4.13 NOISE AND VIBRATION

This chapter describes the potential impacts associated with the adoption and implementation of the proposed project that are related to noise and vibration. A summary of the relevant regulatory framework and existing conditions is followed by a discussion of potential impacts and cumulative impacts related to implementation of the proposed project. Noise monitoring and modeling data are included as Appendix H, Noise Data, of this Draft Environmental Impact Report (EIR).

4.13.1 ENVIRONMENTAL SETTING

4.13.1.1 TERMINOLOGY

The following are definitions for terms used throughout this chapter.

- **Sound.** A disturbance created by a vibrating object, which when transmitted by pressure waves through a medium such as air, is capable of being detected by the human ear.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A measure of sound on a logarithmic scale.
- **AWeighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Equivalent Continuous Noise Level (L_{eq}).** The mean of the noise level, energy averaged over the measurement period.
- **L_{max}.** The maximum noise level during a measurement period.
- **Statistical Sound Level (L_n).** The sound level that is exceeded "n" percent of time during a given sample period. For example, the L_{50} level is the statistical indicator of the time-varying noise signal that is exceeded 50 percent of the time (during each sampling period). This is also called the "median sound level." The L_{10} level, likewise, is the value that is exceeded 10 percent of the time (i.e., near the maximum) and this is often known as the "intrusive sound level." The L_{90} is the sound level exceeded 90 percent of the time and is often considered the "effective background level" or "residual noise level."
- **Day-Night Sound Level (L_{dn} or DNL).** The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the sound levels occurring during the period from 10:00 pm to 7:00 am.
- **Community Noise Equivalent Level (CNEL).** The energy-average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the levels occurring during the period from 7:00 pm to 10:00 pm and 10 dB added to the sound levels occurring during the period from 10:00 pm to 7:00 am. Note: For general community/environmental noise, CNEL and L_{dn} values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered equivalent/interchangeable.

- **Peak Particle Velocity (PPV).** The peak rate of speed at which soil particles move (e.g., inches per second or in/sec) due to ground vibration.
- **Vibration Decibel (VdB).** A unitless measure of vibration, expressed on a logarithmic scale and with respect to a defined reference vibration velocity. In the United States, the standard reference velocity is 1 micro-inch per second ($1x10^{-6}$ in/sec).
- **Sensitive Receptor.** Noise- and vibration-sensitive receptors include land uses where quiet environments are necessary for enjoyment and public health and safety. Residences, schools, motels and hotels, libraries, religious institutions, hospitals, and nursing homes are examples.

4.13.1.2 SOUND FUNDAMENTALS

Sound is a pressure wave transmitted through the air. It is described in terms of loudness or amplitude (measured in decibels), frequency or pitch (measured in Hertz [Hz] or cycles per second), and duration (measured in seconds or minutes). The standard unit of measurement of the loudness of sound is the decibel (dB). Changes of 1 to 3 dBA are detectable under quiet, controlled conditions and changes of less than 1 dBA are usually indiscernible. A 3 dBA change in noise levels is considered the minimum change that is detectable with human hearing in outside environments. A change of 5 dBA is readily discernable to most people in an exterior environment whereas a 10 dBA change is perceived as a doubling (or halving) of the sound.

The human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all and are "felt" more as a vibration. Similarly, while people with extremely sensitive hearing can hear sounds as high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above about 10,000 Hz and below about 200 Hz. Since the human ear is not equally sensitive to sound at all frequencies, a special frequency dependent rating scale is usually used to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by weighting frequencies in a manner approximating the sensitivity of the human ear.

Noise is defined as unwanted sound and is known to have several adverse effects on people, including hearing loss, speech and sleep interference, physiological responses, and annoyance. Based on these known adverse effects, the federal government, the State of California, and many local governments have established criteria to protect public health and safety and to prevent disruption of certain human activities.

Sound Measurement

Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale, representing points on a sharply rising curve. On a logarithmic scale, an increase of 10 dBA is 10 times more intense than 1 dBA, 20 dBA is 100 times more intense, and 30 dBA is 1,000 times more intense. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. Ambient sounds generally range from 30 dBA (very quiet) to 100 dBA (very loud).

