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Noise Impact Analysis Report
Burbank Avenue Subdivision Project
City of Santa Rosa, Sonoma County, California

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Date: December 18, 2019

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ACRONYMS AND ABBREVIATIONS

ADT	average daily traffic
APN	Assessor’s Parcel Number
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
du/acre	dwelling units per acre
EPA	United States Environmental Protection Agency
FCS	FirstCarbon Solutions
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
in/sec	inch per second
L_{dn}	day/night average sound level
L_{eq}	equivalent sound level
L_{max}	maximum noise/sound level
MM	Mitigation Measure
PPV	peak particle velocity
rms	root mean square
STC	Standard Transmission Class
TTM	Tentative Tract Map
VdB	velocity in decibels

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SECTION 1: INTRODUCTION

1.1 - Purpose of Analysis and Study Objectives

This Noise Impact Analysis has been prepared by FirstCarbon Solutions (FCS) to determine the off-site and on-site noise impacts associated with the proposed Burbank Avenue Subdivision Project (proposed project). The following is provided in this report:

- A description of the study area, project site, and proposed project
- Information regarding the fundamentals of noise and vibration
- A description of the local noise guidelines and standards
- A description of the existing noise environment
- An analysis of the potential short-term, construction-related noise and vibration impacts from the proposed project
- An analysis of long-term, operations-related noise and vibration impacts from the proposed project

1.2 - Project Summary

1.2.1 - Site Location

The proposed project site is located east of Burbank Avenue and opposite Roseland Creek Elementary School in the Roseland Neighborhood of the City of Santa Rosa. The proposed site is on 14.6 acres comprised of four merged parcels located at 1400, 1690, 1720, and 1780 Burbank Avenue. The project is located entirely within the City of Santa Rosa's Roseland Area/Sebastopol Road Specific Plan[1], which was approved by the City in 2016 pursuant to the Roseland Area/Sebastopol Road Specific Plan and Roseland Area Annexation Project Environmental Impact Report.[2] The regional location is shown in Exhibit 1.

Surrounding land uses include residential single-family to the east, and rural low-density residential single-family to the north, south, and southwest. Single-family residences directly border the proposed project site to the northwest, west, and south. Roseland Creek Elementary School lies to the northwest corner and Sheppard Accelerated Elementary School lies to the southeast corner of the project site. The site is currently occupied by one single-family residence to the southwest, and four agricultural storage facilities to the west (Exhibit 2).

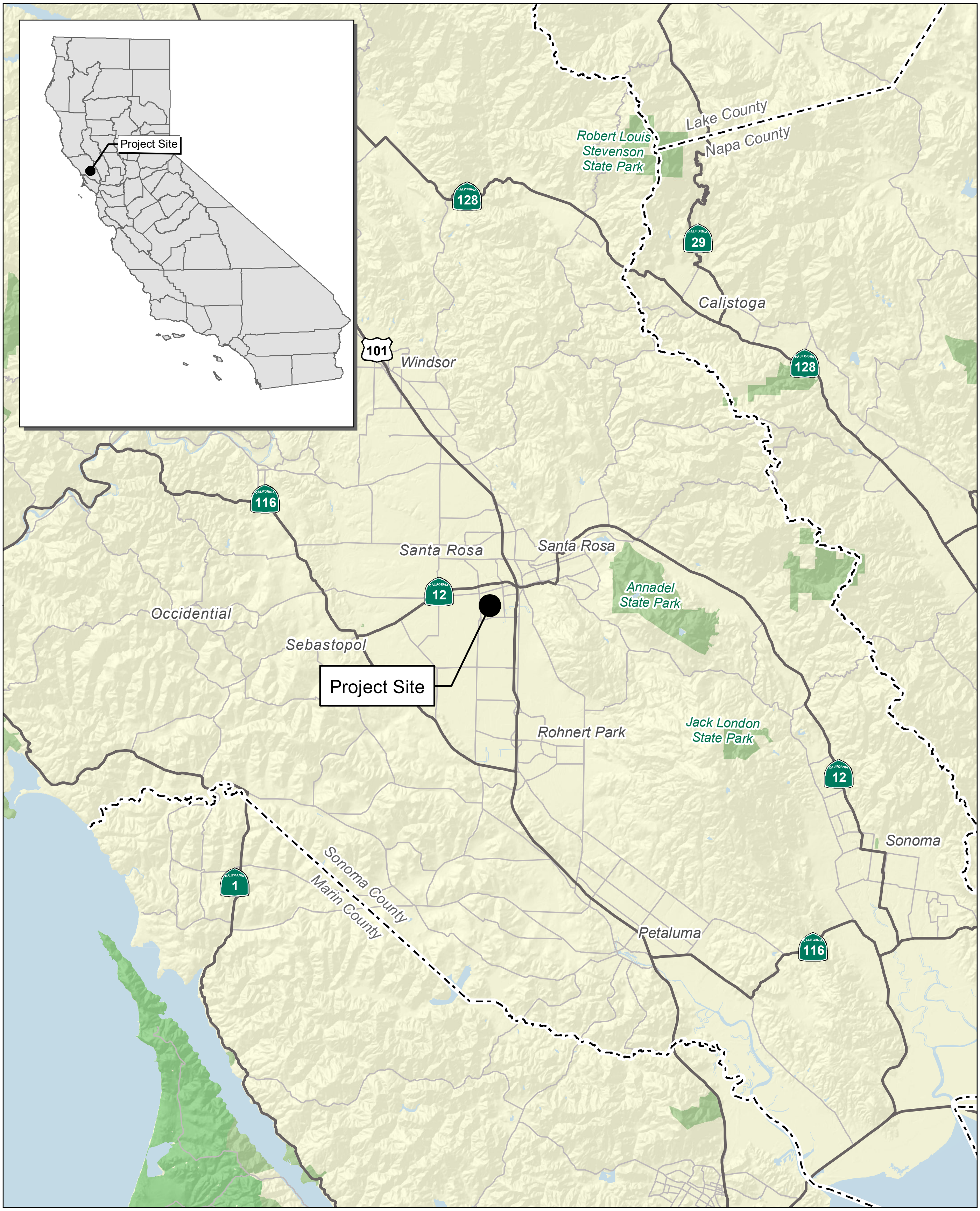
1 City of Santa Rosa. 2016. Roseland Area/Sebastopol Road Specific Plan. Website: https://srcity.org/DocumentCenter/View/18332/Roseland-AreaSebastopol-Road-Specific-Plan?bidId=. Accessed October 16, 2019.

2 City of Santa Rosa. 2016. Roseland Area/Sebastopol Road Specific Plan and Roseland Area Annexation Projects Environmental Impact Report. August. Website: https://www.srcity.org/2437/Roseland-Area-Projects-Environmental-Imp.

1.2.2 - Project Description

The Burbank Avenue Subdivision Project proposes to demolish the existing residences and facilities and construct 62 lots for single-family units, 12 lots for duplex row houses and 62 affordable apartments. A total of 136 residential units are planned as part of the development. There is no commercial or industrial component. The proposed site has two entry roads off Burbank Avenue. An apartment complex is located along the southern entry road, a duplex complex along the northern entry road with the remainder of the site occupied by detached single-family dwellings. The tentative site plan is shown in Exhibit 3.

Project zoning is R-1-6 and the Specific Plan designated the site Medium-Low Density Residential. According to the General Plan, the Medium-Low density classification permits between 8-13 units per acre and is intended for attached single-family residential development, but single-family detached housing and multi-family development may also be permitted. The General Plan states that development at the mid-point of the density range is desirable, but not required. Utilizing a mid-point of 10 dwelling units per acre (du/acre), the midpoint development for this site would be 146 units.



