Noise and Vibration Report

Bruce Road Reconstruction Project, Capital Project No. 16038
City of Chico, California

June 2020

ICF. 2020. Noise and Vibration Report. Bruce Road Reconstruction Project, Capital Project No. 16038. June. (ICF 00609.19.) Sacramento, CA. Prepared for City of Chico, Chico, CA.

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List of Abbreviated Terms

ADT	average daily traffic
CAD	computer-aided design
CEQA	California Environmental Quality Act
CIDH	cast-in-drilled-hole
City	City of Chico
CNEL	community noise equivalent level
CUSD	Chico Unified School District
dB	decibels
dBA	A-weighted sound level
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
General Plan	Chico 2030 General Plan
General Plan EIR	Chico 2030 General Plan Update Draft Environmental Impact Report
Hz	Hertz
kHz	kilohertz
Ldn	day-night level
Leq	equivalent sound level
Leq(h)	hourly equivalent sound level
Lmax	maximum sound level
LOS	level of service
Lxx	percentile-exceeded sound level
mPa	micro-Pascals
mph	miles per hour
NAC	noise abatement criteria
NEPA	National Environmental Policy Act
PPV	peack particle velocity
RMS	root-mean-square
ROW	right of way
SPL	sound pressure level
SR 32	State Route 32
TNM	Traffic Noise Model

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Chapter 1. Project Description

1.1. Introduction

The City of Chico (City) proposes the reconstruction and widening of a section of Bruce Road between State Route 32 (SR 32) and Skyway Road, on the eastern side of the city. The purpose of this report is to evaluate potential noise and vibration impacts from the construction and operation of the project according to City of Chico standards, in accordance with the California Environmental Quality Act (CEQA). Where impacts are identified, mitigation measures to minimize or avoid impacts are evaluated.

1.2. Project Description

The Bruce Road Reconstruction Project involves the reconstruction and widening of an approximately 2-mile segment of Bruce Road from State Route 32 (SR 32) to Skyway utilizing roller-compacted concrete pavement. The limits of the area of reconstruction are shown in Figure 1 (Appendix A). The proposed "complete streets" improvements include widening Bruce Road from an existing 2-lane arterial roadway to a 4-lane arterial roadway, and replacement of the existing two-lane, functionally obsolete Bruce Road bridge over Little Chico Creek (Caltrans Bridge # 12C0106) with a new four-lane bridge structure. The new, approximately 96-feet long by 96.5-feet wide bridge will accommodate four lanes of traffic, a center median, pedestrian/bicycle facilities consisting of a Class I bike path on the west side of Bruce Road, and a sidewalk on the east side. The new bridge will be comprised of three-span, cast-in-place, reinforced concrete slab superstructure founded on pile supported abutments and 16-inch diameter multi-column piers supported on spread footings.

The ultimate roadway design includes construction of the following: a 14-foot landscaped center median; roadway lighting; 5-foot bike lanes with 2-foot buffered striping on both east and west sides of Bruce Road; dedicated left turn lanes at various intersections; concrete curb, gutter, and curb ramps; and a 12-foot-wide concrete multi-use path on the west side of Bruce Road. The project also includes storm drainage improvements such as bioretention facilities, drainage pipe, manholes, and curb inlets, as well as minor extension of sewer facilities where required. The proposed project includes construction of most of the ultimate roadway design. The City will be installing all infrastructure improvements detailed herein, except for a few limited frontage improvements on the east side of Bruce Road. Sidewalk and parking strips on the east side of the roadway will be installed by others in conjunction with the requirements of adjacent private subdivisions to be constructed as separate projects.

Excavation will be required throughout the project in order to construct the roadway, bridge and associated improvements. The estimated maximum depth of excavation for the roadway improvements is between 1 and 3 feet below existing grade. Landscaping and drainage facilities, which require trenching, placement of pipe, drainage structures, planting, irrigation, and backfill will have a maximum depth of 6 feet. For the bridge structure, a maximum excavation depth of 35-feet will be required to install abutment support, which are anticipated to be Cast-In-Drilled-Hole (CIDH) piles.

Approximately 0.23 acres of right-of-way acquisition will be needed from 4 parcels. Temporary construction easements will be required in various locations. A drainage easement from Chico Unified School District (CUSD) will be required for the proposed stormwater drainage system. An easement for the installation of the multi-use path will also be required from CUSD. Approximately 23 trees will be removed along Bruce Road, plus an additional 11 trees (approximately) along East 20th Street.

Some segments of the project will receive specific work that differs from work that has been proposed for the entire corridor, as discussed below.

1.2.1. Bruce Road from SR 32 and East 20th Street

- A new storm drain outfall will be installed downstream of the Little Chico Creek bridge crossing, on the southbound side of Bruce Road at the northwest corner of the bridge. The existing upstream storm drain outfall will be removed and diverted to the new outfall.
- The existing asphalt-concrete path from Humboldt Road to Native Oak Drive will be removed and replaced with new sidewalk.
- On the east side of Bruce Road, the existing sidewalk that currently ends just south of the Little Chico Creek bridge will be extended northerly to the bridge.

1.2.2. East 20th Street

- Timing and equipment modifications will be made to the traffic signals at the intersection of Bruce Road and East 20th Street.
- Two traffic signal poles on the SW and SE corners of the Bruce Road and East 20th Street intersection will be relocated.
- Approximately 625 feet of additional work will be completed along East 20th Street right-of way from the Bruce Road intersection easterly to approximately 200 feet east of Belgium Avenue.
- The road will be widened from 3 lanes to 5 lanes to align with the proposed ultimate intersection configuration at Bruce Road and East 20th Street.
- Curb and gutter improvements will be installed on the north side of East 20th Street easterly to Belgium Avenue. No sidewalk or curb and gutter work is planned for the south side of East 20th Street.
- Approximately 11 trees will be removed from the center median of East 20th Street; the median will be modified to a raised curb median.
- Approximately 450 feet of East 20th Street west of Bruce Road will be widened to align with the proposed ultimate intersection configuration.

1.2.3. Bruce Road from East 20th Street to Raley Boulevard

- Proposed improvements include surface and subsurface drainage infrastructure to capture and direct stormwater runoff from Bruce Road to existing storm drain systems on Raley Boulevard and Fremont Street.

- A new 42-inch storm drainpipe will be installed from Bruce Road west across the CUSD parcel and will drain into an existing connection at Fremont Street. Trenching for the new storm drainpipe will be at least 6 feet deep and approximately 6 feet wide.
- The existing culverts under Bruce Road will be removed.
- Conduit will be installed at the intersection of Bruce Road and Raley Boulevard and at the location of the future intersection of Bruce Road and Webster Drive for traffic signals to be installed by developers in the future.
- Bioretention facilities will be installed in both the northbound and southbound lane parkways on Bruce Road at Webster Drive.

1.2.4. Bruce Road from Raley Boulevard to Skyway

- Curb and gutter will be installed on the east side of Bruce Road.

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Chapter 2. Fundamentals of Noise and Vibration

2.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. *Noise* is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receptor determine the sound level and characteristics of the noise perceived by the receptor. The field of acoustics deals primarily with the propagation and control of sound.

2.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

2.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (μPa). One μPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 μPa. Because of this huge range of values, sound is rarely expressed in terms of μPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 μPa.

2.4. Addition of Decibels

Because decibels are logarithmic units, SPLs cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a three-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be three dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

2.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies, as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending upon the human sensitivity to those frequencies. Then, an A-weighted sound level (expressed in units of dBA) can be computed based upon this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B, C, and D scales), but these scales are rarely used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of dBA. Table 1. describes typical A-weighted noise levels for various noise sources.

Table 1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 feet		
	— 100 —	
Gas lawnmower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower at 100 feet	— 70 —	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher (next room)
Quiet urban nighttime	— 40 —	Theater; large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night; concert
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: Caltrans 2013a.

2.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a three-dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different from what is measured.

Under controlled conditions in an acoustical laboratory, the trained healthy human ear is able to discern one dB change in sound levels when exposed to steady single-frequency (pure-tone) signals in the midfrequency (1,000 Hz –8,000 Hz) range. In typical noisy environments, changes in noise of one to two dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of three dB in typical noisy environments. Further, a five-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of

loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway), which would result in a three-dB increase in sound, would generally be perceived as barely detectable.

2.7. Noise Descriptors

Noise in our daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. The noise descriptors most commonly used in traffic noise analysis are listed below.

- **Equivalent Sound Level** (Leq): Leq represents an average of the sound energy occurring over a specified period. In effect, Leq is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The one-hour A-weighted equivalent sound level (Leq(h)) is the energy average of A-weighted sound levels occurring during a one-hour period, and it is the basis for noise abatement criteria (NAC) used by Caltrans and FHWA.
- **Percentile-Exceeded Sound Level** (Lxx): Lxx represents the sound level exceeded for a given percentage of a specified period (e.g., L10 is the sound level exceeded 10 percent of the time, and L90 is the sound level exceeded 90 percent of the time).
- **Maximum Sound Level** (Lmax): Lmax is the highest instantaneous sound level measured during a specified period.
- **Day-Night Level** (Ldn): Ldn is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.
- **Community Noise Equivalent Level** (CNEL): Similar to Ldn, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10:00 p.m. and 7:00 a.m. and a five-dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

2.8. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends upon the factors listed below.

2.8.1. Geometric Spreading

Sound from a localized source (i.e., a *point source*) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of six dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and, hence, can be treated as a *line source*, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as *cylindrical spreading*. Sound levels attenuate at a rate of three dB for each doubling of distance from a line source.

2.8.2. Ground Absorption

The propagation path of noise from a highway to a receptor is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receptor, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

2.8.3. Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can experience lowered noise levels. Sound levels can be increased at large distances from the highway (e.g., more than 500 feet) due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors, such as air temperature, humidity, and turbulence, can also have significant effects.

2.8.4. Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by shielding depends upon the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor for the specific purpose of noise reduction. A barrier that breaks the line of sight between a source and a receptor will typically result in at least five dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and receptor is rarely effective in reducing noise because it does not create a solid barrier.

2.9. Vibration

In contrast to airborne sound, groundborne vibration is not a phenomenon that most people experience every day. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The background vibration velocity level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. Dynamic construction equipment, such as pile drivers, can create vibrations that radiate along the surface and downward into the earth. These surface waves can be felt as groundborne vibration. Vibration can result in effects that range

from annoyance to structural damage. Variations in geology and distance result in different vibration levels with different frequencies and displacements.

Groundborne vibration can be expressed in terms of root-mean-square (RMS) vibration velocity to evaluate human response to vibration levels. RMS is defined as the average of the squared amplitude of the vibration signal. The vibration amplitude is expressed in terms of vibration decibels, which use a reference level of 1 micro-inch per second. Vibration can also measured by peak particle velocity (PPV), defined as the maximum instantaneous peak of the vibration signal in inches per second.