Sound levels are generated from a source and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. This phenomenon is known as "spreading loss." For a single point source, sound levels decrease by approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by on-site operations from stationary equipment or activity at a project site. If noise is produced by a line source, such as highway traffic, the sound decreases by 3 dBA for each doubling of distance in a hard site environment. Line source noise in a relatively flat environment with absorptive vegetation decreases by 4.5 dBA for each doubling of distance.

Time variation in noise exposure is typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called L_{eq}), or alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. For example, the L_{50} noise level represents the noise level that is exceeded 50 percent of the time. Half the time the noise level exceeds this level and half the time the noise level is less than this level. This level is also representative of the level that is exceeded 30 minutes in an hour. Similarly, the L_2, L_8 and L_{25} values represent the noise levels that are exceeded 2, 8, and 25 percent of the time, or 1, 5, and 15 minutes per hour. These "Ln" values are typically used to demonstrate compliance for stationary noise sources with a city's noise ordinance, as discussed below. Other values typically noted during a noise survey are the L_{min} and L_{max}. These values represent the minimum and maximum root-mean-square noise levels obtained over the measurement period.

Because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law and the City require that, for planning purposes, an artificial dBA increment be added to quiet time noise levels in a 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL) or Day-Night Noise Level (L_{dn}). The CNEL descriptor requires that an artificial increment of 5 dBA be added to the actual noise level for the hours from 7:00 p.m. to 10:00 p.m. and 10 dBA for the hours from 10:00 p.m. to 7:00 a.m. The L_{dn} descriptor uses the same methodology except that there is no artificial increment added to the hours between 7:00 pm and 10:00 pm. Both descriptors give roughly the same 24-hour level (i.e., typically within 1 dBA of each other), with the CNEL being only slightly more restrictive (i.e., higher); therefore, they are used interchangeably in this assessment.

Psychological and Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions and thereby affecting blood pressure, the heart, and the nervous system. Extended periods of noise exposure above 90 dBA can result in permanent hearing damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation becomes painful. This is called the threshold of pain. Table 4.13-1 shows typical noise levels from familiar noise sources.

TABLE 4.13-1 TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Onset of physical discomfort	120+	
	110	Rock Band (near amplification system)
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at three 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		
	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 Hall (background)
	20	
		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

Source: California Department of Transportation (Caltrans), 2013. *Technical Noise Supplement ("TeNS")*.

4.13.1.3 VIBRATION FUNDAMENTALS

Vibration is an oscillating motion. Like noise, vibration is transmitted in waves, but through earth or solid objects. Unlike noise, vibration is typically felt rather than heard.

Vibration can be either natural—e.g., from earthquakes, volcanic eruptions, landslides—or human-made, such as from explosions, heavy machinery, or trains. Both natural and human-made vibration may be continuous, such as from operating machinery, or impulsive, as from an explosion.

As with noise, vibration can be described by both its amplitude and frequency. Amplitude can be characterized in three ways—displacement, velocity, and acceleration. Particle displacement is a measure of the distance that a vibrated particle travels from its original position. Particle velocity is the rate of speed at which the particles move in inches per second (in/sec) or millimeters per second. Table 4.13-2 presents the human reaction to various levels of PPV.

TABLE 4.13-2 HUMAN REACTION TO TYPICAL VIBRATION LEVELS

Vibration Level Peak Particle Velocity (in/sec)	Vibration Damage	Vibration Annoyance
0.006–0.019	Vibrations unlikely to cause damage of any type	Threshold of perception, possibility of intrusion
0.08	Recommended upper level of vibration to which ruins and ancient monuments should be subjected	Vibrations readily perceptible
0.10	Virtually no risk of "architectural" (i.e., not structural) damage to normal buildings	Level at which continuous vibration begins to annoy people
0.20	Threshold at which there is a risk to "architectural" damage to normal dwelling, i.e., houses with plastered walls and ceilings	Vibrations annoying to people in buildings
0.4–0.6	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges

Source: California Department of Transportation (Caltrans), 2013. *Transportation and Construction Vibration Guidance Manual*.

