DATE:	20-Oct-23
LOCATION:	Joshua Tree, San Bernardino County, CA 92252	ENGINEER:	F. Irarrazabal

NOISE INPUT DATA Existing + Project (2030) ADT

ROADWAY CONDITIONS

ADT =	3,005
SPEED =	55
PK HR % =	10
NEAR LANE/FAR LANE DIS	12
ROAD ELEVATION =	0.0
GRADE =	0.0 %
PK HR VOL =	301

RECEIVER INPUT DATA

RECEIVER DISTANCE =		60
DIST C/L TO WALL =		40
RECEIVER HEIGHT =		5.0
WALL DISTANCE FROM RECEIVER		20
PAD ELEVATION =		0.0
ROADWAY VIEW:	LF ANGLE=	-90
	RT ANGLE=	90
	DF ANGLE=	180

SITE CONDITIONS

AUTOMOBILES =	10
MEDIUM TRUCKS =	10
HEAVY TRUCKS =	10

(10 = HARD SITE, 15 = SOFT SITE)

WALL INFORMATION

HTH WALL:	0.0
AMBIENT=	0.0
BARRIER =	0 (0 = WALL, 1 = BERM)

VEHICLE MIX DATA

VEHICLE TYPE	DAY	EVENING	NIGHT	DAILY
AUTOMOBILES	0.755	0.140	0.105	0.9742
MEDIUM TRUCK	0.489	0.022	0.489	0.0184
HEAVY TRUCKS	0.473	0.054	0.473	0.0074

MISC. VEHICLE INFO

VEHICLE TYPE	HEIGHT	SLE DISTANCE	GRADE ADJUSTMENT
AUTOMOBILES	2.0	59.77	- -
MEDIUM TRUCKS	4.0	59.71	- -
HEAVY TRUCKS	8.0	59.77	0.00

NOISE OUTPUT DATA

NOISE IMPACTS (WITHOUT TOPO OR BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	63.8	61.8	60.5	54.5	62.9	63.5
MEDIUM TRUCKS	53.7	49.8	42.4	51.1	57.3	57.3
HEAVY TRUCKS	53.7	49.7	46.3	50.9	57.1	57.2
NOISE LEVELS (dBA)	64.6	62.3	60.7	57.3	64.8	65.2

NOISE IMPACTS (WITH TOPO AND BARRIER SHIELDING)

VEHICLE TYPE	PK HR LEQ	DAY LEQ	EVEN LEQ	NIGHT LEQ	LDN	CNEL
AUTOMOBILES	63.8	61.8	60.5	54.5	62.9	63.5
MEDIUM TRUCKS	53.7	49.8	42.4	51.1	57.3	57.3
HEAVY TRUCKS	53.7	49.7	46.3	50.9	57.1	57.2
NOISE LEVELS (dBA)	64.6	62.3	60.7	57.3	64.8	65.2

NOISE CONTOUR (FT)				
NOISE LEVELS	70 dBA	65 dBA	60 dBA	55 dBA
CNEL	20	63	200	632
LDN	18	57	180	571

Appendix C:

Construction Noise Modeling Output

Construction Noise Levels at Senstive Receptors by Phase

Activity	Leq at 1,100 FT (North)	Lmax at 1,100 FT (North)
Site Preparation	49	53
Grading	57	61
Building Construction	52	56
Architectural Coating	48	52

Equipment Summary	Reference (dBA) 50 ft Lmax
Rock Drills	96
Jack Hammers	82
Pneumatic Tools	85
Pavers	80
Dozers	85
Scrapers	87
Haul Trucks	88
Cranes	82
Portable Generators	80
Rollers	80
Tractors	80
Front-End Loaders	86
Hydraulic Excavators	86
Graders	86
Air Compressors	86
Trucks	86

Site Preparation

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
	Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements									
1	Dozer	85	1	40	1100	0.5	0	51.4	47.5	55718.9969
2	Tractor/Loader/Backhoe	80	1	40	1100	0.5	0	46.4	42.5	17619.8939
							Lmax*	**53**	**Leq**	**49**
							Lw	**84**	**Lw**	**80**

Source: MD Acoustics, LLC - Sept. 2021.

1- Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
60	18.3	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
70	21.3	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
80	24.4	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
90	27.4	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
100	30.5	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
110	33.5	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
120	36.6	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
130	39.6	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
140	42.7	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
150	45.7	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
160	48.8	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
170	51.8	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
180	54.9	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
190	57.9	0.5	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
200	61.0	0.5	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
210	64.0	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
220	67.1	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
230	70.1	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
240	73.1	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
250	76.2	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
260	79.2	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
270	82.3	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
280	85.3	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
290	88.4	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
300	91.4	0.5	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
310	94.5	0.5	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
320	97.5	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
330	100.6	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
340	103.6	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
350	106.7	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
360	109.7	0.5	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12
370	112.8	0.5	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12

Grading

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements										
1	Grader	86	1	40	1100	0.5	0	52.4	48.5	70146.0611
2	Dozer	85	1	40	1100	0.5	0	51.4	47.5	55718.9969
3	Tractor/Backhoe	80	2	40	1100	0.5	0	49.4	45.5	35239.7878
4	Scrapers	87	2	40	1100	0.5	0	56.4	52.5	176617.318
5	Excavators	86	2	40	1100	0.5	0	55.4	51.5	140292.122
							Lmax*	61	Leq	57
							Lw	92	Lw	88

Source: MD Acoustics, LLC - Sept. 2021.

1- Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
60	18.3	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
70	21.3	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
80	24.4	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
90	27.4	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
100	30.5	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
110	33.5	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
120	36.6	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
130	39.6	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
140	42.7	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
150	45.7	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
160	48.8	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
170	51.8	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
180	54.9	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
190	57.9	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
200	61.0	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
210	64.0	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
220	67.1	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
230	70.1	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
240	73.1	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
250	76.2	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
260	79.2	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
270	82.3	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
280	85.3	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
290	88.4	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
300	91.4	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
310	94.5	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
320	97.5	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
330	100.6	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
340	103.6	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
350	106.7	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
360	109.7	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
370	112.8	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20

Building Construction

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
		Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements								
1	Forklift/Tractor	80	3	40	1100	0.5	0	51.2	47.2	52859.6817
2	Tractor/Backhoe	80	3	40	1100	0.5	0	51.2	47.2	52859.6817
3	Cranes	82	1	40	1100	0.5	0	48.4	44.5	27925.6499
4	Generator	80	1	40	1100	0.5	0	46.4	42.5	17619.8939
							Lmax*	**56**	**Leq**	**52**
							Lw	**87**	**Lw**	**83**

Source: MD Acoustics, LLC - Sept. 2021.

1- Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**52**	**51**	**50**	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**	**40**	**39**	**38**	**37**
60	18.3	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
70	21.3	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
80	24.4	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
90	27.4	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
100	30.5	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
110	33.5	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	**29**	28
120	36.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
130	39.6	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
140	42.7	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
150	45.7	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
160	48.8	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
170	51.8	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
180	54.9	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
190	57.9	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
200	61.0	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
210	64.0	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
220	67.1	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
230	70.1	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
240	73.1	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
250	76.2	0.5	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
260	79.2	0.5	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
270	82.3	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
280	85.3	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
290	88.4	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
300	91.4	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
310	94.5	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
320	97.5	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
330	100.6	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
340	103.6	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
350	106.7	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
360	109.7	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
370	112.8	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15

Architectural Coating

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
	Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements									
1	Air Compressor	86	1	40	1100	0.5	0	52.4	48.5	70146.0611
							Lmax*	**52**	**Leq**	**48**
							Lw	**84**	**Lw**	**80**

Source: MD Acoustics, LLC - Sept. 2021.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**48**	**47**	**46**	**45**	**44**	**43**	**42**	**41**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**
60	18.3	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
70	21.3	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
80	24.4	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
90	27.4	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
100	30.5	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
110	33.5	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	**26**	25
120	36.6	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
130	39.6	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
140	42.7	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
150	45.7	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
160	48.8	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
170	51.8	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
180	54.9	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20
190	57.9	0.5	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
200	61.0	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
210	64.0	0.5	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
220	67.1	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
230	70.1	0.5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
240	73.1	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
250	76.2	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
260	79.2	0.5	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
270	82.3	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
280	85.3	0.5	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
290	88.4	0.5	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
300	91.4	0.5	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
310	94.5	0.5	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
320	97.5	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
330	100.6	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
340	103.6	0.5	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
350	106.7	0.5	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12
360	109.7	0.5	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12
370	112.8	0.5	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12