Source: Census 2000 Data, The CaSIL

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Exhibit 1
Regional Location Map

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SCHELLINGER BROTHERS
BURBANK AVENUE SUBDIVISION PROJECT
NOISE IMPACT ANALYSIS REPORT

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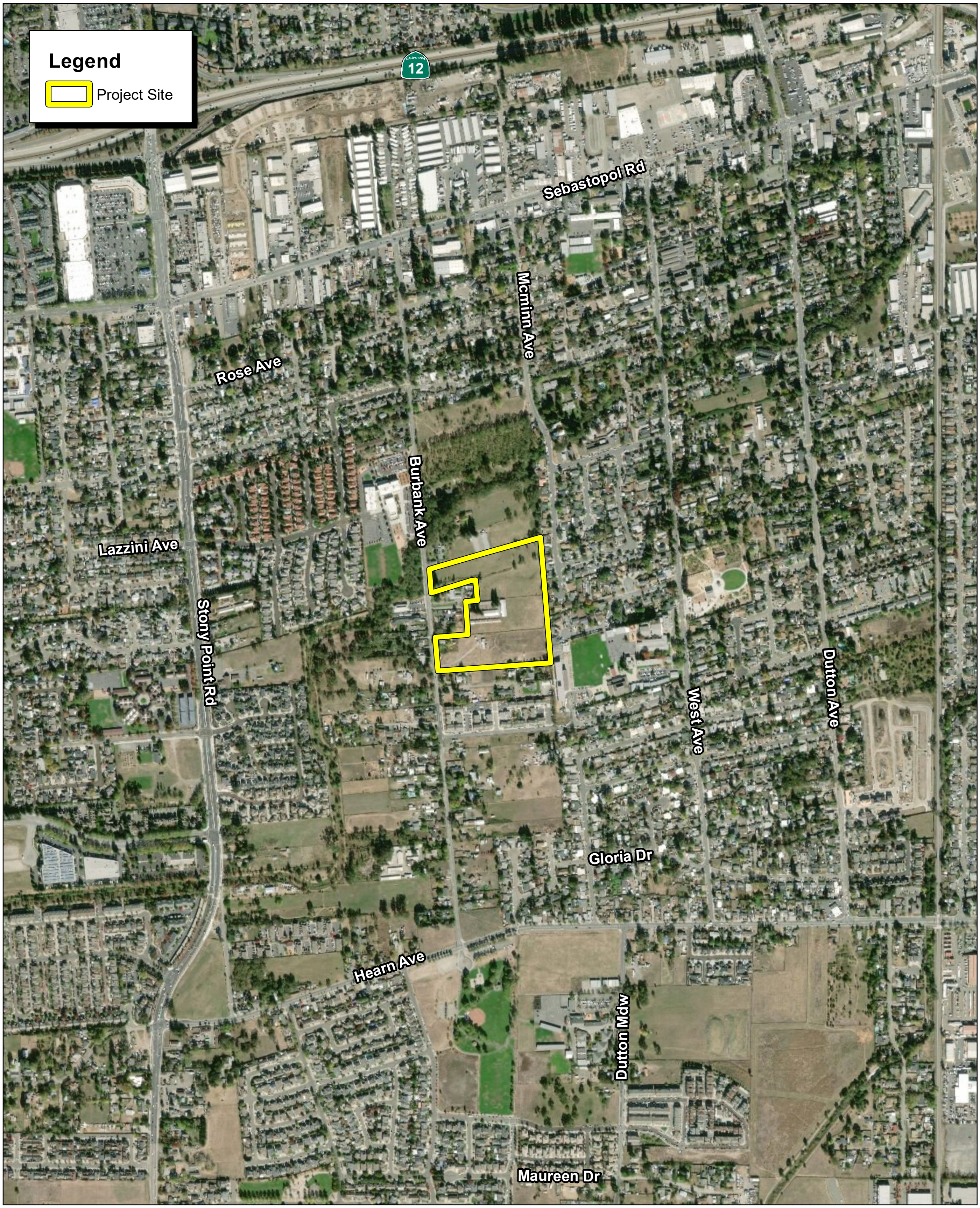

Source: ESRI Aerial Imagery.

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1,000 500 0 1,000
Feet

Exhibit 2
Local Vicinity Map
Aerial Base

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Source: Jon Woden Architects, August 10, 2019.

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Exhibit 3
Site Plan

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SECTION 2: NOISE AND VIBRATION FUNDAMENTALS

2.1 - Characteristics of Noise

Noise is generally defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

Several noise measurement scales exist which are used to describe noise in a particular location. A *decibel* (dB) is a unit of measurement that indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3.0 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3.0 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense. Each 10-dB increase in sound level is perceived as approximately a doubling of loudness. Sound intensity is normally measured through the A-weighted sound level (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

Noise impacts can be described in three categories. The first is audible impacts, which refers to increases in noise levels noticeable to humans. An audible increase in noise levels generally refers to a change of 3.0 dB or greater, since this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1.0 and 3.0 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise level of less than 1.0 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6-dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise-sensitive receptor of concern. A long, closely spaced continuous line of vehicles along a roadway becomes a line source and produces a 3 dBA decrease in sound level for each doubling of distance. However, experimental evidence has shown that where sound from a highway propagates close to “soft” ground (e.g., plowed farmland, grass, crops, etc.), the most suitable drop off rate to use is not 3 dBA but rather 4.5 dBA per distance doubling. There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The predominant rating scales for human communities in the State of California are the equivalent continuous sound level (L_{eq}) and community noise equivalent level (CNEL) or the day/night average level (L_{dn}) based on dBA. L_{eq} is the total sound energy of time-varying noise over a sample period. CNEL is the time-varying noise over a 24-hour period, with a 5-dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00

p.m. to 10:00 p.m. (defined as relaxation hours) and a 10-dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within one dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by L_{max} for short-term noise impacts. L_{max} reflects peak operating conditions and addresses the annoying aspects of intermittent noise.

Common sources of noise in urban environments include mobile sources, such as traffic, and stationary sources, such as mechanical equipment or construction operations.

Construction is performed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on each construction site and, therefore, would change the noise levels as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table 1 shows typical noise levels of construction equipment as measured at a distance of 50 feet from the operating equipment. Construction-period noise levels are higher than background ambient noise levels, but they eventually cease once construction is complete.

Table 1: Typical Construction Equipment Maximum Noise Levels, L_{max}

Category	Impact Device? (Yes/No)	Specification Maximum Sound Levels for Analysis (dBA at 50 feet)
Pickup Truck	No	55
Pumps	No	77
Air Compressors	No	80
Backhoe	No	80
Front-End Loaders	No	80
Portable Generators	No	82
Dump Truck	No	84
Tractors	No	84
Auger Drill Rig	No	85
Concrete Mixer Truck	No	85
Cranes	No	85

Table 1 (cont.): Typical Construction Equipment Maximum Noise Levels, L_{max}

Type of Equipment	Impact Device? (Yes/No)	Specification Maximum Sound Levels for Analysis (dBA at 50 feet)
Dozers	No	85
Excavators	No	85
Graders	No	85
Jackhammers	Yes	85
Man Lift	No	85
Paver	No	85
Pneumatic Tools	No	85
Rollers	No	85
Scrapers	No	85
Concrete/Industrial Saws	No	90
Impact Pile Driver	Yes	95
Vibratory Pile Driver	No	95
Source: Federal Highway Administration (FHWA) 2006.		