In addition to PPVs, vibrations also vary in frequency, and this affects perception. Typical construction vibrations fall in the 10 to 30 Hz range and usually occur around 15 Hz. Traffic vibrations exhibit a similar range of frequencies; however, due to their suspension systems, buses often generate frequencies around 3 Hz at high vehicle speeds. It is less common, but possible, to measure traffic frequencies above 30 Hz.

For vibration annoyance from operational sources, vibration is measured in vibration decibels or VdB. A measurement of 65 VdB would result in an impact to highly sensitive uses with vibration-sensitive equipment (e.g., microscopes in hospitals and research facilities) and a measurement of 72 VdB would result in an impact to residential uses.

4.13.1.4 REGULATORY FRAMEWORK

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, and local governments have established standards and ordinances to control noise.

Federal Regulations

Federal Highway Administration

Proposed federal or federal-aid highway construction projects at a new location, or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes, requires an assessment of noise and consideration of noise abatement pursuant to Code of Federal Regulations Title 23, Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." The Federal Highway Administration (FHWA) has adopted noise abatement criteria (NAC) for sensitive receivers such as picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals—when "worst-hour" noise levels approach or exceed 67 dBA L_{eq}. The California Department of Transportation

(Caltrans) has further defined "approaching" the NAC to be 1 dBA below the NAC for noise sensitive receivers (e.g., 66 dBA L_{eq} is considered approaching the NAC).[1]

United States Environmental Protection Agency

In addition to FHWA standards, the United States Environmental Protection Agency (USEPA) has identified the relationship between noise levels and human response. The USEPA has determined that over a 24-hour period, an L_{eq} of 70 dBA will result in some hearing loss. Interference with activity and annoyance will not occur if exterior levels are maintained at an L_{eq} of 55 dBA and interior levels at or below 45 dBA. While these levels are relevant for planning and design and useful for informational purposes, they are not land use planning criteria because they do not consider economic cost, technical feasibility, or the needs of the community; therefore, they are not mandated.

The USEPA has also set 55 dBA L_{dn} as the basic goal for exterior residential noise intrusion. However, other federal agencies, in consideration of their own program requirements and goals—as well as the difficulty of actually achieving a goal of 55 dBA L_{dn}—have settled on 65 dBA L_{dn} as their standard. At 65 dBA L_{dn}, activity interference is kept to a minimum, and annoyance levels are still low. It is also a level that can realistically be achieved.

Occupational Health and Safety Administration

The federal government regulates occupational noise exposure common in the workplace through the Occupational Safety and Health Administration under the USEPA. Such limitations would apply to the operation of construction equipment and could also apply to any proposed industrial land uses. Noise exposure of this type is dependent on work conditions and is addressed through a facility's Health and Safety Plan, and is therefore not addressed further in this analysis.

United States Department of Housing and Urban Development

The United States Department of Housing and Urban Development (HUD) has set a goal of 65 dBA L_{dn} as a desirable maximum exterior standard for residential units developed under HUD funding. (This level is also generally accepted by the State of California.) While HUD does not specify acceptable interior noise levels, standard construction of residential dwellings typically provides in excess of 20 dBA of attenuation with the windows closed. Based on this premise, the interior L_{dn} should not exceed 45 dBA.

Aircraft Noise Standards

The Federal Aviation Administration Advisory Circular Number 150 5020 2, "Noise Assessment Guidelines for New Helicopters," recommends the use of a cumulative noise measure, the 24-hour equivalent sound level, or $L_{eq}(24)$, so that the relative contributions of the heliport and other sound sources in the community can be compared. The $L_{eq}(24)$ is similar to the L_{dn} used in assessing the impacts of fixed-wing aircraft. The helicopter $L_{eq}(24)$ values are obtained by logarithmically adding the sound exposure level values over a 24-hour period.