VIBRATION LEVEL IMPACT

Project:	TTM 20577 Noise	Date: 10/20/23
Source:	Large Bulldozer	
Scenario:	Unmitigated	
Location:	Residence 1,100 feet north of the Project Site	
Address:	Joshua Tree, San Bernardino County, CA 92252	
PPV = PPVref(25/D)^n (in/sec)		

DATA INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN BLUE
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	1,100.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.001**	IN/SEC	OUTPUT IN RED

Appendix D:

SounPLAN Noise Modeling Input/Output and Noise Level References

4252 Sunburst St Joshua Tree Noise
Octave spectra of the sources in dB(A) - 001 - 4252 Sunburst St Joshua Tree: Outdoor SP

Name	Source type	I or A m,m²	Li dB(A)	R'w dB	L'w dB(A)	Lw dB(A)	KI dB	KT dB	LwMax dB(A)	DO-Wall dB	Time histogram	Emission spectrum	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)	16kHz dB(A)
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9
HVAC Carrier 50TFQ0006	Point				74.9	74.9	0.0	0.0		0	100%/24h	HVAC: 67.7dB @ 3ft - Carrier 50TFQ0006 -	52.0	60.5	62.9	67.2	69.5	69.1	66.1	61.2	48.9

4252 Sunburst St Joshua Tree Noise
Contribution level - 001 - 4252 Sunburst St Joshua Tree:

Source group	Source type	Tr. lane	Leq,d dB(A)	A dB
Receiver 11563316,3781879 Fl G Lr,lim dB(A) Leq,d 24.1 dB(A)				
Default industrial noise	Point		21.1	0.0
Default industrial noise	Point		17.7	0.0
Default industrial noise	Point		12.5	0.0
Default industrial noise	Point		15.8	0.0
Default industrial noise	Point		8.3	0.0
Default industrial noise	Point		9.0	0.0
Receiver 11563513,3781981 Fl G Lr,lim dB(A) Leq,d 28.8 dB(A)				
Default industrial noise	Point		18.8	0.0
Default industrial noise	Point		15.1	0.0
Default industrial noise	Point		18.4	0.0
Default industrial noise	Point		25.9	0.0
Default industrial noise	Point		21.9	0.0
Default industrial noise	Point		15.3	0.0
Receiver 11563529,3781755 Fl G Lr,lim dB(A) Leq,d 25.0 dB(A)				
Default industrial noise	Point		12.9	0.0
Default industrial noise	Point		16.3	0.0
Default industrial noise	Point		20.6	0.0
Default industrial noise	Point		17.0	0.0
Default industrial noise	Point		15.7	0.0
Default industrial noise	Point		17.2	0.0