2.2 - Characteristics of Groundborne Vibration

Groundborne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. Vibrating objects in contact with the ground radiate vibration waves through various soil and rock strata to the foundations of nearby buildings.

Although groundborne 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. When assessing annoyance from groundborne vibration, vibration is typically expressed as root mean square (rms) velocity in units of decibels of 1 micro-inch per second. To distinguish these vibration levels referenced in decibels from noise levels referenced in decibels, the unit is written as "VdB."

In extreme cases, excessive groundborne vibration has the potential to cause structural damage to buildings. Common sources of groundborne vibration include construction activities such as blasting, pile driving, and operating heavy earthmoving equipment. However, construction vibration impacts on building structures are generally assessed in terms of peak particle velocity (PPV). For purposes of this analysis, project-related impacts are expressed in terms of PPV. Typical vibration source levels from construction equipment are shown in Table 2.

Table 2: Vibration Levels of Construction Equipment

Construction Equipment	PPV at 25 Feet (inches/second)	rms Velocity in Decibels (VdB) at 25 Feet
Water Trucks	0.001	57
Scraper	0.002	58
Bulldozer (Small)	0.003	58
Jackhammer	0.035	79
Concrete Mixer	0.046	81
Concrete Pump	0.046	81
Paver	0.046	81
Pickup Truck	0.046	81
Auger Drill Rig	0.051	82
Backhoe	0.051	82
Crane (Mobile)	0.051	82
Excavator	0.051	82
Grader	0.051	82
Loader	0.051	82
Loaded Trucks	0.076	86
Bulldozer (Large)	0.089	87
Caisson drilling	0.089	87
Vibratory Roller (Small)	0.101	88
Compactor	0.138	90
Clam shovel drop	0.202	94
Vibratory Roller (Large)	0.210	94
Pile Driver (Impact: typical)	0.644	104
Pile Driver (Impact: upper range)	1.518	112

Source: Compilation of scientific and academic literature, generated by Federal Transit Administration (FTA) and Federal Highway Administration (FHWA).

The propagation of groundborne vibration is not as simple to model as airborne noise. This is because noise in the air travels through a relatively uniform medium, while groundborne vibrations travel through the Earth, which may contain significant geological differences. Factors that influence groundborne vibration include:

- **Vibration source:** Type of activity or equipment, such as impact or mobile, and depth of vibration source;

- **Vibration path:** Soil type, rock layers, soil layering, depth to water table, and frost depth; and
- **Vibration receiver:** Foundation type, building construction, and acoustical absorption.

Among these factors that influence groundborne vibration, there are significant differences in the vibration characteristics when the source is underground compared to at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of groundborne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Vibration propagation is more efficient in stiff clay soils than in loose sandy soils, and shallow rock seems to concentrate the vibration energy close to the surface, and can result in groundborne vibration problems at large distance from the source. Factors such as layering of the soil and depth to the water table can have significant effects on the propagation of groundborne vibration. Soft, loose, sandy soils tend to attenuate more vibration energy than hard, rocky materials. Vibration propagation through groundwater is more efficient than through sandy soils. 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 type, but it 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. The vibration level (calculated below as PPV) at a distance from a point source can generally be calculated using the vibration reference equation:

$$PPV = PPV_{ref} * (25/D)^n \text{ (in/sec)}$$

Where:

PPV_{ref} = reference measurement at 25 feet from vibration source
D = distance from equipment to property line
n = vibration attenuation rate through ground

According to Section 7 of the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual, an "n" value of 1.5 is recommended to calculate vibration propagation through typical soil conditions.[3]

[3] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.

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SECTION 3: REGULATORY SETTING

3.1 - Federal Regulations

3.1.1 - United States Environmental Protection Agency

In 1972, Congress enacted the Noise Control Act. This Act authorized the United States Environmental Protection Agency (EPA) to publish descriptive data on the effects of noise and establish levels of sound "requisite to protect the public welfare with an adequate margin of safety." These levels are separated into health (hearing loss levels) and welfare (annoyance levels) categories, as shown in Table 3. The EPA cautions that these identified levels are not standards because they do not take into account the cost or feasibility of the levels.

For protection against hearing loss, 96 percent of the population would be protected if sound levels are less than or equal to an $L_{eq(24)}$ of 70 dBA. The "(24)" signifies an L_{eq} duration of 24 hours. The EPA activity and interference guidelines are designed to ensure reliable speech communication at about 5 feet in the outdoor environment. For outdoor and indoor environments, interference with activity and annoyance should not occur if levels are below 55 dBA and 45 dBA, respectively.

Table 3: Summary of EPA Recommended Noise Levels to Protect Public Welfare

Effect	Level	Area
Hearing loss	$L_{eq}(24) \leq 70$ dB	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq}(24) \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{eq} \leq 45$ dB	Indoor residential areas.
	$L_{eq}(24) \leq 45$ dB	Other indoor areas with human activities such as schools, etc.
Source: EPA 1974.		

3.1.2 - Federal Transit Administration

The FTA has established industry accepted standards for vibration impact criteria and impact assessment. These guidelines are published in its Transit Noise and Vibration Impact Assessment

Manual.[4] The FTA Guidelines include thresholds for construction vibration impacts for various structural categories as shown in Table 4.

Table 4: Federal Transit Administration Construction Vibration Impact Criteria

Building Category	PPV (in/sec)	Approximate VdB
I. Reinforced—Concrete, Steel or Timber (no plaster)	0.5	102
II. Engineered Concrete and Masonry (no plaster)	0.3	98
III. Non Engineered Timber and Masonry Buildings	0.2	94
IV. Buildings Extremely Susceptible to Vibration Damage	0.12	90

Note:
VdB = velocity in decibels
in/sec = inch per second
Source: FTA. 2018. Transit Noise and Vibration Impact Assessment Manual. September

3.2 - State Regulations

The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the "State Noise Insulation Standard," it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. State regulations include requirements for the construction of new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor-ceiling assemblies must block or absorb sound. For limiting noise from exterior noise sources, the noise insulation standards set an interior standard of 45 dBA CNEL in any habitable room with all doors and windows closed. In addition, the standards require preparation of an acoustical analysis demonstrating the manner in which dwelling units have been designed to meet this interior standard, where such units are proposed in an area with exterior noise levels greater than 60 dBA CNEL.

The State has also established land use compatibility guidelines for determining acceptable noise levels for specified land uses. The City of Santa Rosa has adopted and modified those guidelines as described as follows.

3.3 - Local Regulations

The project site is located within the City of Santa Rosa and this analysis was performed using the City's noise regulations. The City of Santa Rosa addresses noise in the Noise Element of the Santa Rosa General Plan 2035 (2009)[5] and in the City of Santa Rosa Municipal Code.[6]

[4] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.

Santa Rosa General Plan 2035

For the proposed project, both the residential single-family and residential multi-family land use designations of the City's land use compatibility guidelines are applicable to the project. Table 5 lists the General Plan's land use compatibility standards applicable to the land use designation of residential single-family and residential multi-family.