Table 2 summarizes typical vibration levels generated by construction equipment at a reference distance of 25 feet and other distances. Caltrans has developed guidelines to assess damage and annoyance potential from the transient and continuous vibration that is usually associated with construction activity. 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 2. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 Feet	PPV at 50 Feet	PPV at 75 Feet	PPV at 100 Feet
Impact Pile Driver	1.518	0.054	0.2920	0.190
Auger drill	0.089	0.032	0.017	0.011
Hoe ram	0.089	0.032	0.017	0.011
Large bulldozer	0.089	0.032	0.017	0.011
Loaded trucks	0.076	0.027	0.015	0.010

Source: Federal Transit Administration 2018.

PPV = peak particle velocity.

Chapter 3. Regulatory Setting

This section summarizes key state and local regulations, laws, and policies relevant to noise in the project area, in accordance with the requirements of CEQA.

3.1. State Regulations and Policies

3.1.1. California Noise Control Act

The California Noise Control Act was enacted in 1973. In preparing its general plan noise element, a city or county must identify local noise sources and analyze and quantify to the extent practicable current and projected noise levels from various sources, including highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operations; and other stationary ground noise sources.

The *State of California General Plan Guidelines* (Governor's Office of Planning and Research 2017) provides noise compatibility guidelines for land use planning according to the existing community noise level; however, these guidelines offer no information regarding construction noise. The state has also published its Model Community Noise Ordinance (California Office of Noise Control 1977), which provides guidance to cities and counties on how to develop a community noise ordinance.

3.1.2. California Building Code

Title 24 of the California Code of Regulations contains standards for noise levels in interior residential building spaces. The standards state the following:

> Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL).

3.1.3. California Airport Noise Regulations

Airport noise standards are described in the California Code of Regulations (Title 21, Sections 5000-5090). The code states the following:

> The level of noise acceptable to a reasonable person residing in the vicinity of an airport is established as a CNEL value of 65 dBA for purposes of these regulations. Noise-sensitive land uses (i.e., residential dwellings, schools, hospitals and convalescent homes, and places of worship) that are located within the 65 dBA CNEL noise contour would be considered incompatible, unless mitigation has been incorporated. This criterion level has been chosen for reasonable persons residing in urban residential areas where houses are of typical California construction and may have windows partially open. It has been selected with reference to speech, sleep, and community reaction.

3.1.4. California Department of Transportation Vibration Standards

Caltrans provides guidelines regarding vibration associated with construction and operation of transportation infrastructure. Table 3 provides the Caltrans vibration guidelines for potential damage to different types of structures.

Table 3. Caltrans Vibration Guidelines for Potential Damage to Structures

	Maximum Peak Particle Velocity (PPV, in/sec)	
Structure Type and Condition	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: California Department of Transportation, 2013b.

Note: Transient sources create a single, isolated vibration event (e.g., blasting or the use of drop balls). Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

PPV = peak particle velocity.

Ground-borne vibration and noise can also disturb people. Numerous studies have been conducted to characterize the human response to vibration. In general, people are more sensitive to vibration during nighttime hours when sleeping than during daytime waking hours. Table 4 provides the Caltrans guidelines regarding vibration annoyance potential (expressed here as peak particle velocity [PPV]).

Table 4. Caltrans Guidelines for Vibration Annoyance Potential

	Maximum PPV (in/sec)	
Human Response	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: California Department of Transportation, 2013b.

Note: Transient sources create a single, isolated vibration event (e.g., 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.

PPV = peak particle velocity.

3.2. Local Regulations and Policies

3.2.1. Chico 2030 General Plan

The Noise Element of the *Chico 2030 General Plan* (General Plan) (City of Chico 2017) specifies guidelines for noise compatibility of land uses in the city. The following policies address noise levels within the city.

> Policy N-1.1 (New Development and Transportation Noise) – New development of noise-sensitive land uses will not be permitted in areas exposed to existing or planned transportation noise sources that exceed the levels specified in Table N-1, unless the project design includes measures to reduce exterior and interior noise levels to those specified in Table N-1 (Table 5 of this report).
> Policy N-1.2 (New Development and Non-Transportation Noise) – New development of noise-sensitive land uses will not be permitted in areas exposed to existing non-transportation noise sources that exceed the levels specified in Table N-2, unless the project design includes measures to reduce exterior noise levels to the unadjusted levels specified in Table N-2 (Table 6 of this report).

Table 5. Maximum Allowable Noise Levels from Transportation Sources

Land Use	Outdoor Activity Areas[1] Ldn/CNEL, dB	Interior Spaces	
		Ldn/CNEL, dB	Leq, dB[2]
Residential	65 [3]	45	--
Transient Lodging	--	45	--
Hospitals, Nursing Homes	65 [3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls	65 [3]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	65 [3]	--	45
Playgrounds, Neighborhood Parks	70	--	--

Notes:

1. Noise standards are to be applied at outdoor activity areas with the greatest exposure to the noise source. When it is not practical to mitigate exterior noise levels at the patios or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area. For noise-sensitive land uses that do not include outdoor activity areas, only the interior noise standard shall apply.

2. As determined for a typical worst-case hour during periods of use.

3. Where it is not possible to reduce noise in outdoor activity areas to 65 dB Ldn/CNEL or less using all feasible noise reduction measures, an exterior noise level of up to 70 dB Ldn/CNEL may be allowed provided that interior noise levels are in compliance with this table.

Table 6. Maximum Allowable Noise Levels from Transportation Sources

Noise Level Descriptor (dBA)	Exterior Noise Level (dBA)	
	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Average-Hourly Noise Level (L_{eq})	55	50
Intermittent Noise Level (L_{2} or L_{max})	75	65

Notes:

1. Noise levels are for planning purposes and may vary from the standards of the City's Noise Ordinance, which are for enforcement purposes.

2. Noise levels shall be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. Noise level standards do not apply to mixed-use residential units established in conjunction with industrial or commercial uses provided interior noise levels remain below 45 dB Ldn/CNEL.

3. In areas where the existing ambient noise level exceeds the established daytime or nighttime standard, the existing level shall become the respective noise standard and an increase of 3 dBA or more shall be significant. Noise levels shall be reduced 5 dBA if the existing ambient hourly Leq is at least 10 dBA lower than the standards.

4. Noise standards are to be applied at outdoor activity areas with the greatest exposure to the noise source. When it is not practical to mitigate exterior noise levels at patio or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area.

3.2.2. Chico Municipal Code

City of Chico Municipal Code Chapter 9.38 regulates noise levels within the city. In accordance with the City's Municipal Code, noise levels associated with residential land uses, measured at any point outside the property line, are limited to a maximum of 70 dBA between the hours of 7 a.m. and 9 p.m. and 60 dBA between the hours of 9 p.m. and 7 a.m.

For construction-related activities that occur between the hours of 10 a.m. and 6 p.m. on Sundays and holidays, and 7 a.m. and 9 p.m. on weekdays, the following limitations apply:

1) No individual device or piece of equipment shall produce a noise level exceeding 83 dBA at a distance of 25 feet from the source. If the device or equipment is housed within a structure on the property, the measurement shall be made outside the structure at a distance as close as possible to 25 feet from the equipment.

2) The noise level at any point outside the property plane of the project shall not exceed 86 dBA.

Chapter 4. Study Methods and Procedures

4.1. Methods for Identifying Land Uses and Selecting Modeling Receptor Locations

A survey of aerial mapping was done to identify land uses that could be subject to traffic and construction noise impacts from the proposed project. Land uses in the project area were categorized by land use type and the extent of outdoor areas frequent human use. Although all developed land uses are evaluated in this analysis, the focus of the impact analysis is on locations of frequent human use that would benefit from a lowered noise level, such as locations with defined outdoor activity areas, or residential interior locations. For this project, potentially affected noise-sensitive uses include single-family residences, multi-family dwellings, outdoor use areas associated with residential properties, and office buildings. Noise levels were also predicted at commercial and undeveloped uses for informational purposes, although these locations do not include apparent frequent outdoor use areas, nor do they have defined outdoor activity areas. Noise modeling prediction locations are shown in Figure 2 (Appendix A).

Although originally planned, noise monitoring was not conducted for this project. The timing of this study coincided with the "shelter-in-place" order by Governor Newsom in March 2020 in response to the coronavirus pandemic in the U.S. In addition to personnel safety reasons, it has been observed that as a by-product of the order, vehicle traffic has declined significantly. Because of this, traffic noise levels would be expected to be lower over the course of the order while people stay at home. This is considered a temporary effect and not typical of normal daily ambient noise conditions, which would normally be disclosed in the environmental document.

In place of project-specific measurements, noise modeling of existing conditions and monitoring and modeling data from relevant environmental documents are provided to characterize existing noise conditions (see results in Chapter 5, *Existing Noise Environment*).

4.2. Prediction of Traffic Noise Levels

Traffic noise levels were predicted using FHWA Traffic Noise Model (TNM), version 2.5. TNM is a computer model based upon two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a; FHWA 1998b). Geometric inputs to the traffic noise model include the locations of roadways, shielding features (e.g., topography and buildings), noise barriers, and receptors, as well as ground type. Three-dimensional representations of these inputs were developed using computer-aided design (CAD) drawings and topographic contours for both existing and build conditions provided by the project engineer. MicroStation V8i software was the primary tool used to digitize model objects for input into TNM version 2.5.

Traffic noise was evaluated under existing year (2020), opening year (2024), and future year (2040) conditions. Both with-project and no-project scenarios were analyzed for each model case. Traffic volume

data for Bruce Road and cross-streets was provided by the city engineer (Bettencourt pers. comm.). Appendix B contains average daily traffic (ADT) and peak hour traffic volumes used for the existing and future model conditions.

The loudest hour is characterized by the highest hourly volume of traffic traveling at the roadway's design speed (i.e. in a free-flowing state). Traffic volumes during the PM peak hour were used to model traffic noise emissions on the Bruce Road mainline, as projected traffic volumes during the PM peak hour were generally higher than volumes during the AM peak hour. The sound levels from PM peak hour are used to derive CNEL values, as described in Chapter 5.

4.3. Prediction of Construction Noise Levels

The assessment of potential construction noise levels was based on methodology developed by the Federal Transit Administration (FTA) (2018) and construction noise criteria from applicable local guidance (such as local general plan documents or noise ordinances). Noise levels produced by commonly used construction equipment are shown in Table 7. Individual types of heavy construction equipment are expected to generate maximum noise levels ranging from 80 to 89 dBA at a reference distance of 50 feet. At a distance of 25 feet, individual types of construction equipment are expected to produce maximum noise levels from 86 to 95 dBA. The construction noise level at a given receiver location depends on the type of construction activity and the distance and shielding between the activity and noise-sensitive receivers.

Table 7. Commonly Used Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 Feet from Source	Typical Noise Level (dBA) 25 Feet from Source
Auger Drill Rig (for drilled piles)	85	91
Heavy Truck	84	90
Excavator	85	91
Bulldozer	85	91
Pump	81	87
Generator	81	87
Mixer	80	86
Grader	85	91
Compactor	82	88
Scraper	89	95
Backhoe	85	91
Loader	84	90

Source: Federal Transit Administration 2018.
dBA = A-weighted decibel.