[1] Caltrans Division of Environmental Analysis, 2020, *Traffic Noise Analysis Protocol.*

Public Law 96 193 also directs the Federal Aviation Administration to identify land uses that are "normally compatible" with various levels of noise from aircraft operations. Because of the size and complexity of many major hub airports and their operations, Federal Aviation Regulation Part 150 identifies a large number of land uses and their attendant noise levels.

State Regulations

General Plan Guidelines

The State of California, through its general plan guidelines, discusses how ambient noise should influence land use and development decisions and includes a table of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable uses at different noise levels, expressed in CNEL. A conditionally acceptable designation implies new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements for each land use and needed noise insulation features are incorporated in the design. By comparison, a normally acceptable designation indicates that standard construction can occur with no special noise reduction requirements. The general plan guidelines provide cities with recommended community noise and land use compatibility standards that can be adopted or modified at the local level based on conditions and types of land uses specific to that jurisdiction.

California Building Code

The California Building Code is Title 24 of the California Code of Regulations. California Building Code Part 2, Volume 1, Chapter 12, Section 1207.11.2, Allowable Interior Noise Levels, requires that interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric is evaluated as either the L_{dn} or the CNEL, consistent with the noise element of the local general plan. The City regularly adopts updates to the California Building Code in the San Rafael Municipal Code (SRMC) Chapter 12.100, Adopted Codes.

California Building Code: California Green Building Standards Code

The State of California's noise insulation standards for nonresidential uses are codified in the California Code of Regulations, Title 24, Building Standards Administrative Code, Part 11, California Green Building Standards Code. The California Green Building Standards Code noise standards are applied to new or renovation construction projects in California to control interior noise levels resulting from exterior noise sources. Proposed projects may use either the prescriptive method (Section 5.507.4.1) or the performance method (Section 5.507.4.2) to show compliance. Under the prescriptive method, a project must demonstrate transmission loss ratings for the wall and roof-ceiling assemblies and exterior windows when located within a noise environment of 65 dBA CNEL or higher. Under the performance method, a project must demonstrate that interior noise levels do not exceed 50 dBA $L_{eq(1hr)}$.

Airport Noise Standards

California Code of Regulations Title 21, Subchapter 6, Airport Noise Standards, establishes 65 dBA CNEL as the acceptable level of aircraft noise for persons living in the vicinity of airports. Noise-sensitive land uses in locations where the aircraft exterior noise level exceeds 65 dBA CNEL are generally incompatible, unless

an aviation easement for aircraft noise has been acquired by the airport proprietor, or the residence is a high-rise with an interior CNEL of 45 dBA or less in all habitable rooms and an air circulation or air conditioning system, as appropriate. Assembly Bill (AB) 2776 requires any person who intends to sell or lease residential properties in an airport influence area to disclose that fact to the person buying the property.

Local Regulations

San Rafael General Plan 2020

The City of San Rafael 2020 General Plan goals, policies, and programs that are relevant to noise are primarily in the Noise Element. As part of the proposed project, some existing General Plan goals, policies, and programs would be amended, substantially changed, or new policies would be added. A comprehensive list of policy changes is provided in Appendix B, Proposed General Plan Goals, Policies, and Programs, of this Draft EIR. Applicable goals, policies, and programs are identified and assessed for their effectiveness and potential to result in an adverse physical impact later in this chapter in Section 4.13.3, Impact Discussion.

The Noise Element aims to limit the exposure of the community to excessive noise levels by guiding decisions concerning land use and location of new roads and transportation facilities. The City's land use compatibility standards provide urban planners with a tool to gauge the compatibility of land uses relative to existing and future noise levels.

San Rafael Municipal Code

The SRMC includes various directives pertaining to noise. The SRMC is organized by title, chapter, and section. Most provisions related to noise impacts are included Title 8, Morals and Conduct, as follows:

- Chapter 8.13, Noise. This chapter limits exterior noise limits during daytime and nighttime hours. Section 8.13.040, General Noise Limits, states that no person shall produce noise levels greater than as summarized in Table 4.13-3, when measured on the designated property.