Applicable goals and policies of the General Plan are summarized as follows:

- **NS-B-1:** Do not locate noise-sensitive uses in proximity to major noise sources, except residential is allowed near rail to promote future ridership.
- **NS-B-2:** Encourage residential developers to provide buffers other than sound walls, where practical. Allow sound walls only when projected noise levels at a site exceed the City's land use compatibility standards.
- **NS-B-3:** Prevent new stationary and transportation noise sources from creating a nuisance in existing developed areas. Use a comprehensive program of noise prevention through planning and mitigation, and consider noise impacts as a crucial factor in project approval.
- **NS-B-4:** Require new projects in the following categories to submit an acoustical study, prepared by a qualified acoustical consultant:
  - All new projects proposed for areas with existing noise above 60 dBA L_{dn}. Mitigation shall be sufficient to reduce noise levels below 45 dBA L_{dn} in habitable rooms and 60 dBA L_{dn} in private and shared recreational facilities. Additions to existing housing units are exempt.
  - All new projects that could generate noise whose impacts on other existing uses would be greater than those normally acceptable (as specified in the Land Use Compatibility Standards).
- **NS-B-5:** Pursue measures to reduce noise impacts primarily through site planning. Engineering solutions for noise mitigation, such as sound walls, are the least desirable alternative.
- **NS-B-6:** Do not permit existing uses to generate new noises exceeding normally acceptable levels unless:
  - Those noises are mitigated to acceptable levels; or
  - The activities are specifically exempted by the City Council on the basis of community health, safety, and welfare.
- **NS-B-8:** Adopt mitigations, including reduced speed limits, improved paving texture, and traffic controls, to reduce noise to normally acceptable levels in areas where noise standards may be exceeded (e.g., where homes front regional/arterial streets and in areas of mixed use development.)
- **NS-B-9:** Encourage developers to incorporate acoustical site planning into their projects. Recommended measures include:
  - Incorporating buffers and/or landscaped earth berms;
  - Orienting windows and outdoor living areas away from unacceptable noise exposure;
  - Using reduced-noise pavement (rubberized-asphalt);
  - Incorporating traffic calming measures, alternative intersection designs, and lower speed limits; and

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[5] City of Santa Rosa. 2009. Santa Rosa General Plan 2035. November.
[6] City of Santa Rosa. 2019. Santa Rosa City Code. June.

  - Incorporating state-of-the-art structural sound attenuation and setbacks.
- **NS-B-14:** Discourage new projects that have potential to create ambient noise levels more than 5 dBA L_{dn} above existing background, within 250 feet of sensitive receptors.

Table 5: Land Use Compatibility for Community Noise Exposure (dBA CNEL or L_{dn})

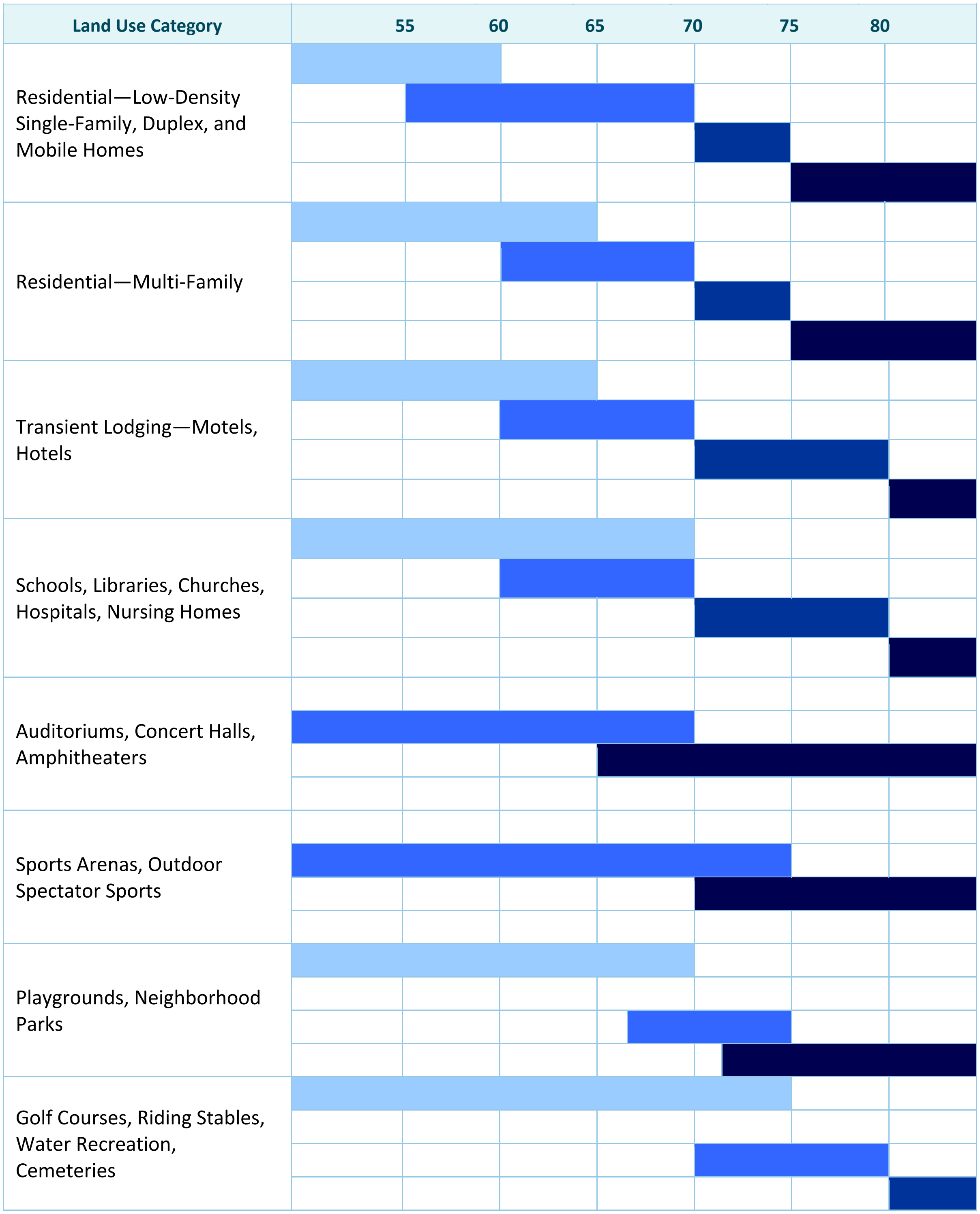
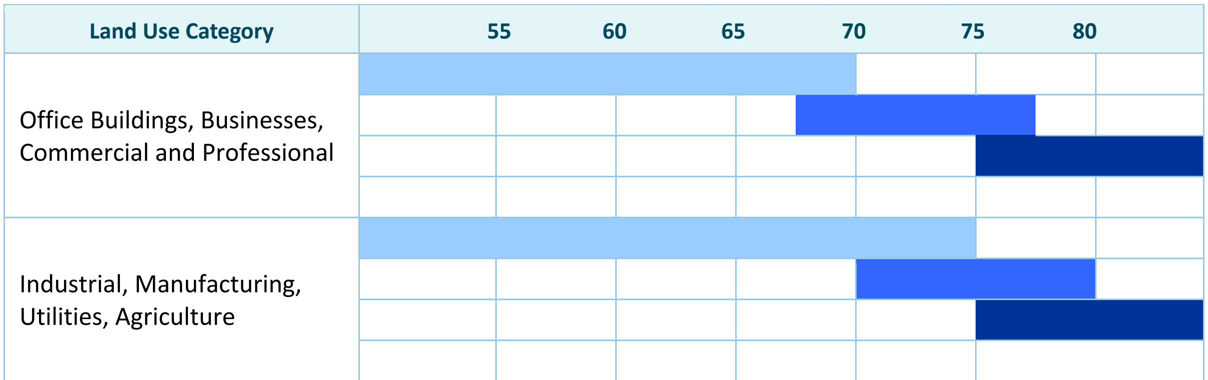


Table 5 (cont.): Land Use Compatibility for Community Noise Exposure (dBA CNEL or L_{dn})



Source: Santa Rosa General Plan 2035. 2009. Noise and Safety Element. November.