Construction equipment used would vary by construction phase of the proposed project and would involve the use of excavators, bulldozers, heavy trucks, pumps, generators, graders, compactors, and other heavy equipment. Reconstruction of the bridge over Little Chico Creek is expected to use drilled pile methods and CIDH piles. The source levels used to calculate noise exposure are based on the Lmax of equipment emission levels developed by FTA. Usage factors for construction noise are used in the

analysis to develop reasonable worst-case noise exposure values. The noise level value accounts for the energy-average of noise over a specified interval (usually 1 hour), and usage factors represent the amount of time a type of equipment is used during a typical interval.

Potential noise levels resulting from construction of the proposed project were evaluated by combining the noise levels of the three loudest pieces of equipment that would likely operate at the same time (for example, an excavator, bulldozer and truck being operated simultaneously during the site preparation phase), and applying the appropriate usage factor (percent of time equipment is in operation) to each piece of equipment. Sound levels from construction activities are calculated as a function of distance from the source(s), based on point-source attenuation over hard (i.e., acoustically reflective) ground, noting that 6 dB of reduction per doubling of distance can be assumed over hard ground.

4.4. Prediction of Construction Vibration Levels

With regard to potential vibration impacts during construction, such effects were evaluated using the construction vibration modeling methods recommended by the U.S. Department of Transportation, along with construction equipment data provided by the City of Chico. Reasonable worst-case construction vibration levels are provided and compared to the *Caltrans Vibration Guidelines for Damage and Annoyance* (refer to Tables 3 and 4 in Chapter 2). The construction vibration analysis assumes that piles would be installed using a drill rig and CIDH methods. Vibration source levels for an auger drill is shown in Table 2 (see Chapter 2).

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Chapter 5. Existing Noise Environment

5.1. Existing Land Uses

Land uses in the project area consist of single-family residences, multi-family dwellings, office buildings, commercial uses and undeveloped land. It was observed from online street view photography that single-family residences include privacy walls along the property frontage adjacent to Bruce Road. The walls have an approximate height of 6 feet relative to road elevation.

5.2. Existing Measured Noise Levels from the Stonegate Vesting Tentative Subdivision Environmental Impact Report

An Environmental Impact Report (EIR) was prepared for the Stonegate Subdivision project, proposed to be located along the east and west side of Bruce Road between East 20th Street and Skyway Road. Measurement results taken in July of 2016 indicated that existing noise levels were in the range of 63 to 64 dBA Ldn (Ldn is assumed to be roughly equal to the CNEL metric used in this analysis), at a distance of approximately 75 feet from the centerline of Bruce Road (City of Chico 2018).

5.3. Existing Noise Levels from the Chico 2030 General Plan EIR

Existing noise levels from transportation sources are described in the *Chico 2030 General Plan Update Draft Environmental Impact Report* (General Plan EIR) (City of Chico 2010). The study includes a discussion of existing traffic noise levels in the planning area, for the purpose of determining potential land use compatibility conflicts. The modeled noise contours for Bruce Road between Humboldt Road and Picholine Way indicate a noise level of 66 dBA CNEL at a distance of 50 feet from the near travel lane centerline (City of Chico 2010:App D), and assumes no intervening terrain, walls, or buildings. This level is based on an ADT of 10,500 vehicles per day.

5.4. Existing Modeled Noise Levels

Traffic noise levels were calculated using existing case traffic provided by the City of Chico (Bettencourt pers. comm.) using TNM Lookup traffic emissions tables. Based on the existing ADT of 12,986 on the segment of Bruce Road between Humboldt Road and Picholine Way, traffic noise levels are predicted to be 68 dBA CNEL at a distance of 50 feet from near-lane centerline, assuming no intervening terrain, walls, or buildings. This prediction is in close agreement with the values measured for the Stonegate Subdivision EIR and modeled values from the General Plan EIR, assuming increased traffic from regional growth.

Based on an existing PM peak traffic volume of 1,329 vehicles per hour along the same segment, a worst-hour noise level is predicted to be 68 Leq(h) at a distance of 50 feet from near-lane centerline, assuming no intervening terrain, walls, or buildings. Given that the peak hour value and the CNEL value are equal

for this analysis, peak hour modeled values can be used to give CNEL values in the Bruce Road model with no additional model adjustment factors.

Chapter 6. Environmental Consequences

6.1. Thresholds of Significance

In accordance with the State CEQA Guidelines and the City of Chico's environmental checklist, the proposed project or its related activities would be considered to have a significant effect if it would result in any of the conditions indicated in the environmental checklist, which asks the following questions related to the significance of noise and vibration.

1) Exposure of persons to or generation of noise levels in excess of standards established in the Chico 2030 General Plan, noise ordinance, or applicable standards of other agencies?
2) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?
3) Exposure of sensitive receptors (residential, parks, hospitals, schools) to exterior noise levels (CNEL) of 65 dBA or higher?
4) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?
5) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?
6) For a project located within the airport land use plan, would the project expose people residing or working in the Study Area to excessive noise levels?
7) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the Study Area to excessive noise levels?

6.2. Selection of Future Year Baseline Conditions

The CEQA Guidelines provide that existing conditions at the time a Notice of Preparation is released or when environmental review begins "normally" constitute the baseline for environmental analysis. (Guidelines Section 15125). In 2010, the California Supreme Court issued an opinion holding that while lead agencies have some flexibility in determining what constitutes the baseline, relying on "hypothetical allowable conditions" when those conditions are not a realistic description of the conditions without the project would be an illusory basis for a finding of no significant impact from the project and, therefore, a violation of CEQA (Communities for a Better Environment v. South Coast Air Quality Management District (2010) 48 Cal.4th 310).

On August 5, 2013, the California Supreme Court handed down its second baseline decision when it decided Neighbors for Smart Rail v. Exposition Metro Line Construction Authority (57 Cal.4th 439). This latest decision has clarified that, under certain circumstances, a baseline may reflect future, rather than existing, conditions. The rule specifies that factual circumstances can justify an agency departing from that norm in the following circumstances, when such reasons are supported by substantial evidence.

- When necessary to prevent misinforming or misleading the public and decision makers; and
- When their use in place of existing conditions is justified by unusual aspects of the project or surrounding conditions.

With respect to the proposed project, utilizing existing conditions to evaluate operational noise impacts would misrepresent and mislead the public and decision makers with respect to potential noise impacts because the project would be constructed and operational by 2024, after the time environmental review was initiated. Existing conditions do not represent the traffic volumes and traffic-related noise levels anticipated at the time the proposed project is first operational. These facts represent substantial evidence in support of utilizing a future baseline, rather than existing conditions, to evaluate operational noise impacts. Accordingly, the CEQA baseline for the purposes of this analysis is defined as opening year (2024) conditions. The 2024 baseline represents the opening year, which reflects noise and impacts when the project is first operational. The year 2040 data represents the full build year, which reflects full impacts of the project, accounting for future traffic volumes from other planned development identified in the General Plan. Utilizing opening year and design year conditions for the determination of impacts will avoid misinforming and misleading the public and decision makers with respect to operational noise impacts, consistent with current CEQA case law. Noise modeling results from opening year and design year are shown in in Appendix C, Table C-2. Noise levels under existing conditions (2020) are presented in Appendix C, Table C-1, for informational purposes.

6.3. Impact Discussion

Impact NV-1. Exposure of persons to or generation of noise levels in excess of standards established in the Chico 2030 General Plan, noise ordinance, or applicable standards of other agencies?

Operation

Traffic noise modeling results for existing (2020), opening year (2024), and full build-out year (2040) conditions without and with the project are summarized in Table C-1 in Appendix C. Existing conditions without and with the project are included for CEQA purposes and to evaluate the effect of nose level increases due to the project, excluding the effects of future growth in traffic. However, opening year and future build-out year comparisons without and with the project are used to determine the increase in noise levels due to project operation. The comparison of with-project to without-project conditions indicates the direct effect of the project. Modeling results are rounded to the nearest decibel.

As shown in Table C-2, traffic noise levels at modeled receiver locations for opening year (2024) no-build conditions are predicted to be in the range of 46 to 69 dBA CNEL, accounting for all types of land use in the study area. Under opening year build conditions, traffic noise levels are predicted to range from 48 to 69 dBA CNEL.

In the design year (2040), traffic noise levels are predicted to be in the range of 49 to 71 dBA CNEL under the no-build condition. Under design year build conditions, traffic noise levels are predicted to range from 51 to 71 dBA CNEL.

The highest receiver noise level in each of the model cases was found to occur at patios of Willow Oak Villas apartment units that face Bruce Road, represented by receiver R-55 in Table C-2. Locations of modeled receivers are shown in Figure 2 (Appendix A).

Predicted traffic noise levels were compared to exterior and interior maximum allowable levels from the General Plan to determine noise compatibility of the project with existing land uses. At single-family residences, exterior noise levels would have a maximum value of 63 dBA CNEL in the opening year (2024) under the build condition. Under the future year (2040) build condition exterior noise levels would be up to 65 dBA CNEL at outdoor areas of 7 single-family residences nearest to the project, located on Bruce Road and East 20th Street (see model results for receivers R-06, R-07, R-16, R-17, R-38, R-58, and R-59 in Table C-2 of Appendix C). These levels account for the acoustical effect of privacy walls along property frontage facing Bruce Road. The modeled level of 65 dBA CNEL is equal to the City maximum allowable noise standard for residential use. As such, traffic noise levels from the project under both opening year and future year conditions would be considered compatible with single-family residences.

At multi-family residences in the Willow Oak Villa complex, noise levels would be up to 71 dBA CNEL at patios of residential units facing Bruce Road. The General Plan indicates that where it is not practical to mitigate exterior noise levels at the patios or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area. The common area at the outdoor pool (receiver R-53) is predicted to have a noise level of 55 CNEL under the future build condition, which would not exceed the noise compatibility standard for exterior noise levels at residential use. The lower noise level at the pool is due to its setback location within the complex, and acoustical shielding from surrounding buildings relative to Bruce Road and East 20th Street.

Building interior noise levels under the future build condition were predicted based on outdoor-to-indoor noise reduction values for typical building components used in Department of Housing and Urban Development (HUD) guidance (2009). Interior noise levels at single-family and multi-family residences are shown in Table C-3 of Appendix C. The analysis assumes a building noise reduction factor of 30 dB, which is associated with standard framing double-hung windows, with up to 30% coverage of windows on the building structure. Based on this assumption, interior noise levels at all receiver locations are predicted have values of less than 45 dBA CNEL under both opening year and design year conditions.

Based on the above analysis, operation of the project will not expose persons to or generate noise levels in excess of standards established in the General Plan or respective noise ordinance. Therefore, this impact is considered to be **less than significant** and no mitigation is required.