TABLE 4.13-3 EXTERIOR PROPERTY NOISE LIMITS (DBA)

Category	Daytime [a] Intermittent [c]/Constant [d]	Nighttime [b] Intermittent [c]/Constant [d]
Residential	60/50	50/40
Mixed Use	65/55	55/45
Commercial	65/55	65/55
Industrial	70/60	NA

Notes:
a. *"Daytime" hours are Sunday through Thursday 7:00 a.m. to 9:00 p.m. and 7:00 a.m. to 10:00 p.m. Friday and Saturday*
b. *"Nighttime" hours are 9:00 p.m. to 7:00 a.m. Sunday through Thursday and 10:00 p.m. to 7:00 p.m. Friday and Saturday*
c. For intermittent sound, Lmax shall be used.
d. For constant sound, Leq shall be used.
Source: City of San Rafael Municipal Code, Section 8.13 *Noise.*

For public property, the most restrictive noise standard shall apply to any private property adjoining the public property. Interior noise levels of a multifamily residential structure are limited to 40 dBA L_{max} and 35 dBA L_{eq} for daytime hours, and 35 dBA L_{max} and 30 dBA L_{eq} for nighttime hours.

Under SRMC Section 8.13.050, construction noise is an exception to the provisions of the SRMC during the hours of 7:00 a.m. to 6:00 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. Saturdays, and no construction activities are to take place on Sundays and holidays, unless otherwise approved by the City. In addition to this exception, noise levels are not to exceed 90 dBA L_{max} during allowable construction hours at any point outside the property plane (property line) of the project.

Pursuant to SRMC Section 8.13.050, sound-generating devices or instruments used for any indoor or outdoor sound performances, athletic events, and special events shall be permitted, provided they do not exceed a noise level of 80 dBA measured at a distance of not less than 50 feet from the property line or other limits, as may be established by any required approvals and permits.

Section 8.13.070 exempts the following from the provisions of the SRMC:

- Aerial warning devices which are required by law to protect the health, safety, and welfare of the community;
- Emergency vehicle responses and all necessary equipment utilized for the purpose of responding to an emergency, or necessary to restore, preserve, protect or save lives or property from imminent danger of loss or harm;
- Aviation, railroad, and public transit operations;
- The operation of any municipal or public utility vehicles;
- Public safety training exercises conducted between the hours of eight a.m. (8:00 a.m.) and eight p.m. (8:00 p.m.);
- Uses established through any applicable discretionary review process containing specific noise conditions of approval and/or mitigation measures;
- Work on capital improvements, or repairs on public property by employees or contractors of the city;
- Vehicle noise subject to regulation under the California Vehicle Code;
- Emergency repair work performed by, or at the request of, a property owner on his or her private property, where the delay required to obtain an exception permit under this chapter would result in substantial damage, personal injuries, or property loss to the owner, provided that such emergency work shall be subject to such reasonable conditions as may be imposed by authorized city employees to mitigate the noise level of the activity.
- Portable generator used during emergencies or utility power outages per manufacturer's recommendations.
- Stationary generator installed and used during emergencies, utility power outages or routine testing per manufacturer's recommendations. Routine testing for stationary generators shall be conducted between the hours of ten a.m. (10:00 a.m.) and four p.m. (4:00 p.m.).

4.13.1.5 EXISTING CONDITIONS

Primary noise sources in the EIR Study Area include US-101, I-580, the Sonoma-Marin Area Rail Transit (SMART) rail, and traffic on local roadways. In commercial and retail areas, truck loading docks can be a source of localized noise.

Sensitive Receptors

Certain land uses, such as residences, schools, and hospitals, are particularly sensitive to noise and vibration. Sensitive receptors within the EIR Study Area include residences, senior housing, schools, places of worship, and recreational areas. These uses are regarded as sensitive because they are where citizens most frequently engage in activities that are likely to be disturbed by noise, such as reading, studying, sleeping, resting, or otherwise engaging in quiet or passive recreation. Commercial and industrial uses are not particularly sensitive to noise or vibration.