Key:

	Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements.
	Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
	Normally Unacceptable: New construction and 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.
	Clearly Unacceptable: New construction or development should generally not be undertaken.

Santa Rosa Municipal Code

The City of Santa Rosa also addresses noise in the ordinances of the City Code. Santa Rosa Municipal Code Section 17-16.120, Machinery and Equipment, states that "it is unlawful for any person to operate any machinery, equipment, pump, fan, air-conditioning apparatus or similar mechanical device in any manner so as to create any noise, which would cause the noise level at the property line of any property to exceed the ambient base noise level by more than five decibels."

Standard City conditions of project approval limit the hours of construction to 7:00 a.m. to 7:00 p.m., Monday through Friday, and 8:00 a.m. to 6:00 p.m. on Saturdays. No construction is permitted on Sundays and holidays.

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SECTION 4: EXISTING NOISE CONDITIONS

The following section describes the existing ambient noise environment of the project vicinity.

4.1 - Existing Noise Sources

The proposed project site is located in the City of Santa Rosa, California. The project site is bound by Burbank Avenue to the west; rural low-density residential single-family land use to the north, south, and west; and residential single-family to the east.

4.2 - Existing Ambient and Traffic Noise Levels

The existing noise levels on the project site were documented through a noise monitoring effort performed at the project site. Noise monitoring location and measurements are described in detail in Appendix A. Two short-term noise measurements (15 minutes each) were taken on Thursday, September 5, 2019, starting at 1:56 p.m. and ending at 2:44 p.m., during the midday peak noise hours. These short-term noise measurements are summarized in Table 6. The noise monitoring survey data sheets are provided in Appendix A.

Noise measurement ST-1 was taken in the northwest corner of the project site, on the east side of Burbank Avenue approximately 50 feet south of the closest residential receptor. The resulting measurement showed that ambient noise levels at this location averaged 58.5 dBA L_{eq}. As was observed by the technician at the time of the noise measurement, the dominant noise source in the project vicinity was from vehicle traffic along Burbank Avenue.

Noise measurement ST-2 was taken in the southwestern portion of the project site, approximately 250 feet east of Burbank Avenue and 350 feet north of the unnamed road between Hughes Avenue and Hearn Avenue. The resulting measurement showed that ambient noise levels at this location averaged 48.0 dBA L_{eq}. As was observed by the technician at the time of the noise measurement, the dominant noise source in the project vicinity was from vehicle traffic along Burbank Avenue.

Table 6: Short-term Noise Monitoring Summary

Site Location	Description	L_{eq}	L_{max}	L_{min}
ST-1	Northwest corner of the project site, on the east side of Burbank Avenue approximately 50 feet south of the closest residential receptor.	58.5	73.6	41.8
ST-2	Southwestern portion of the project site, approximately 250 feet east of Burbank Avenue and 350 feet north of the unnamed road between Hughes Avenue and Hearn Avenue.	48.0	70.7	40.0
Source: FCS 2019.				

4.3 - Existing Stationary Source Noise Levels

Surrounding land uses include residential single-family development to the east and rural low-density residential single-family development to the north, south, and east. Roseland Creek Elementary School lies to the northwest corner and Sheppard Accelerated Elementary School lies to the southeast corner of the project site. While some of these surrounding land uses generate noise from typical parking lot activities and mechanical ventilation systems, the noise environment in the project vicinity is dominated by vehicle traffic noise on Burbank Avenue.

4.4 - Existing Traffic Noise

The Federal Highway Administration (FHWA) highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate the general existing traffic noise levels in the project vicinity. The daily traffic volumes were obtained from the Traffic Impact Study prepared for the project by W-Trans, dated November 6, 2019. The resultant noise levels were weighed and summed over a 24-hour period in order to determine the L_{dn} values. The traffic volumes described here correspond to the existing without project conditions traffic scenario as described in the transportation analysis. The model inputs and outputs—including the 60 dBA, 65 dBA, and 70 dBA L_{dn} noise contour distances—are provided in Appendix B of this document. A summary of the modeling results is shown in Table 7.

Table 7: Existing Traffic Noise Levels

Roadway Segment	Approximate Average Daily Traffic (ADT)	Centerline to 70 L_{dn} (feet)	Centerline to 65 L_{dn} (feet)	Centerline to 60 L_{dn} (feet)	L_{dn} (dBA) 50 feet from Centerline of Outermost Lane
Burbank Avenue—Hughes Avenue to Hearn Avenue	4,200	<50	<50	<50	56.6

Note:
These modeling results do not take into account mitigating features such as topography, vegetative screening, fencing, building design, or structure screening. Rather, it assumes a worst case of having a direct line of site on flat terrain.
Source: FCS 2019.

SECTION 5: THRESHOLDS OF SIGNIFICANCE AND IMPACT ANALYSIS

5.1 - Thresholds of Significance

According to California Environmental Quality Act (CEQA) Guidelines updated Appendix G, to determine whether impacts related to noise and vibration are significant environmental effects, the following questions are analyzed and evaluated.

It should be noted that the significance criteria question (a), below, is from the Land Use and Planning section of the CEQA Guidelines Appendix G checklist questions. However, this question addresses impacts related to conflicts with land use plans, which would include project-related conflicts to the noise land use compatibility standards of the Noise Element of the General Plan. Therefore, these impacts are addressed here.

Would the proposed plan:

a) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

b) Generate 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?

c) Generate excessive groundborne vibration or groundborne noise levels?

d) 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 - Noise Levels That Would Conflict with Any Land Use Plan, Policy, or Regulation

A significant impact would occur for the proposed project if residential single-family and residential multi-family land use development would be exposed to transportation noise levels in excess of the City's "Normally Acceptable" land use compatibility standards. For residential single-family, a standard of up to 60 dBA L_{dn} is considered "normally acceptable" and for residential multi-family, a standard of up to 65 dBA L_{dn} is considered "normally acceptable". Additionally, the interior noise levels are not to exceed the State of California's interior noise standard of 45 dBA L_{dn}.

Land uses and environments with ambient noise levels for residential single-family from 55 dBA to 70 dBA L_{dn}, and residential multi-family from 60 dBA to 70 dBA L_{dn} are considered "Conditionally Acceptable." In the event that conditions for the proposed type of land use have been designated "Conditionally Acceptable," construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice. Environments with ambient noise levels from 70 dBA to 75 dBA L_{dn} are considered "Normally Unacceptable," while environments with ambient noise levels above 75 dBA L_{dn} are considered "Clearly Unacceptable," for both residential single-family and residential multi-family land uses.

5.2.1 - Traffic Noise Compatibility

The ambient noise environment of the project site has also been documented through traffic noise modeling. The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate existing and future traffic noise conditions in the project vicinity. The projected future traffic noise levels adjacent to the project site were analyzed to determine compliance with the City's noise and land use compatibility standards. The daily traffic volumes were obtained from the Traffic Impact Study prepared for the project by W-Trans.[7] The resultant noise levels were weighed and summed over a 24-hour period in order to determine the L_{dn} values. The traffic noise modeling input and output files are included in Appendix B of this document. Table 8 shows a summary of the traffic noise levels for existing background traffic noise levels without, and with, the project as measured at 50 feet from the centerline of the outermost travel lane.