Construction

Construction equipment used during roadway reconstruction and widening would produce maximum noise levels of up to 95 dBA at a distance of 25 feet. As such, noise from individual pieces of construction equipment may potentially exceed the city limit of 83 dBA at a distance of 25 feet. Noise levels during construction are also expected to intermittently exceed the city limit of 86 dBA along the property plane of residences directly adjacent to Bruce Road. However, construction noise at a given location would be short term, as construction equipment used to build the project would progress over time along the 2-mile extent of the project corridor. Construction would be a temporary effect, ceasing once work is complete.

During construction, contractors would be required to comply with city noise regulations (Chapter 9.38 of the Chico Municipal Code) that limit hours of construction and minimize construction noise levels in the surrounding community. Construction would be performed between the hours of 7 a.m. to 5 p.m., Monday through Friday.

Noise levels during construction are expected to exceed city standards on an intermittent basis. Therefore, impacts from construction are considered **significant**. Implementation of Mitigation Measure NV-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure

> **Mitigation Measure NV-MM-1. Employ Best Noise Control Practices during Construction**
>
> The City shall require all construction contractors to employ best noise control practices to minimize construction noise levels at nearby residences. The noise control shall include, at a minimum, the following best practices.
>
> - Stationary equipment (e.g., generators, compressors, cement mixers, idling trucks) shall be located as far as possible from noise-sensitive land uses.
> - Construction equipment powered by gasoline or diesel engines shall be required to have sound control devices that are at least as effective as those originally provided by the manufacturer; all equipment shall be operated and maintained to minimize noise generation.
> - Excessive noise shall be prevented by shutting down idle vehicles or equipment.
> - Noise-reducing enclosures shall be used around noise-generating equipment.
> - Adjacent residents shall be notified in advance of construction work.

Impact NV-2. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

Reconstruction of the bridge would require the installation of piles at the bridge abutments. The piles are expected to be installed using CIDH method, which would use a drill rig, and would not require the use of impact or vibratory driving methods. A drill rig would produce a vibration level of less than 0.1 in/sec

PPV at a distance of 25 feet. The residence nearest to the bridge is about 150 feet away. As such, the installation of piles is not expected to be a significant source of vibration.

Operation of construction equipment may potentially result in perceptible levels of ground-borne vibration in the immediate vicinity of residences and other sensitive land uses during construction of the road. In general vibration at noticeable levels is highly localized around the source of vibration. Vibration-generating equipment that would be operated along the project alignment includes compactors, rollers, bulldozers, and heavy trucks. These types of equipment typically produce peak particle velocity vibration levels of less than 0.10 inches per second at a distance of 25 feet, which may intermittently be noticeable inside of buildings, but may only occur briefly during a period of time when equipment is operated near structures.

Use of heavy equipment during construction of the project would be temporary and would cease once construction is complete. The types of equipment scheduled for use in the work areas along Bruce Road would produce a level of vibration that is not expected to result in exceedance of the Caltrans guidelines for damage and annoyance.. Rubber-tired vehicles are not a significant source of groundborne vibration and operation of the project is not expected to generate noticeable levels of vibration. Therefore, this impact would be **less than significant**. No mitigation is required.

Impact NV-3. Exposure of sensitive receptors (residential, parks, hospitals, schools) to exterior noise levels (CNEL) of 65 dBA or higher?

This impact is discussed above under Impact NV-1. Operation of the project is not expected to exceed maximum allowable exterior noise levels under opening year (2024) or future year (2040) conditions. This impact is considered **less than significant**. No mitigation is required.

Impact NV-4. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

See the discussion above under Impact NV-1. As shown in Table C-1 of Appendix C, predicted traffic noise levels under the design-year build condition would result in an increase of up to 3 dB compared to design-year no-build conditions. As described in Section 2.6, a 5 dB increase in noise levels would be perceived by the human ear to be a noticeable increase. Because the future predicted increase with the project would be below this threshold, this impact is considered **less than significant**. No mitigation is required.

Impact NV-5. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Project construction will temporarily increase ambient noise levels at residences near construction sites from the use of heavy equipment, which would include bulldozers, loaders, excavators, heavy trucks, and paving equipment. However, construction noise at a given location would be short term, as the building of the project would progress over time along the 2-mile length of the project corridor. Furthermore, project contractors would be required to comply with existing City noise regulations (Chapter 9.38 of the Chico Municipal Code) which limit the hours of construction to minimize construction related noise impacts.

Construction would be performed between the hours of 7 a.m. to 5 p.m., Monday through Friday. Heavy equipment noise associated with the project would cease once construction is complete.

Noise levels during construction are expected to be noticeable above existing ambient levels on an intermittent basis. Therefore, impacts due to a temporary increase in noise levels from construction are considered **significant**. Implementation of mitigation measure NV-MM-1 would reduce this impact to a less than significant level.

Impact NV-6. For a project located within the airport land use plan, would the project expose people residing or working in the Study Area to excessive noise levels?

The site is not located within the Airport Influence Area of the Chico Municipal Airport. The Chico Municipal Airport is approximately 3 miles north of the project site. The project site is not located in an airport land use plan area and would not change noise related to airport uses. Therefore, there would be **no impact**. No mitigation is required.

Impact NV-7. For a project within the vicinity of a private airstrip, would the project expose people residing or working in the Study Area to excessive noise levels?

The private Butte Creek Hog Ranch airstrip is located outside the city limits approximately 1.75 miles south of the project site. The airstrip is not listed in Butte County Airport Compatibility Land Use Planning documents. Based on a visual survey it is assumed that the airstrip is only used occasionally for private use. The project would not change noise related to airport uses. There would be **no impact**. No mitigation is required.