4252 Sunburst St Joshua Tree Noise
Contribution spectra - 001 - 4252 Sunburst St Joshua Tree: Outdoor SP

Time slice	Sum	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
Receiver 11563316,3781879 Fl G Lr,lim dB(A) Leq,d 24.1 dB(A)																															
Leq,d	15.8	-37.9	-31.9	-27.8	-14.8	-9.7	-15.6	-7.5	-5.4	-6.2	-3.9	-3.5	-1.6	0.7	1.6	5.5	8.9	4.7	6.5	7.5	4.8	4.9	0.3	-1.0	-6.7	-12.4	-25.9	-43.3	-62.5	-89.5	
Leq,d	8.3	-40.6	-34.6	-30.6	-17.6	-12.7	-18.7	-11.1	-9.2	-10.3	-8.3	-8.4	-6.5	-5.5	-4.6	-0.8	1.1	-3.2	-1.5	-0.7	-3.6	-3.9	-9.1	-11.5	-18.7	-26.7	-43.6	-66.1	-92.4		
Leq,d	9.0	-37.9	-31.9	-28.0	-15.0	-10.1	-16.2	-9.1	-7.3	-8.5	-7.3	-7.4	-5.6	-4.4	-3.7	0.0	2.2	-2.3	-0.9	-0.4	-3.6	-4.2	-9.8	-12.6	-20.3	-29.0	-46.9	-70.5	-98.4		
Leq,d	21.1	-33.2	-27.2	-23.1	-10.1	-5.1	-11.0	-2.9	-0.9	-1.8	0.3	0.6	2.8	4.2	5.8	10.6	13.8	9.9	11.7	12.8	10.5	10.9	7.0	6.7	2.6	-0.7	-10.7	-22.8	-34.8	-52.0	-74.6
Leq,d	17.7	-33.5	-27.4	-23.4	-10.4	-5.5	-11.4	-3.4	-1.5	-2.5	-0.5	-0.4	1.6	2.6	3.6	7.6	9.5	5.5	7.5	8.9	6.8	7.6	4.2	4.6	1.7	-1.1	-11.1	-23.3	-35.5	-53.0	-75.8
Leq,d	12.5	-37.0	-30.9	-27.0	-14.0	-9.0	-15.0	-7.0	-5.1	-6.2	-4.2	-4.2	-2.3	-1.4	-0.5	3.4	5.1	0.9	2.6	3.5	0.9	0.9	-3.6	-4.9	-10.4	-15.7	-28.5	-44.7	-62.4	-87.1	
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Receiver 11563513,3781981 Fl G Lr,lim dB(A) Leq,d 28.8 dB(A)																															
Leq,d	25.9	-28.8	-22.7	-18.7	-5.7	-0.7	-6.6	1.5	3.5	2.6	4.8	5.0	7.2	8.6	10.1	14.9	18.0	14.5	16.4	17.6	15.4	16.1	12.5	12.7	9.4	7.4	-0.5	-9.8	-17.8	-29.7	-45.7
Leq,d	21.9	-32.5	-26.5	-22.5	-9.4	-4.4	-10.4	-2.3	-0.2	-1.1	1.0	1.3	3.5	4.9	6.5	11.3	14.6	10.6	12.4	13.7	11.3	11.8	7.9	7.7	3.7	0.6	-8.9	-20.5	-31.7	-48.0	-69.3
Leq,d	15.3	-36.7	-30.7	-26.7	-13.7	-8.7	-14.7	-6.6	-4.7	-5.7	-3.7	-3.6	-1.6	-0.5	0.6	4.7	6.7	2.9	5.1	6.8	5.3	6.7	2.3	1.3	-3.8	-8.7	-21.0	-36.6	-53.4	-77.0	
Leq,d	18.8	-31.8	-25.8	-21.8	-8.8	-3.8	-9.8	-1.8	0.2	-0.9	1.1	1.1	3.1	4.1	5.1	9.0	10.9	6.8	8.7	9.9	7.6	8.2	4.5	4.5	0.9	-1.8	-10.7	-21.4	-31.4	-46.0	-65.1
Leq,d	15.1	-35.4	-29.3	-25.3	-12.3	-7.4	-13.4	-5.3	-3.4	-4.5	-2.5	-2.4	-0.5	0.5	1.5	5.4	7.3	3.2	5.1	6.3	3.9	4.4	0.5	0.0	-4.3	-7.9	-18.3	-31.0	-45.2	-66.0	-93.0
Leq,d	18.4	-34.8	-28.7	-24.7	-11.7	-6.7	-12.7	-4.6	-2.7	-3.7	-1.6	-1.5	0.6	1.8	3.0	7.3	9.5	6.0	8.9	11.2	8.7	9.1	5.0	4.4	-0.2	-4.1	-14.9	-28.5	-42.4	-62.2	-87.9
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Leq,d																															
Receiver 11563529,3781755 Fl G Lr,lim dB(A) Leq,d 25.0 dB(A)																															
Leq,d	17.0	-35.3	-29.3	-25.3	-12.3	-7.3	-13.3	-5.3	-3.3	-4.4	-2.4	-2.3	-0.3	0.7	1.7	5.7	7.6	5.2	7.3	8.7	6.8	7.5	3.6	5.4	1.8	-2.5	-13.8	-27.9	-42.5	-63.3	-90.2
Leq,d	15.7	-37.0	-31.0	-27.0	-14.0	-9.0	-15.0	-6.9	-4.9	-6.0	-3.9	-3.8	-1.7	-0.6	0.6	4.8	6.9	3.3	6.0	8.3	6.1	6.2	1.8	0.7	-4.5	-9.6	-22.2	-38.2	-55.6	-80.0	
Leq,d	17.2	-33.6	-27.6	-23.6	-10.6	-5.6	-11.6	-3.6	-1.6	-2.7	-0.7	-0.6	1.4	2.3	3.4	7.3	9.2	5.1	7.1	8.3	6.1	6.8	3.1	3.1	-0.6	-3.2	-12.0	-23.8	-36.1	-53.8	-76.9
Leq,d	12.9	-37.2	-31.1	-27.1	-14.1	-9.2	-15.2	-7.2	-5.2	-6.3	-4.3	-4.3	-2.3	-1.4	-0.4	3.5	5.3	1.2	3.0	4.1	1.6	1.9	-2.4	-3.3	-8.4	-13.2	-25.4	-40.9	-57.4	-80.8	
Leq,d	16.3	-33.9	-27.9	-23.9	-10.9	-5.9	-11.9	-3.9	-2.0	-3.0	-1.0	-1.0	0.9	1.9	2.9	6.8	8.6	4.4	6.3	7.4	5.0	5.4	1.4	0.9	-3.3	-6.9	-17.2	-29.9	-42.6	-60.9	-84.7
Leq,d	20.6	-30.4	-24.3	-20.4	-7.4	-2.4	-8.4	-0.3	1.6	0.5	2.6	2.6	4.6	5.6	6.6	10.6	12.5	8.4	10.4	11.7	9.5	10.3	6.8	7.1	4.0	2.1	-5.6	-14.6	-22.9	-36.3	-54.2
Leq,d																															
Leq,d																															