Table 8: Traffic Noise Model Results Summary

Roadway Segment	Existing No Project (dBA) L_{dn}	Existing Plus Project (dBA) L_{dn}	Increase over Existing No Project (dBA)	Baseline No Project (dBA) L_{dn}	Baseline Plus Project (dBA) L_{dn}	Increase over Baseline No Project (dBA)
Burbank Avenue—Hughes Avenue to Hearn Avenue	56.6	57.1	0.5	57.1	57.6	0.5

Notes:
ADT is calculated by the FHWA model based on PM peak-hour traffic volumes from the traffic study prepared for the project.
L_{dn} (dBA) is stated as measured at 50 feet from the centerline of the outermost travel lane.
Source: FCS 2019.

The modeling results in Table 8 show that traffic noise levels along the modeled roadway segment of Burbank Avenue, between Hughes Avenue and Hearn Avenue, would range up to 57.6 dBA L_{dn} under Baseline Plus Project traffic conditions as measured at 50 feet from the centerline of the outermost travel lane. These traffic noise levels are within the City's normally acceptable land use compatibility threshold of below 60 dBA L_{dn} for new residential low-density single-family, and 65 dBA L_{dn} for residential multi-family land use development. Therefore, the project would not conflict with the City's noise land use compatibility standards and the impact would be less than significant.

This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

7 W-Trans., 2019. Traffic Impact Study for the Burbank Avenue Subdivision Project. November 6.

5.3 - Substantial Noise Increase in Excess of Standards

A significant impact would occur if the project would generate a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

5.3.1 - Construction Noise Impacts

Short-Term Construction Impacts

For purposes of this analysis, a significant impact would occur if construction activities would result in a substantial temporary increase in ambient noise levels outside of the City's permissible hours for construction that would result in annoyance or sleep disturbance of nearby sensitive receptors. The City's standard conditions of project approval limit the hours of construction to 7:00 a.m. to 7:00 p.m. Monday through Friday, and 8:00 a.m. to 6:00 p.m. on Saturdays; no construction permitted on Sundays and holidays.

Construction-related Traffic Noise

Noise impacts from construction activities associated with the project would be a function of the noise generated by construction equipment, equipment location, sensitivity of nearby land uses, and the timing and duration of the construction activities. One type of short-term noise impacts that could occur during project construction would result from the increase in traffic flow on local streets, associated with the transport of workers, equipment, and materials to and from the project site.

The transport of workers and construction equipment and materials to the project site would incrementally increase noise levels on access roads leading to the site. Because workers and construction equipment would use existing routes, noise from passing trucks would be similar to existing vehicle-generated noise on these local roadways. Typically, a doubling of the average daily trip (ADT) hourly volumes on a roadway segment is required in order to result in an increase of 3 dBA in traffic noise levels, which, as discussed in the characteristics of nose discussion above, is the lowest change that can be perceptible to the human ear in outdoor environments. Project-related construction trips would not be expected to double the hourly traffic volumes along any roadway segment in the project vicinity. For this reason, short-term intermittent noise from construction trips would be minor when averaged over a longer time-period and would not result in a perceptible increase in hourly- or daily-average traffic noise levels in the project vicinity. Therefore, short-term construction-related noise impacts associated with the transportation of workers and equipment to the project site would be less than significant.

Construction Equipment Operational Noise

The second type of short-term noise impact is related to noise generated during construction on the project site. Construction is completed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the site and, therefore, the noise levels surrounding the site as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction related noise ranges to be categorized by work phase. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings. Impact equipment, such as impact pile drivers, are not expected to be used during construction of this project.

The demolition phase is expected to require the use of rubber-tired dozers, excavators, and concrete/industrial saws. The site preparation and grading phase of the project is expected to require the use of scrapers, rubber-tired dozers, tractors, front-end loaders, backhoes, water trucks, and graders. The building construction phase is expected to require the use of cranes, forklifts, portable generators, tractors, front-end loaders, backhoes, and welder torches.

The loudest phase of construction is typically the site preparation and grading phase as that is when the loudest pieces of heavy construction equipment would operate. For example, the maximum noise level generated by each scraper is assumed to be 85 dBA L_{max} at 50 feet from this equipment. Each bulldozer would also generate 85 dBA L_{max} at 50 feet. The maximum noise level generated by graders is approximately 85 dBA L_{max} at 50 feet.

A conservative but reasonable assumption is that this equipment would operate simultaneously and continuously over at least a 1-hour period in the vicinity of the closest existing residential receptors, but would move linearly over the project site as they perform their earth moving operations, spending a relatively short amount of time adjacent to any one receptor. A characteristic of sound is that each doubling of sound sources with equal strength increases a sound level by 3 dBA. Assuming that each piece of construction equipment operates at some distance from the other equipment, a reasonable worst-case combined noise level during this phase of construction would be 90 dBA L_{max} at a distance of 50 feet from the acoustic center of a construction area. The acoustical center reference is used because construction equipment must operate at some distance from one another on a project site, and the combined noise level as measured at a point equidistant from the sources (acoustic center) would be the worst-case maximum noise level. These operations would be expected to result in a reasonable worst-case hourly average of 86 dBA L_{eq} at a distance of 50 feet from the acoustic center of a construction area. These worst-case construction noise levels would only occur during the site preparation phase of development.

The nearest off-site receptor is a single-family residence located to the west of the project site, approximately 64 feet from the nearest acoustic center of construction activity where heavy construction equipment would operate during construction of the proposed project. At this distance, construction noise levels would range up to approximately 87.8 dBA L_{max}, with a relative worst-case hourly average of 83.8 dBA L_{eq}, if multiple pieces of heavy construction equipment operate simultaneously during construction of the proposed private street.

Although there could be a relatively high single event noise exposure potential causing an intermittent noise nuisance, the effect of construction activities on longer-term (hourly or daily) ambient noise levels would be small but could result in a temporary increase in ambient noise levels in the project vicinity that could result in annoyance or sleep disturbance of nearby sensitive receptors. Therefore, limiting construction activities to the daytime hours would reduce the effects of noise levels produced by these activities on longer-term (hourly or daily) ambient noise levels, and would reduce potential impacts that could result in annoyance or sleep disturbances at nearby sensitive receptors. However, the City has established standard conditions of project approval that limit hours of construction to 7:00 a.m. to 7:00 p.m. Monday through Friday, and 8:00 a.m. to 6:00 p.m. on Saturdays; no construction is permitted on Sundays and holidays. The project will comply with this restriction of construction activities to these stated time-periods which would ensure that construction noise would not result in a substantial temporary increase in ambient noise levels that would result in annoyance or sleep disturbance of nearby sensitive receptors.

Construction-related traffic noise and construction equipment operation noise would therefore be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

5.3.2 - Mobile Source Operational Noise Impacts

The City of Santa Rosa does define “substantial increase” for mobile noise sources. Therefore, for purpose of this analysis, a substantial increase is based on the following criteria. As noted in the characteristics of noise discussion, audible increases in noise levels generally refer to a change of 3 dBA or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. A change of 5 dBA is considered the minimum readily perceptible change to the human ear in outdoor environments. Therefore, a significant impact would occur if the project would cause the L_{dn} to increase by any of the following:

- 5 dBA or more even if the L_{dn} would remain below normally acceptable levels for a receiving land use.
- 3 dBA or more, thereby causing the L_{dn} in the project vicinity to exceed normally acceptable levels and result in noise levels that would be considered conditionally acceptable for a receiving land use.
- 1.5 dBA or more where the L_{dn} currently exceeds conditionally acceptable levels.