Chapter 7. References

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Appendix A Figures

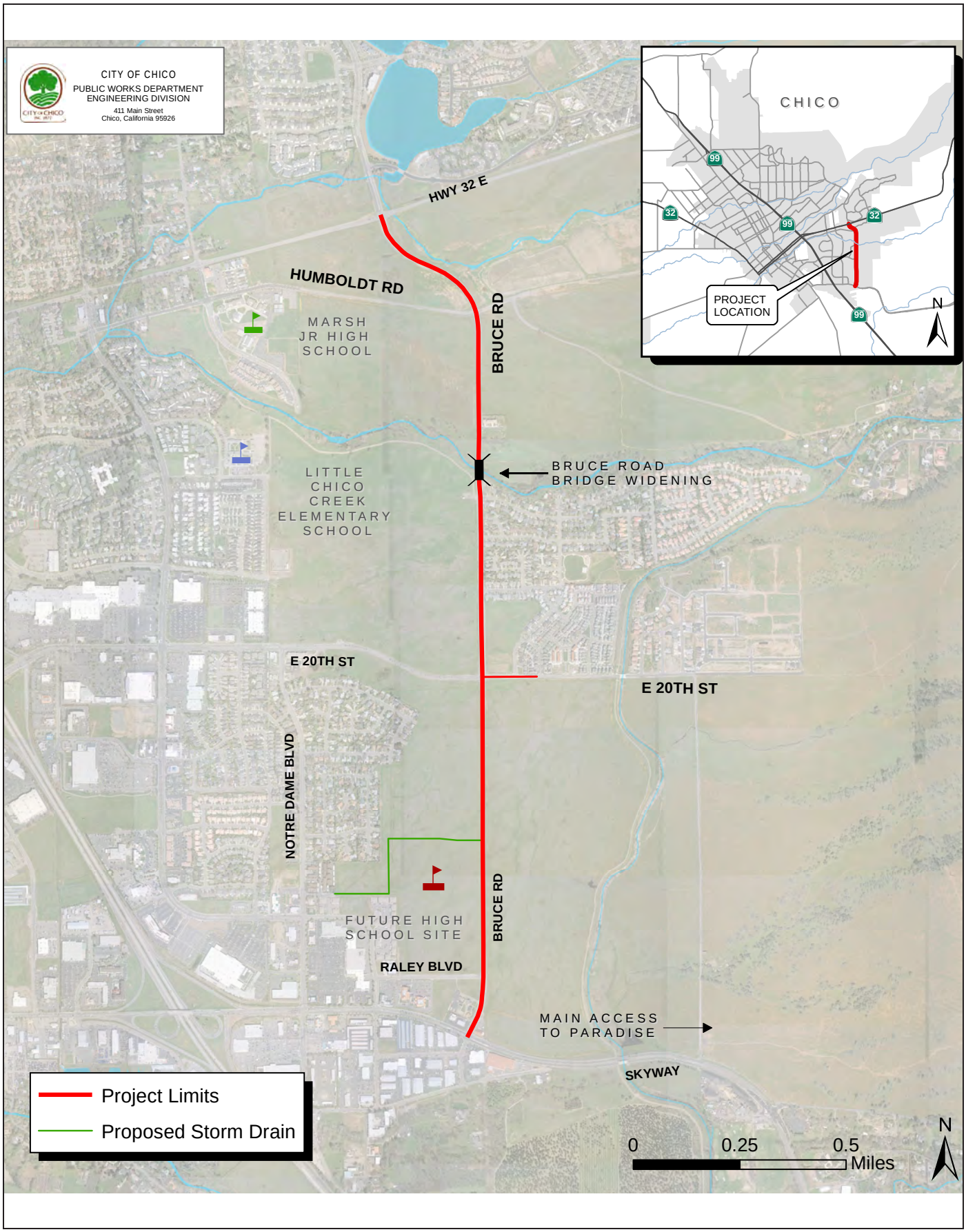

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Figure 1
Project Limits

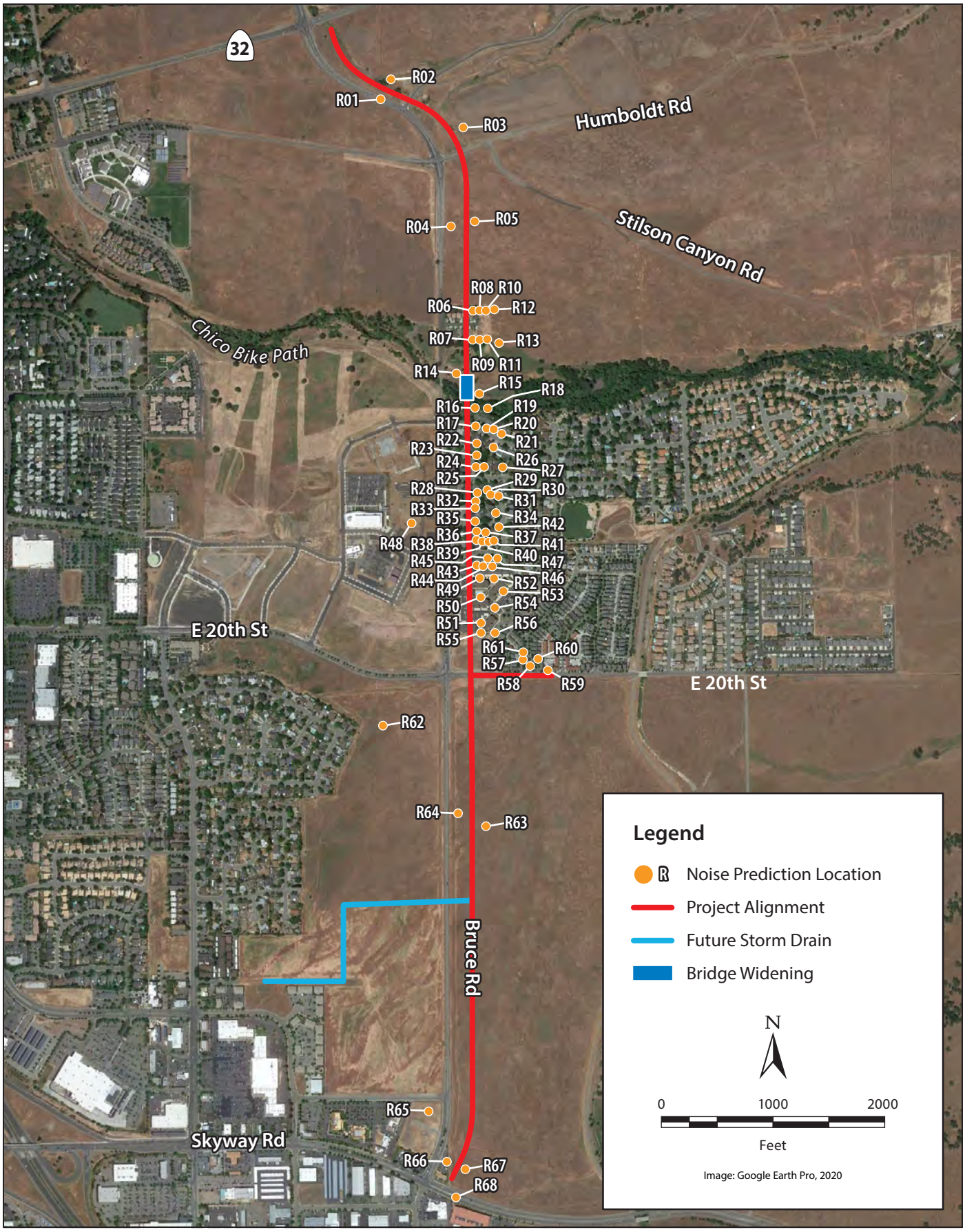

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Figure 2
Noise Prediction Locations

Appendix B Traffic Data

Existing

Roadway	Location	Daily Volume			Speed Limit	% Heavy Vehicles		
		Total	NB	SB		Total	NB	SB
Bruce Road	SR 32 to Humboldt Rd	12498	6348	6150	45	0.5%	0.4%	0.4%
Bruce Road	Humboldt Rd to Picholine Way	12986	6162	6824	45	1.4%	2.4%	0.4%
Bruce Road	Picholine Way to E. 20th St	12686	6555	6131	45	0.9%	0.8%	1.0%
Bruce Road	E. 20th St to Skyway	8648	3786	4862	45	2.0%	1.6%	2.4%

Opening Day

Roadway	Location	Daily Volume		
		Total	NB	SB
Bruce Road	SR 32 to Humboldt Rd	15350	7800	7550
Bruce Road	Humboldt Rd to Picholine Way	15820	7510	8310
Bruce Road	Picholine Way to E. 20th St	16350	8450	7900
Bruce Road	E. 20th St to Skyway	12430	5440	6990

2040

Roadway	Location	Daily Volume		
		Total	NB	SB
Bruce Road	SR 32 to Humboldt Rd	26780	13600	13180
Bruce Road	Humboldt Rd to Picholine Way	27210	12910	14300
Bruce Road	Picholine Way to E. 20th St	31040	16040	15000
Bruce Road	E. 20th St to Skyway	27590	12080	15510

Existing - No Build

Maximum Capacity on Bruce Road 20570

Roadway	Location	Daily Volume			Bruce Rd	
		Total	Bruce Rd	Alt. Route	Trip Length	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	12498	12498	0	0.3	3749
Bruce Road	Humboldt Rd to Picholine Way	12986	12986	0	0.4	5194
Bruce Road	Picholine Way to E. 20th St	12686	12686	0	0.4	5074
Bruce Road	E. 20th St to Skyway	8648	8648	0	0.9	7783
Bruce Road	***SR 32 to Skyway***				***2.0***	***21801***

Existing - Build

Maximum Capacity on Bruce Road 31790

Roadway	Location	Daily Volume			Bruce Rd	
		Total	Bruce Rd	Alt. Route	Trip Length	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	12498	12498	0	0.3	3749
Bruce Road	Humboldt Rd to Picholine Way	12986	12986	0	0.4	5194
Bruce Road	Picholine Way to E. 20th St	12686	12686	0	0.4	5074
Bruce Road	E. 20th St to Skyway	8648	8648	0	0.9	7783
Bruce Road	***SR 32 to Skyway***				***2.0***	***21801***

Project Induced VMT

Roadway	Location	Existing Lane Miles	Proposed Lane Miles	%Δ in Lane Miles	Elasticity	Project Induced VMT
Bruce Road	SR 32 to Skyway	7,276	3.22	0.044%	0.4	***862***

Total Existing - Build Daily VMT	***22663***

Opening Day - No Build

Maximum Capacity on Bruce Road 20570

Roadway	Location	Daily Volume			Bruce Rd	
		Total	Bruce Rd	Alt. Route	Trip Length	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	15350	15350	0	0.3	4605
Bruce Road	Humboldt Rd to Picholine Way	15820	15820	0	0.4	6328
Bruce Road	Picholine Way to E. 20th St	16350	16350	0	0.4	6540
Bruce Road	E. 20th St to Skyway	12430	12430	0	0.9	11187
Bruce Road	***SR 32 to Skyway***				***2.0***	***28660***

Opening Day - Build

Maximum Capacity on Bruce Road 31790

Roadway	Location	Daily Volume			Bruce Rd	
		Total	Bruce Rd	Alt. Route	Trip Length	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	15350	15350	0	0.3	4605
Bruce Road	Humboldt Rd to Picholine Way	15820	15820	0	0.4	6328
Bruce Road	Picholine Way to E. 20th St	16350	16350	0	0.4	6540
Bruce Road	E. 20th St to Skyway	12430	12430	0	0.9	11187
Bruce Road	***SR 32 to Skyway***				***2.0***	***28660***

Project Induced VMT

Roadway	Location	Existing Lane Miles	Proposed Lane Miles	%Δ in Lane Miles	Elasticity	Project Induced VMT
Bruce Road	SR 32 to Skyway	7,276	3.22	0.044%	0.4	***862***

Total Opening Day - Build Daily VMT	***29522***

2040 - No Build

Maximum Capacity on Bruce Road 20570

Remaining Capacity on Forest Avenue 6380

Roadway	Location	Daily Volume				Bruce Rd		Forest St		Notre Dame Blvd		Total
		Total	Bruce Rd	Diverted to Forest St	Diverted to Notre Dame Blvd	Trip Length	Daily VMT	Trip Length	Daily VMT	Trip Length	Daily VMT	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	26780	20570	6210	0	0.3	6171					
Bruce Road	Humboldt Rd to Picholine Way	27210	20570	6380	260	0.4	8228					
Bruce Road	Picholine Way to E. 20th St	31040	20570	6380	4090	0.4	8228					
Bruce Road	E. 20th St to Skyway	27590	20570	6380	640	0.9	18513					
Bruce Road	***SR 32 to Skyway***				0	***2.0***	***41140***	***3.1***	***19778***	***2.7***	***11043***	***71961***

2040 - Build

Maximum Capacity on Bruce Road 31790

Roadway	Location	Daily Volume			Bruce Rd	
		Total	Bruce Rd	Alt. Route	Trip Length	Daily VMT
Bruce Road	SR 32 to Humboldt Rd	26780	26780	0	0.3	8034
Bruce Road	Humboldt Rd to Picholine Way	27210	27210	0	0.4	10884
Bruce Road	Picholine Way to E. 20th St	31040	31040	0	0.4	12416
Bruce Road	E. 20th St to Skyway	27590	27590	0	0.9	24831
Bruce Road	***SR 32 to Skyway***				***2.0***	***56165***

Project Induced VMT

Roadway	Location	Existing Lane Miles	Proposed Lane Miles	%Δ in Lane Miles	Elasticity	Project Induced VMT
Bruce Road	SR 32 to Skyway	7,276	3.22	0.044%	0.4	***862***

Total 2040 - Build Daily VMT	***57027***

Table 4: Existing Intersection Level of Service

Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Road/SR 32	Signal								
Overall		35.8	D	27.5	C	20.6	C	18.7	B
Bruce Rd/Humboldt Rd	Signal								
Overall		11.5	B	10.6	B	10.2	B	7.8	A
Bruce Rd/Picholine Way	Signal								
Overall		6.5	A	8.1	A	6.2	A	7.3	A
Bruce Rd/E. 20th St	Signal								
Overall		18.1	B	21.3	C	15.0	B	16.0	B
Bruce Rd/Skyway	Signal								
Overall		20.8	C	23.8	C	20.8	C	23.0	C