Ambient Noise Measurements

Ambient noise monitoring was conducted within the EIR Study Area by PlaceWorks in May 2019 to determine a baseline noise level at different environments. Measurements were made during weekday periods when the EIR Study Area is expected to be most active. Long-term (48-hour) measurements were conducted at 10 locations within the EIR Study Area, and short-term (10 minute) measurements were conducted at 22 locations in the EIR Study Area. Of these, 3 long-term and 9 short-term measurements were conducted in the Downtown Precise Plan Area. All measurements were conducted from Thursday, May 2, through Thursday, May 9, 2019. Short-term measurements were generally made during morning (7:00 a.m. to 10:00 a.m.) and evening (3:00 p.m. to 7:00 p.m.) peak commute hours.

Meteorological conditions during the measurement periods were favorable for outdoor sound measurements and were noted to be representative of the typical conditions for the season. All sound level meters were equipped with a windscreen during measurements.

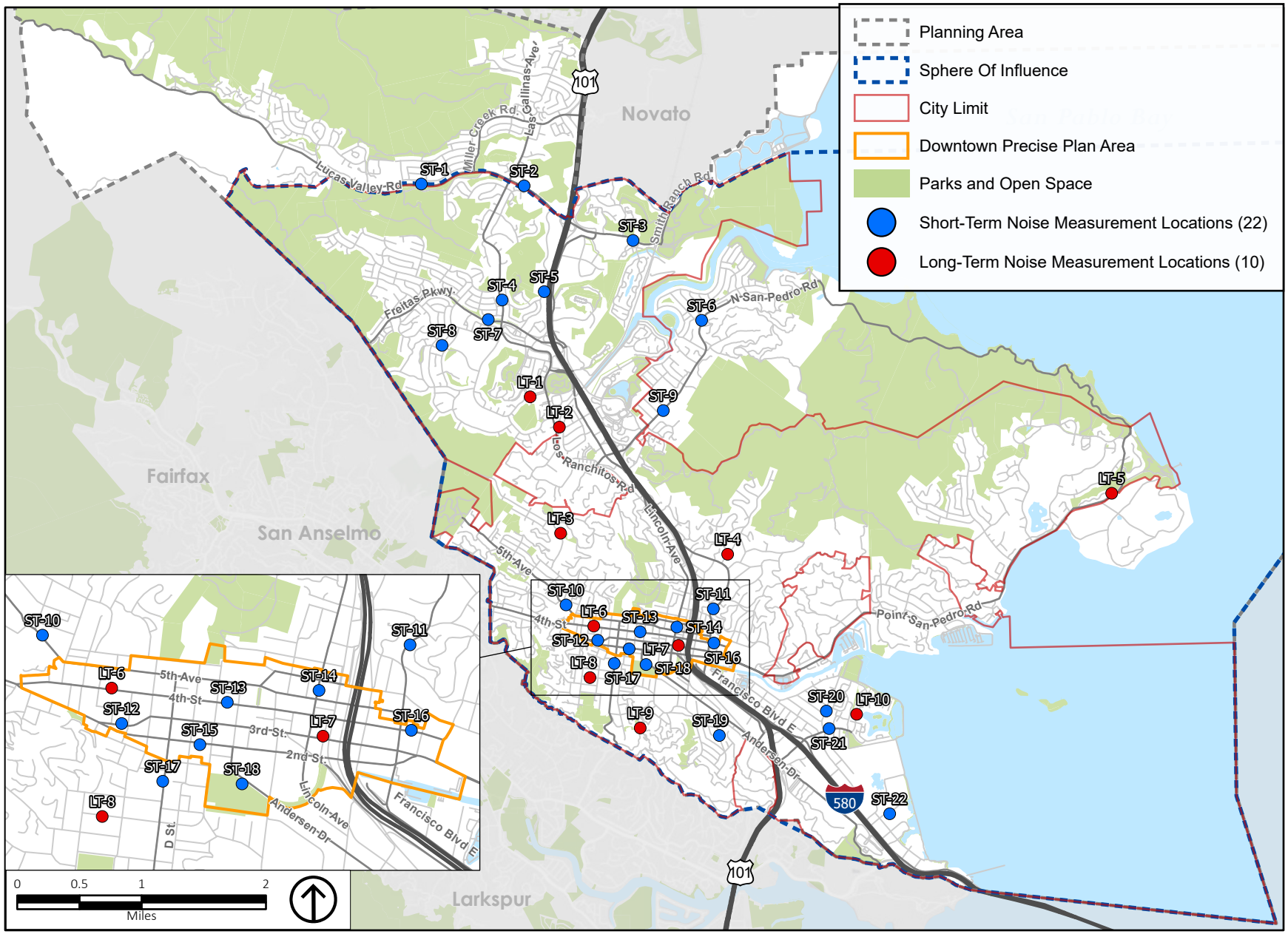
All sound level meters used for noise monitoring satisfy the American National Standards Institute standard for Type 1 instrumentation.[2] The sound level meters were set to "slow" response and "A" weighting (dBA). The meters were calibrated prior to and after the monitoring period. All measurements were at least 5 feet above the ground and away from reflective surfaces. Noise measurement locations are described below and shown on Figure 4.13-1.