The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate project trip contributions to adjacent roadways. The daily traffic volumes were obtained from the Traffic Impact Study prepared for the project by W-Trans, Inc., dated November 6, 2019. The resultant noise levels were weighed and summed over a 24-hour period in order to determine the L_{dn} values. The traffic noise modeling input and output files are included in Appendix B of this document. Table 8, in the impact discussion section 5.2.1 above, shows a summary of the traffic noise levels for existing and baseline traffic conditions without and with the project, as measured at 50 feet from the centerline of the outermost travel lane.

The highest traffic noise level increase with implementation of the project along Burbank Avenue, between Hughes Avenue and Hearn Avenue would be an increase of 0.9 dBA compared to conditions that would exist without the project. This increase is well below the 5-dBA increase that would be considered a substantial permanent increase in noise levels, compared with noise levels that would exist without the project. Therefore, project traffic noise impacts would be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

5.3.3 - Stationary Source Operational Noise Impacts

The proposed project would include new stationary noise sources, such as typical parking lot activities and mechanical ventilation systems. A significant impact would occur if the proposed parking lot or mechanical ventilation systems exceed the City's noise performance standard. According to the City's noise ordinances, no person within the City shall create any sound radiated for extended periods from any premises that produces a sound pressure level at any point on the property line in excess of 60 dBA L_{eq} in accordance with the noise measurement requirements listed in the noise ordinance. Furthermore, Policy NS-B-14 of the Noise Element of the General Plan discourages projects that have the potential to create ambient noise levels more than 5 dBA L_{dn} above existing background.

Parking Lot Activities

According to the project site plans, parking spaces for the proposed multi-family residential units would be located approximately 33.5 feet north of the nearest noise-sensitive receptor, a single-family residence south of the project site. Representative parking activities, such as vehicles cruising at slow speeds, door slamming, or cars starting, would generate approximately 60 dBA to 70 dBA L_{max} at 50 feet. Typical parking events take an average of less than one minute. Assuming each of the parking spaces at the southern portion of the project site would incur one parking event in a maximum use hour, the combined parking lot activity would generate a reasonable worst-case hourly average noise level of up to 59 dBA L_{eq} as measured at the nearest receptor. These noise levels from parking lot activities would not exceed the City's noise performance standard of 60 dBA L_{eq}. Assuming these reasonable worst-case parking lot activity hourly average noise levels would occur during all morning, midday, and evening hours when residences would typically leave or return, they would result in a 24-hour average noise level of 56 dBA L_{dn}. Existing background traffic noise levels are documented to range up to 56 dBA L_{dn} in the project vicinity. Therefore, parking lot activity noise levels would not result in a substantial (+5 dBA) permanent increase in noise levels in excess of established standards and this impact would be less than significant. The impact of project-related parking lot activities on sensitive off-site receptors would be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

Mechanical Equipment Operations

At the time of preparation of this analysis, details were not available pertaining to proposed mechanical ventilation systems for the project; therefore, a reference noise level for typical mechanical ventilation systems was used. Noise levels from typical residential mechanical ventilation equipment range from 50 dBA to 70 dBA L_{eq} at a distance of approximately 5 feet. Mechanical ventilation systems could be located as close as approximately 40 feet of the nearest off-site receptors. At this distance noise generated by mechanical ventilation equipment would attenuate to approximately 52 dBA L_{eq} at the nearest off-site residential receptors. Therefore, mechanical ventilation equipment operational noise levels would not exceed the City's noise performance standard of 60 dBA L_{eq}. Furthermore, when averaged over a 24-hour period, these mechanical ventilation equipment operational noise levels would also not exceed existing 24-hour average background noise levels. Therefore, mechanical ventilation system operational noise levels would not result in a substantial (+5 dBA) permanent increase in noise levels in excess of established standards and this impact would be less than significant. The impact of mechanical ventilation equipment operational noise levels on sensitive off-site receptors would be less than significant.

Mobile source operational noise impacts and stationary source operational noise impacts would be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

5.4 - Groundborne Vibration/Noise Levels

A significant impact would occur if the project would generate excessive groundborne vibration or groundborne noise levels as measured at the nearest receptors.

Project-related construction and operational groundborne vibration impacts are analyzed separately below. Groundborne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. Vibrating objects in contact with the ground radiate vibration waves through various soil and rock strata to the foundations of nearby buildings.

In extreme cases, excessive groundborne vibration has the potential to cause structural damage to buildings. Common sources of groundborne vibration include construction activities such as blasting, pile driving, and operating heavy earthmoving equipment. In general, if groundborne vibration levels do not exceed levels considered to be perceptible, then groundborne noise levels would not be perceptible in most interior environments. Therefore, this analysis focuses on determining exceedances of groundborne vibration levels.

The City of Santa Rosa has not adopted a provision addressing the impacts of groundborne vibration levels. Therefore, for purposes of this analysis, the FTA's vibration impact criteria are utilized. The FTA has established industry accepted standards for vibration impact assessment in its Transit Noise and Vibration Impact Assessment Manual.[8] These guidelines are summarized in Table 4.

5.4.1 - Short-term Construction Vibration Impacts

A significant impact would occur if the project construction activities would generate groundborne vibration levels in excess of levels established by the FTA's Construction Vibration Damage Criteria as measured at existing structures in the project vicinity.

Of the variety of equipment used during construction, the large vibratory rollers anticipated to be used in the site preparation phase of construction would produce the greatest groundborne vibration levels. Large vibratory rollers produce groundborne vibration levels ranging up to 0.210 inch per second (in/sec) PPV at 25 feet from the operating equipment.

[8] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.

The nearest off-site receptor is a single family residence located west of the project site, approximately 35 feet from the nearest construction footprint where large vibratory rollers would potentially operate. At this distance, groundborne vibration levels could range up to 0.127 PPV from operation of a large vibratory roller. This is below the FTA's construction vibration damage criteria of 0.2 PPV for this type of structure—buildings of non-engineered timber and masonry construction. Therefore, project construction activities would not generate groundborne vibration levels in excess of the FTA's criteria and impacts would be considered less than significant as measured at the nearest receiving structures in the project vicinity. Project construction related groundborne vibration impacts would be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

5.4.2 - Operational Vibration Impacts

Implementation of the project would not include any permanent sources that would expose persons in the project vicinity to groundborne vibration levels that could be perceptible without instruments at any existing sensitive land use in the project vicinity. In addition, there are no existing significant permanent sources of groundborne vibration in the project vicinity. Therefore, project operational groundborne vibration level impacts would be less than significant.

Short-term construction vibration impacts and operational vibration impacts would be less than significant. This finding is consistent with the findings of the Roseland Area Annexation Project Environmental Impact Report.

5.5 - Excessive Noise Levels from Airport Activity

A significant impact would occur if the project would expose people residing or working in the project area to excessive noise levels for a project located within the vicinity of a private airstrip or an Airport Land Use Compatibility Plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport.

The nearest airport to the project site is a private airstrip located 1.21 miles west of the project site. The nearest public airport to the project site is the Sonoma County Airport, located approximately 6.8 miles northwest. Because of the distance from and orientation of the airport runways, the project site is located well outside of the 65 dBA CNEL airport noise contours. While aircraft noise is occasionally audible on the project site from aircraft flyovers, aircraft noise associated with nearby airport activity would not expose people residing or working near the project site to excessive noise levels. Therefore, implementation of the project would not expose persons residing or working in the project vicinity to noise levels from airport activity that would be in excess of normally acceptable standards for multi-family residential land use development. Therefore, there would be no impact associated with airport noise. This finding is consistent with the environmental impact report findings of the Roseland Area Annexation Project Environmental Impact Report.