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020

Table 5: Opening Day Intersection Level of Service

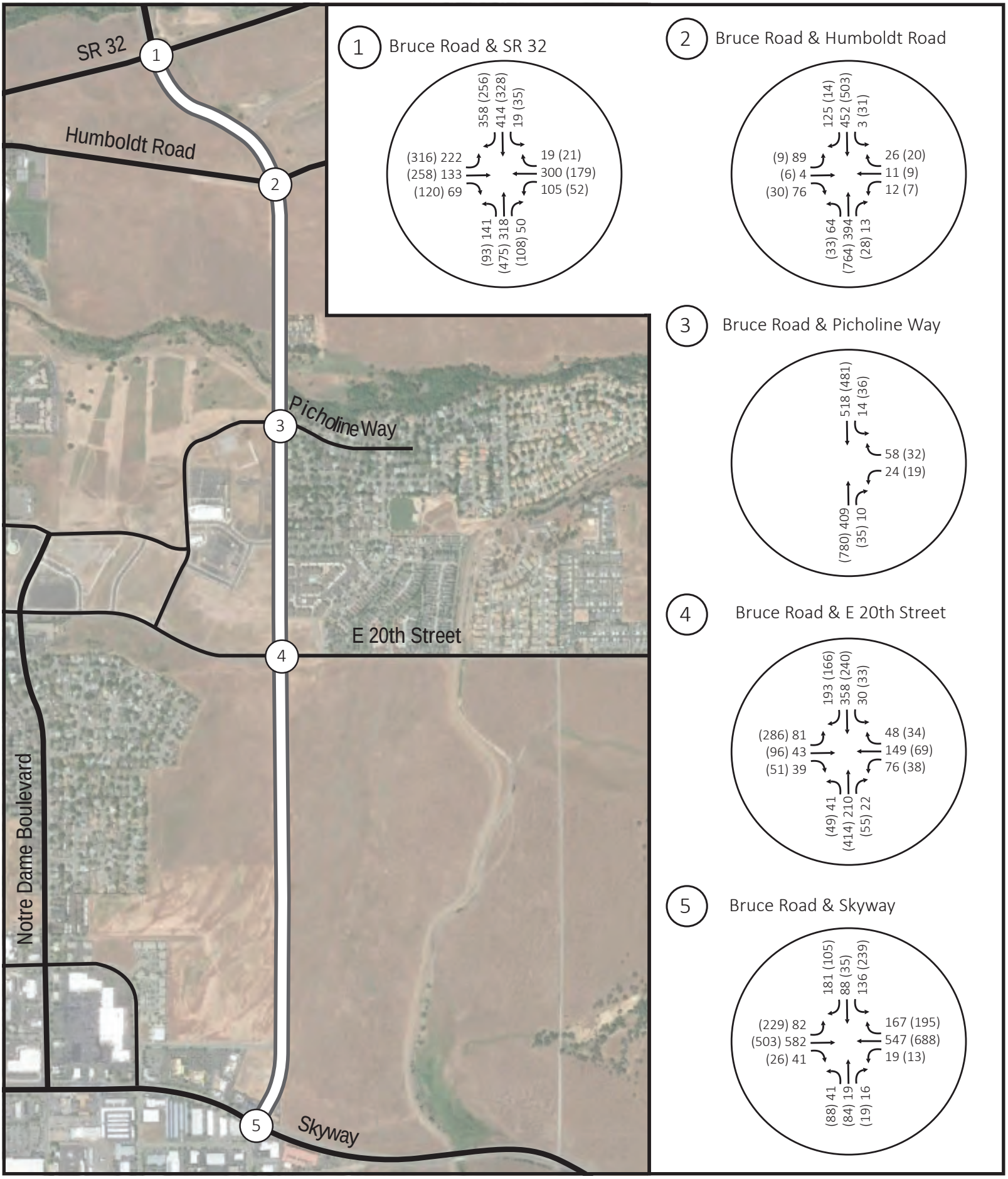
Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Rd/SR 32	Signal								
Overall		59.2	E	35.3	D	21.7	C	19.5	B
Bruce Rd/Humboldt Rd	Signal								
Overall		15.6	B	14.8	B	12.1	B	10.9	B
Bruce Rd/Picholine Way	Signal								
Overall		10.4	B	14.1	B	9.8	A	10.0	B
Bruce Rd/E. 20th St	Signal								
Overall		30.0	C	34.4	C	17.5	B	18.3	B
Bruce Rd/Skyway	Signal								
Overall		25.5	C	28.2	C	24.5	C	26.6	C

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020

Table 6: 2040 Intersection Level of Service

Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Rd/SR 32	Signal								
Overall		**234.6**	**F**	**209.9**	**F**	32.5	C	32.3	C
Bruce Rd/Humboldt Rd	Signal								
Overall		**119.7**	**F**	**140.9**	**F**	56.8	E	53.2	D
Bruce Rd/Picholine Way	Signal								
Overall		**107.2**	**F**	**133.8**	**F**	19.5	B	21.4	C
Bruce Rd/E. 20th St	Signal								
Overall		**268.0**	**F**	**272.8**	**F**	41.6	D	55.8	E
Bruce Rd/Skyway	Signal								
Overall		**83.0**	**F**	**145.5**	**F**	41.8	D	64.8	E

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020



HEADWAY TRANSPORTATION

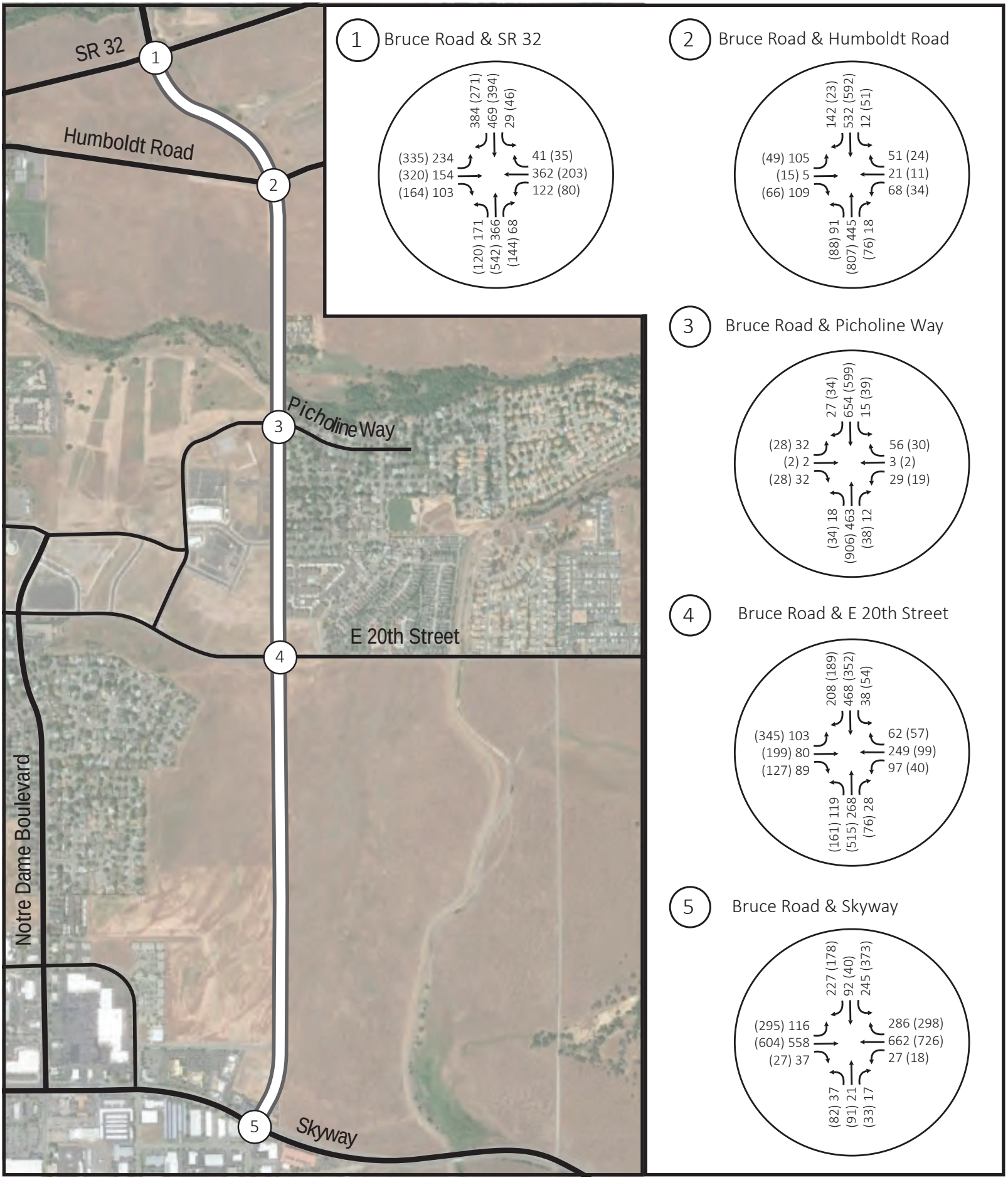
NO SCALE

- Study Roadway

X - Study Intersection

Figure 4

Bruce Road CEQA
Traffic/Transportation Technical Study
Existing Traffic Volumes



HEADWAY TRANSPORTATION

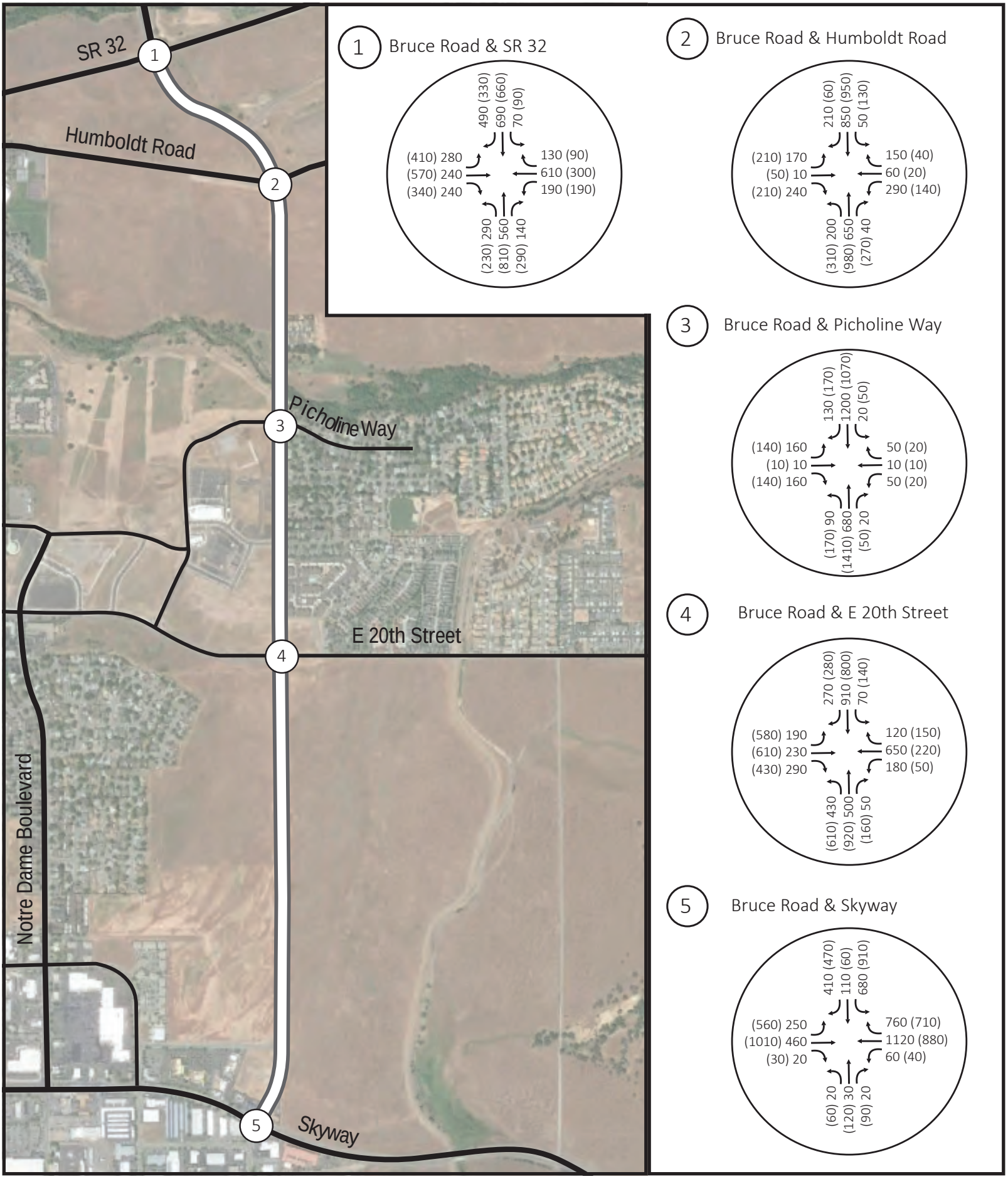
NO SCALE

- Study Roadway

X - Study Intersection

Figure 5

Bruce Road CEQA
Traffic/Transportation Technical Study
Opening Day Traffic Volumes