4252 Sunburst St Joshua Tree Noise
Contribution spectra - 001 - 4252 Sunburst St Joshua Tree: Outdoor SP

Time slice	Sum dB(A)	25Hz dB(A)	31.5Hz dB(A)	40Hz dB(A)	50Hz dB(A)	63Hz dB(A)	80Hz dB(A)	100Hz dB(A)	125Hz dB(A)	160Hz dB(A)	200Hz dB(A)	250Hz dB(A)	315Hz dB(A)	400Hz dB(A)	500Hz dB(A)	630Hz dB(A)	800Hz dB(A)	1kHz dB(A)	1.25kHz dB(A)	1.6kHz dB(A)	2kHz dB(A)	2.5kHz dB(A)	3.15kHz dB(A)	4kHz dB(A)	5kHz dB(A)	6.3kHz dB(A)	8kHz dB(A)	10kHz dB(A)	12.5kHz dB(A)	16kHz dB(A)	20kHz dB(A)
Leq,d Leq,d Leq,d Leq,d																															

Project:	Sound Library	**Site Observations:**	
Job Number:	0000-2020-02	Clear sky, measurements were performed at 3ft from source.	
Site Address/Location:	Gilbert, AZ		
Date:	09/18/2018		
Field Tech/Engineer:	Robert Pearson		
Source/System:	Carrier 50TFQ0006 - 5 Ton		
General Location:	Measured @ 3'		
Sound Meter:	NTi XL2	**SN:** A2A-05967-E0	
Settings:	A-weighted, slow, 1-sec, 10-sec duration		
Meteorological Cond.:	90 degrees, 0 mph wind		

Leq	Lmin	Lmax
67.7	66.9	68.5

Ln 2	Ln 8	Ln 25	Ln 50	Ln 90	Ln 99
0.0	0.0	0.0	0.0	0.0	0.0

Table 1: Summary Measurement Data

Source/System	Overall Source	Overall	3rd Octave Band Data (dBA)																												
		dB(A)	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	12.5k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Carrier 50TFQ0006 - 5 Ton	HVAC	67.7	11.0	14.0	20.0	24.0	37.0	42.0	36.0	47.0	49.0	48.0	50.0	50.0	52.0	53.0	54.0	58.0	59.0	55.0	57.0	58.0	56.0	57.0	54.0	55.0	53.0	53.0	48.0	43.0	41.0	37.0	31.0

Figure 1: Commercial Air Conditioner - Carrier 50TFQ0006 - 5 Ton