Appendix A: Noise Monitoring Data

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Project Number: 3481.0002
Project Name: Burbank Avenue
Test Personnel: Spencer

Sheet ___of ____

Noise Measurement Survey

Site Number: ST-1 Date: 9/5/2019 Time: From 1:56 To 2:11

Site Location:
Northern most corner of the site

Primary Noise Sources: Car traffic along Burbank Avenue

Measurement Results

	dBA
Leq	58.5
Lmax	73.6
Lmin	41.8
L5	64.1
L10	62.6
L50	52.3
L90	44.21
Ldn	
CNEL	

Observed Noise Sources/Events

Time	Noise Source/Event	dBA

Comments: (Student group talking) passed within 100 feet

Equipment: LXT-1
Settings: A-Weighted☒ Other☐__________

Measured Difference: 0.02 dBA
Slow☐ Fast☐ Windscreen☒

Atmospheric Conditions:

Maximum Wind Velocity (mph)	Average Wind Velocity (mph)	Temperature (F)	Relative Humidity (%)	
4.9	2.0	77	–	
Comments:	Cloudless, Sunny day w/ slight winds			

Project Number: 3481.0002
Project Name: Burbank Avenue
Test Personnel: Spencer

Sheet ___ of ___

Noise Measurement Survey

Site Number: ST-2 Date: 9/5/2019 Time: From 2:29 To 2:44

Site Location:
200 feet to Burbank Ave, near Southern Border of project site

Primary Noise Sources: Burbank Ave traffic

Measurement Results

	dBA
Leq	48.0
Lmax	70.7
Lmin	40.0
L5	49.1
L10	46.9
L50	43.4
L90	41.4
Ldn	
CNEL	

Observed Noise Sources/Events

Time	Noise Source/Event	dBA

Comments: ______

Equipment: LXT-1 Measured Difference: 0.02 dBA
Settings: A-Weighted☒ Other☐ Slow☐ Fast☐ Windscreen☒

Atmospheric Conditions:

Maximum Wind Velocity (mph)	Average Wind Velocity (mph)	Temperature (F)	Relative Humidity (%)	
~~[illegible]~~ 10.9	2.0	72		
Comments:	Cloudless, Sunny day, slight winds, some gusts			

Appendix B: Noise Modeling Data

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TABLE Existing (Year 2019)-01

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 11/07/2019
ROADWAY SEGMENT: Burbank Avenue - Hughes Avenue to Hearn Avenue
NOTES: Burbank Avenue Subdivision - Existing (Year 2019)

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 4200   SPEED (MPH): 25   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	NIGHT
AUTOS		
	88.08	9.34
M-TRUCKS		
	1.65	0.19
H-TRUCKS		
	0.66	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

* * CALCULATED NOISE LEVELS * *

Ldn AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.55

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO Ldn

70 Ldn	65 Ldn	60 Ldn	55 Ldn
0.0	0.0	0.0	70.9

TABLE Existing with Project (Year 2019)-01

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 11/07/2019
ROADWAY SEGMENT: Burbank Avenue - Hughes Avenue to Hearn Avenue
NOTES: Burbank Avenue Subdivision - Existing with Project (Year 2019)

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 4800   SPEED (MPH): 25   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	NIGHT
AUTOS	88.08	9.34
M-TRUCKS	1.65	0.19
H-TRUCKS	0.66	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

Ldn AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.13

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO Ldn

70 Ldn	65 Ldn	60 Ldn	55 Ldn
0.0	0.0	0.0	77.5

TABLE Baseline No Project-01

FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 11/07/2019
ROADWAY SEGMENT: Burbank Avenue - Hughes Avenue to Hearn Avenue
NOTES: Burbank Avenue Subdivision - Baseline No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 4800   SPEED (MPH): 25   GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	NIGHT
AUTOS	88.08	9.34
M-TRUCKS	1.65	0.19
H-TRUCKS	0.66	0.08

ACTIVE HALF-WIDTH (FT): 6   SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

Ldn AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.13

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO Ldn

70 Ldn	65 Ldn	60 Ldn	55 Ldn
0.0	0.0	0.0	77.5

TABLE Baseline Plus Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 11/07/2019
ROADWAY SEGMENT: Burbank Avenue - Hughes Avenue to Hearn Avenue
NOTES: Burbank Avenue Subdivision - Baseline Plus Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 5400 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	NIGHT
AUTOS	88.08	9.34
M-TRUCKS	1.65	0.19
H-TRUCKS	0.66	0.08

ACTIVE HALF-WIDTH (FT): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

Ldn AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.64

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO Ldn

70 Ldn	65 Ldn	60 Ldn	55 Ldn
0.0	0.0	0.0	83.8

Parking Lot activity

Receptor: Closest Residence

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage factor[1]	Distance to Receptor	Ground Effect[2]	Shielding (dBA)[3]	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	parking lot activity	70	7	1	35	1	5	68.1	58.1	645362.79
2	parking lot activity	70	6	1	60	1	5	63.4	50.4	109801.31
3	parking lot activity	70	3	1	75	1	5	61.5	44.5	28109.135
4										
5										
6										
7										
8										
9										
10										
							Lmax[4]	**68**	**Leq**	**59**

Notes:

[1] Percentage of time activity occurs each hour

[2] Soft ground terrain between project site and receptor.

[3] Shielding due to terrain or structures

[4] Calculated Lmax is the Loudest value.

Ldn Calculations					
	Time	Hourly Leq	Leq'	0.1*Leq	antiLog
Night	12:00 AM	45.0	55.0	5.5	316227.766
	1:00 AM	45.0	55.0	5.5	316227.766
	2:00 AM	45.0	55.0	5.5	316227.766
	3:00 AM	45.0	55.0	5.5	316227.766
	4:00 AM	45.0	55.0	5.5	316227.766
	5:00 AM	45.0	55.0	5.5	316227.766
	6:00 AM	45.0	55.0	5.5	316227.766
Day	7:00 AM	58.9	58.9	5.89391328	783273.23
	8:00 AM	58.9	58.9	5.89391328	783273.23
	9:00 AM	45.0	45.0	4.5	31622.7766
	10:00 AM	45.0	45.0	4.5	31622.7766
	11:00 AM	45.0	45.0	4.5	31622.7766
	12:00 PM	58.9	58.9	5.89391328	783273.23
	1:00 PM	45.0	45.0	4.5	31622.7766
	2:00 PM	45.0	45.0	4.5	31622.7766
	3:00 PM	45.0	45.0	4.5	31622.7766
	4:00 PM	45.0	45.0	4.5	31622.7766
	5:00 PM	58.9	58.9	5.89391328	783273.23
	6:00 PM	58.9	58.9	5.89391328	783273.23
	7:00 PM	58.9	58.9	5.89391328	783273.23
	8:00 PM	58.9	58.9	5.89391328	783273.23
	9:00 PM	58.9	58.9	5.89391328	783273.23
Night	10:00 PM	45.0	55.0	5.5	316227.766
	11:00 PM	45.0	55.0	5.5	316227.766
			Sum		9333595.17
			Sum/24		388899.799
			Log10(Sum/24)		5.58983772
			10*Log10(Sum/24)		55.8983772
			24 Hour Ldn		56

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