HEADWAY TRANSPORTATION

NO SCALE

- Study Roadway

X - Study Intersection

Figure 6

Bruce Road CEQA
Traffic/Transportation Technical Study
2040 Traffic Volumes

Appendix C Predicted Traffic Noise Levels and Impact Assessment

Table C-1. Predicted Exterior Noise Levels, Existing Year (2020)

Receiver I.D.	Land Use	Address	Existing Noise Level, CNEL	Existing-year with-project Noise Level, CNEL	Existing-year with-project minus Existing no-project, dB
R-01	Undeveloped land	between SR 32 and Humboldt Road	64	65	+ 1
R-02	Undeveloped land	between SR 32 and Humboldt Road	64	64	0
R-03	Undeveloped land	between SR 32 and Humboldt Road	62	63	+ 1
R-04	Undeveloped land	between Humboldt Road and Picholine Way	62	64	+ 2
R-05	Undeveloped land	between Humboldt Road and Picholine Way	63	65	+ 2
R-06	Single family residence	Banner Peak Drive	61	61	0
R-07	Single family residence	Banner Peak Drive	61	62	+ 1
R-08	Single family residence	Banner Peak Drive	59	61	+ 2
R-09	Single family residence	Banner Peak Drive	59	61	+ 2
R-10	Single family residence	Banner Peak Drive	57	59	+ 2
R-11	Single family residence	Banner Peak Drive	56	58	+ 2
R-12	Single family residence	Banner Peak Drive	53	55	+ 2
R-13	Single family residence	Banner Peak Drive	52	54	+ 2
R-14	Undeveloped land	Little Chico Creek	63	64	+ 1
R-15	Undeveloped land	Little Chico Creek	61	62	+ 1
R-16	Single family residence	Picholine Way	61	61	0
R-17	Single family residence	Picholine Way	61	62	+ 1
R-18	Single family residence	Picholine Way	54	56	+ 2
R-19	Single family residence	Picholine Way	56	57	+ 1
R-20	Single family residence	Picholine Way	54	55	+ 1
R-21	Single family residence	Picholine Way	50	51	+ 1
R-22	Single family residence	Nevadillo Court	58	58	0
R-23	Single family residence	Nevadillo Court	60	60	0
R-24	Single family residence	Via Mission Drive	60	60	0
R-25	Single family residence	Via Mission Drive	53	53	0
R-26	Single family residence	Nevadillo Court	52	52	0
R-27	Single family residence	Via Mission Drive	51	51	0
R-28	Single family residence	Via Mission Drive	59	59	0
R-29	Single family residence	Via Mission Drive	53	54	+ 1
R-30	Single family residence	Patches Drive	52	53	+ 1
R-31	Single family residence	Patches Drive	50	51	+ 1
R-32	Single family residence	Patches Drive	58	58	0
R-33	Single family residence	Patches Drive	60	60	0
R-34	Single family residence	Patches Drive	51	51	0
R-35	Single family residence	Patches Drive	60	61	+ 1
R-36	Single family residence	Patches Drive	60	60	0
R-37	Single family residence	Patches Drive	52	53	+ 1
R-38	Single family residence	Remington Drive	61	61	0
R-39	Single family residence	Remington Drive	55	55	0
R-40	Single family residence	Remington Drive	54	55	+ 1
R-41	Single family residence	Remington Drive	53	54	+ 1

Receiver I.D.	Land Use	Address	Existing Noise Level, CNEL	Existing-year with-project Noise Level, CNEL	Existing-year with-project minus Existing no-project, dB
R-42	Single family residence	Patches Drive	50	51	+ 1
R-43	Single family residence	Remington Drive	60	61	+ 1
R-44	Single family residence	Remington Drive	58	59	+ 1
R-45	Single family residence	Remington Drive	56	57	+ 1
R-46	Single family residence	Remington Drive	53	54	+ 1
R-47	Single family residence	Remington Drive	52	53	+ 1
R-48	Office	Concord Avenue	50	53	+ 3
R-49	Multi-family residence	Willow Oak Villas	67	68	+ 1
R-50	Multi-family residence	Willow Oak Villas	67	68	+ 1
R-51	Multi-family residence	Willow Oak Villas	63	64	+ 1
R-52	Multi-family residence	Willow Oak Villas	53	55	+ 2
R-53	Multi-family residence	Willow Oak Villas Pool	50	51	+ 1
R-54	Multi-family residence	Willow Oak Villas	53	55	+ 2
R-55	Multi-family residence	Willow Oak Villas	68	68	0
R-56	Multi-family residence	Willow Oak Villas	55	57	+ 2
R-57	Single family residence	Belgium Avenue	55	55	0
R-58	Single family residence	Belgium Avenue	60	60	0
R-59	Single family residence	England Street	60	60	0
R-60	Single family residence	England Street	53	54	+ 1
R-61	Single family residence	Belgium Avenue	52	53	+ 1
R-62	Single family residence	Parkhurst Street	45	47	+ 2
R-63	Undeveloped land	Between 20th Street and Skyway Road	62	65	+ 3
R-64	Undeveloped land	Between 20th Street and Skyway Road	61	64	+ 3
R-65	Commercial	Bruce Road/Skyway Road	53	56	+ 3
R-66	Commercial	Bruce Road/Skyway Road	66	66	0
R-67	Commercial	Bruce Road/Skyway Road	65	66	+ 1
R-68	Commercial	Bruce Road/Skyway Road	59	60	+ 1

Table C-2. Impact Assessment and Predicted Exterior Noise Levels, Opening Year (2024) and Future Year (2040)

Receiver I.D.	Land Use	Address	Opening year no-project noise level, CNEL	Opening-year with-project noise level, CNEL	Opening-year with-project minus Opening-year no-project, dB	Design Year no-project noise level, CNEL	Design-year with-project noise level, Exterior CNEL	Design Year with-project minus Design Year no-project, dB	Design Year with-project minus Opening year no-project, dB	Exterior Threshold, CNEL	Impact Type
R-01	Undeveloped land	between SR 32 and Humboldt Road	65	66	+ 1	67	68	N/A	N/A	N/A	N/A
R-02	Undeveloped land	between SR 32 and Humboldt Road	65	65	0	67	67	N/A	N/A	N/A	N/A
R-03	Undeveloped land	between SR 32 and Humboldt Road	63	64	+ 1	65	66	N/A	N/A	N/A	N/A
R-04	Undeveloped land	between Humboldt Road and Picholine Way	64	66	+ 2	66	68	N/A	N/A	N/A	N/A
R-05	Undeveloped land	between Humboldt Road and Picholine Way	64	66	+ 2	66	68	N/A	N/A	N/A	N/A
R-06	Single family residence	Banner Peak Drive	62	63	+ 1	64	65	+ 1	+ 3	65	None
R-07	Single family residence	Banner Peak Drive	63	63	0	65	65	0	+ 2	65	None
R-08	Single family residence	Banner Peak Drive	61	62	+ 1	63	64	+ 1	+ 3	65	None
R-09	Single family residence	Banner Peak Drive	60	62	+ 2	62	64	+ 2	+ 4	65	None
R-10	Single family residence	Banner Peak Drive	58	60	+ 2	60	63	+ 3	+ 5	65	None
R-11	Single family residence	Banner Peak Drive	57	59	+ 2	59	61	+ 2	+ 4	65	None
R-12	Single family residence	Banner Peak Drive	54	57	+ 3	57	59	+ 2	+ 5	65	None
R-13	Single family residence	Banner Peak Drive	54	55	+ 1	56	58	+ 2	+ 4	65	None
R-14	Undeveloped land	Little Chico Creek	65	66	+ 1	67	68	N/A	N/A	N/A	N/A
R-15	Undeveloped land	Little Chico Creek	62	63	+ 1	65	66	N/A	N/A	N/A	N/A
R-16	Single family residence	Picholine Way	63	63	0	65	65	0	+ 2	65	None
R-17	Single family residence	Picholine Way	63	63	0	65	65	0	+ 2	65	None
R-18	Single family residence	Picholine Way	55	57	+ 2	58	59	+ 1	+ 4	65	None
R-19	Single family residence	Picholine Way	57	59	+ 2	60	61	+ 1	+ 4	65	None
R-20	Single family residence	Picholine Way	55	56	+ 1	58	58	0	+ 3	65	None
R-21	Single family residence	Picholine Way	52	53	+ 1	54	55	+ 1	+ 3	65	None
R-22	Single family residence	Nevadillo Court	59	60	+ 1	61	62	+ 1	+ 3	65	None
R-23	Single family residence	Nevadillo Court	61	61	0	63	63	0	+ 2	65	None
R-24	Single family residence	Via Mission Drive	61	61	0	63	64	+ 1	+ 3	65	None
R-25	Single family residence	Via Mission Drive	54	54	0	56	56	0	+ 2	65	None
R-26	Single family residence	Nevadillo Court	53	54	+ 1	56	56	0	+ 3	65	None
R-27	Single family residence	Via Mission Drive	52	52	0	54	54	0	+ 2	65	None
R-28	Single family residence	Via Mission Drive	60	61	+ 1	62	63	+ 1	+ 3	65	None
R-29	Single family residence	Via Mission Drive	55	56	+ 1	57	58	+ 1	+ 3	65	None
R-30	Single family residence	Patches Drive	54	54	0	56	56	0	+ 2	65	None
R-31	Single family residence	Patches Drive	52	52	0	54	54	0	+ 2	65	None
R-32	Single family residence	Patches Drive	60	60	0	62	62	0	+ 2	65	None
R-33	Single family residence	Patches Drive	61	62	+ 1	63	64	+ 1	+ 3	65	None
R-34	Single family residence	Patches Drive	52	52	0	54	55	+ 1	+ 3	65	None
R-35	Single family residence	Patches Drive	62	62	0	64	64	0	+ 2	65	None
R-36	Single family residence	Patches Drive	61	61	0	63	63	0	+ 2	65	None
R-37	Single family residence	Patches Drive	54	54	0	56	56	0	+ 2	65	None
R-38	Single family residence	Remington Drive	62	62	0	64	65	+ 1	+ 3	65	None
R-39	Single family residence	Remington Drive	56	56	0	58	58	0	+ 2	65	None
R-40	Single family residence	Remington Drive	55	56	+ 1	57	59	+ 2	+ 4	65	None
R-41	Single family residence	Remington Drive	54	55	+ 1	56	57	+ 1	+ 3	65	None
R-42	Single family residence	Patches Drive	52	52	0	54	54	0	+ 2	65	None
R-43	Single family residence	Remington Drive	62	62	0	64	64	0	+ 2	65	None
R-44	Single family residence	Remington Drive	59	60	+ 1	61	62	+ 1	+ 3	65	None
R-45	Single family residence	Remington Drive	57	59	+ 2	59	61	+ 2	+ 4	65	None
R-46	Single family residence	Remington Drive	54	55	+ 1	56	58	+ 2	+ 4	65	None
R-47	Single family residence	Remington Drive	54	55	+ 1	56	57	+ 1	+ 3	65	None
R-48	Office	Concord Avenue	51	54	+ 3	53	56	+ 3	+ 5	N/A	None
R-49	Multi-family residence	Willow Oak Villas	68	69	+ 1	71	71	0	+ 3	65 (1)	None
R-50	Multi-family residence	Willow Oak Villas	68	69	+ 1	71	71	0	+ 3	65 (1)	None
R-51	Multi-family residence	Willow Oak Villas	65	65	0	67	68	+ 1	+ 3	65 (1)	None
R-52	Multi-family residence	Willow Oak Villas	54	56	+ 2	57	58	+ 1	+ 4	65 (1)	None
R-53	Multi-family residence	Willow Oak Villas Pool	51	53	+ 2	54	55	+ 1	+ 4	65	None
R-54	Multi-family residence	Willow Oak Villas	54	57	+ 3	57	59	+ 2	+ 5	65 (1)	None
R-55	Multi-family residence	Willow Oak Villas	69	69	0	71	71	0	+ 2	65 (1)	None
R-56	Multi-family residence	Willow Oak Villas	56	58	+ 2	59	61	+ 2	+ 5	65 (1)	None
R-57	Single family residence	Belgium Avenue	56	57	+ 1	60	60	0	+ 4	65	None

Receiver I.D.	Land Use	Address	Opening year no-project noise level, CNEL	Opening-year with-project noise level, CNEL	Opening-year with-project minus Opening-year no-project, dB	Design Year no-project noise level, CNEL	Design-year with-project noise level, Exterior CNEL	Design Year with-project minus Design Year no-project, dB	Design Year with-project minus Opening year no-project, dB	Exterior Threshold, CNEL	Impact Type
R-58	Single family residence	Belgium Avenue	61	61	0	65	65	0	+ 4	65	None
R-59	Single family residence	England Street	62	62	0	65	65	0	+ 3	65	None
R-60	Single family residence	England Street	55	56	+ 1	59	59	0	+ 4	65	None
R-61	Single family residence	Belgium Avenue	54	55	+ 1	57	58	+ 1	+ 4	65	None
R-62	Single family residence	Parkhurst Street	46	48	+ 2	49	51	+ 2	+ 5	65	None
R-63	Undeveloped land	Between 20th Street and Skyway Road	64	66	+ 2	66	68	N/A	N/A	N/A	N/A
R-64	Undeveloped land	Between 20th Street and Skyway Road	62	65	+ 3	65	67	N/A	N/A	N/A	N/A
R-65	Commercial	Bruce Road/Skyway Road	54	57	+ 3	57	59	N/A	N/A	N/A	N/A
R-66	Commercial	Bruce Road/Skyway Road	67	67	0	69	70	N/A	N/A	N/A	N/A
R-67	Commercial	Bruce Road/Skyway Road	66	67	+ 1	68	69	N/A	N/A	N/A	N/A
R-68	Commercial	Bruce Road/Skyway Road	60	61	+ 1	62	63	N/A	N/A	N/A	N/A

Note:

(1) As indicated in the General Plan Noise Element, when it is not practical to mitigate exterior noise levels at the patios or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area. For noise-sensitive land uses that do not include outdoor activity areas, only the interior noise standard shall apply.

Table C-3. Interior Noise Levels, Opening Year (2024) and Future Year (2040)

Receiver I.D.	Land Use	Address	Opening-year with-project noise level, Exterior CNEL	Design-year with-project noise level, Exterior CNEL	Opening year with-project noise level, Interior CNEL	Design-year with-project noise level, Interior CNEL	Interior Threshold, CNEL	Required Outdoor-to-Indoor Noise Reduction, dB (1) (2)	Estimated Outdoor-to-Indoor Noise Reduction, dB	Potential Exceedence of Maximum Allowable Interior Level? (3)
R-01	Undeveloped land	between SR 32 and Humboldt Road	66	68	N/A	N/A	N/A	N/A	N/A	N/A
R-02	Undeveloped land	between SR 32 and Humboldt Road	65	67	N/A	N/A	N/A	N/A	N/A	N/A
R-03	Undeveloped land	between SR 32 and Humboldt Road	64	66	N/A	N/A	N/A	N/A	N/A	N/A
R-04	Undeveloped land	between Humboldt Road and Picholine Way	66	68	N/A	N/A	N/A	N/A	N/A	N/A
R-05	Undeveloped land	between Humboldt Road and Picholine Way	66	68	N/A	N/A	N/A	N/A	N/A	N/A
R-06	Single family residence	Banner Peak Drive	63	65	33	35	45	20	30	No
R-07	Single family residence	Banner Peak Drive	63	65	33	35	45	20	30	No
R-08	Single family residence	Banner Peak Drive	62	64	32	34	45	19	30	No
R-09	Single family residence	Banner Peak Drive	62	64	32	34	45	19	30	No
R-10	Single family residence	Banner Peak Drive	60	63	30	33	45	18	30	No
R-11	Single family residence	Banner Peak Drive	59	61	29	31	45	16	30	No
R-12	Single family residence	Banner Peak Drive	57	59	27	29	45	14	30	No
R-13	Single family residence	Banner Peak Drive	55	58	25	28	45	13	30	No
R-14	Undeveloped land	Little Chico Creek	66	68	N/A	N/A	N/A	N/A	N/A	N/A
R-15	Undeveloped land	Little Chico Creek	63	66	N/A	N/A	N/A	N/A	N/A	N/A
R-16	Single family residence	Picholine Way	63	65	33	35	45	20	30	No
R-17	Single family residence	Picholine Way	63	65	33	35	45	20	30	No
R-18	Single family residence	Picholine Way	57	59	27	29	45	14	30	No
R-19	Single family residence	Picholine Way	59	61	29	31	45	16	30	No
R-20	Single family residence	Picholine Way	56	58	26	28	45	13	30	No
R-21	Single family residence	Picholine Way	53	55	23	25	45	10	30	No
R-22	Single family residence	Nevadillo Court	60	62	30	32	45	17	30	No
R-23	Single family residence	Nevadillo Court	61	63	31	33	45	18	30	No
R-24	Single family residence	Via Mission Drive	61	64	31	34	45	19	30	No
R-25	Single family residence	Via Mission Drive	54	56	24	26	45	11	30	No
R-26	Single family residence	Nevadillo Court	54	56	24	26	45	11	30	No
R-27	Single family residence	Via Mission Drive	52	54	22	24	45	9	30	No
R-28	Single family residence	Via Mission Drive	61	63	31	33	45	18	30	No
R-29	Single family residence	Via Mission Drive	56	58	26	28	45	13	30	No
R-30	Single family residence	Patches Drive	54	56	24	26	45	11	30	No
R-31	Single family residence	Patches Drive	52	54	22	24	45	9	30	No
R-32	Single family residence	Patches Drive	60	62	30	32	45	17	30	No
R-33	Single family residence	Patches Drive	62	64	32	34	45	19	30	No
R-34	Single family residence	Patches Drive	52	55	22	25	45	10	30	No
R-35	Single family residence	Patches Drive	62	64	32	34	45	19	30	No
R-36	Single family residence	Patches Drive	61	63	31	33	45	18	30	No
R-37	Single family residence	Patches Drive	54	56	24	26	45	11	30	No
R-38	Single family residence	Remington Drive	62	65	32	35	45	20	30	No
R-39	Single family residence	Remington Drive	56	58	26	28	45	13	30	No
R-40	Single family residence	Remington Drive	56	59	26	29	45	14	30	No
R-41	Single family residence	Remington Drive	55	57	25	27	45	12	30	No
R-42	Single family residence	Patches Drive	52	54	22	24	45	9	30	No
R-43	Single family residence	Remington Drive	62	64	32	34	45	19	30	No
R-44	Single family residence	Remington Drive	60	62	30	32	45	17	30	No
R-45	Single family residence	Remington Drive	59	61	29	31	45	16	30	No
R-46	Single family residence	Remington Drive	55	58	25	28	45	13	30	No
R-47	Single family residence	Remington Drive	55	57	25	27	45	12	30	No
R-48	Office	Concord Avenue	54	56	24	26	45 (4)	11	30	No
R-49	Multi-family residence	Willow Oak Villas	69	71	39	41	45	26	30	No
R-50	Multi-family residence	Willow Oak Villas	69	71	39	41	45	26	30	No
R-51	Multi-family residence	Willow Oak Villas	65	68	35	38	45	23	30	No
R-52	Multi-family residence	Willow Oak Villas	56	58	26	28	45	13	30	No
R-53	Multi-family residence	Willow Oak Villas Pool	53	55	N/A	N/A	N/A	N/A	N/A	N/A
R-54	Multi-family residence	Willow Oak Villas	57	59	27	29	45	14	30	No
R-55	Multi-family residence	Willow Oak Villas	69	71	39	41	45	26	30	No
R-56	Multi-family residence	Willow Oak Villas	58	61	28	31	45	16	30	No
R-57	Single family residence	Belgium Avenue	57	60	27	30	45	15	30	No
R-58	Single family residence	Belgium Avenue	61	65	31	35	45	20	30	No
R-59	Single family residence	England Street	62	65	32	35	45	20	30	No

Receiver I.D.	Land Use	Address	Opening-year with-project noise level, Exterior CNEL	Design-year with-project noise level, Exterior CNEL	Opening year with-project noise level, Interior CNEL	Design-year with-project noise level, Interior CNEL	Interior Threshold, CNEL	Required Outdoor-to-Indoor Noise Reduction, dB (1) (2)	Estimated Outdoor-to-Indoor Noise Reduction, dB	Potential Exceedence of Maximum Allowable Interior Level? (3)
R-60	Single family residence	England Street	56	59	26	29	45	14	30	No
R-61	Single family residence	Belgium Avenue	55	58	25	28	45	13	30	No
R-62	Single family residence	Parkhurst Street	48	51	18	21	45	6	30	No
R-63	Undeveloped land	Between 20th Street and Skyway Road	66	68	N/A	N/A	N/A	N/A	N/A	N/A
R-64	Undeveloped land	Between 20th Street and Skyway Road	65	67	N/A	N/A	N/A	N/A	N/A	N/A
R-65	Commercial	Bruce Road/Skyway Road	57	59	N/A	N/A	N/A	N/A	N/A	N/A
R-66	Commercial	Bruce Road/Skyway Road	67	70	N/A	N/A	N/A	N/A	N/A	N/A
R-67	Commercial	Bruce Road/Skyway Road	67	69	N/A	N/A	N/A	N/A	N/A	N/A
R-68	Commercial	Bruce Road/Skyway Road	61	63	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

(1) As indicated in the General Plan Noise Element, when it is not practical to mitigate exterior noise levels at the patios or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area. For noise-sensitive land uses that do not include outdoor activity areas, only the interior noise standard shall apply.

(2) Calculated value: Exterior CNEL at location minus Maximum Allowable Interior CNEL

(3) Assumes a building noise reduction factor of 30 dB, based on HUD values for standard framing and double hung windows (HUD 2009)

(4) Based on Leq interior value for office buildings.