Long-Term Noise Monitoring Locations

- Long-Term Location 1 (LT-1) was on Northgate Drive across from Northgate Mall. The measurement location was approximately 30 feet south of the Northgate Drive eastbound centerline. A 24-hour noise measurement was conducted, beginning at the 5:00 p.m. hour on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic.

[2] Monitoring of ambient noise was performed using Larson-Davis Model LxT and 820 sound level meters.

- Long-Term Location 2 (LT-2) was adjacent to the SMART train right-of-way at the end of Las Gallinas Avenue. During train pass-bys, the crossing bell was noted, but there was no train horn. The measurement location was approximately 50 feet east of the SMART centerline. A 24-hour noise measurement was conducted, beginning at the 5:00 p.m. hour on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by rail activity and traffic on Los Ranchitos Road.
- Long-Term Location 3 (LT-3) was on Elizabeth Way north of Chestnut Avenue. The measurement location was approximately 25 feet east of the Elizabeth Way northbound centerline. A 24-hour noise measurement was conducted, beginning at the 4:00 p.m. hour on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic.
- Long-Term Location 4 (LT-4) was on Mountain View Avenue south of Linden Lane. The measurement location was approximately 15 feet west of the Mountain View Avenue southbound centerline. A 24-hour noise measurement was conducted, beginning at the 8:00 p.m. hour on Thursday, May 2, 2019. The noise environment of this site is characterized primarily by local traffic.
- Long-Term Location 5 (LT-5) was on Point San Pedro Road east of Heritage Drive. The measurement location was approximately 45 feet north of the Point San Pedro Road westbound centerline. A 24-hour noise measurement was conducted, beginning at the 4:00 p.m. hour on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic.
- Long-Term Location 6 (LT-6) was on Fourth Street east of F Street. The measurement location was approximately 20 feet north of the Fourth Street westbound centerline. A 24-hour noise measurement was conducted, beginning at the 7:00 p.m. hour on Thursday, May 2, 2019. The noise environment of this site is characterized primarily by local traffic and downtown commercial activity.
- Long-Term Location 7 (LT-7) was on the corner of Third Street and Tamalpais Avenue. A 24-hour noise measurement was conducted, beginning at the 6:00 p.m. hour on Thursday, May 2, 2019. The noise environment of this site is characterized primarily by traffic on local roadways and US-101, SMART rail activity, and downtown commercial activity.
- Long-Term Location 8 (LT-8) was on Bayview Street west of Marin Street. The measurement location was approximately 20 feet south of the Bayview Street eastbound centerline. A 24-hour noise measurement was conducted, beginning at the 6:00 p.m. hour on Thursday, May 2, 2019. The noise environment of this site is characterized primarily by local traffic.
- Long-Term Location 9 (LT-9) was on Southern Heights Boulevard north of Meyer Road. A 24-hour noise measurement was conducted, beginning at the 3:00 p.m. hour on Tuesday, May 7, 2019. The noise environment of this site was noted to be relatively low, however distant property maintenance noise was noted during installation of the noise monitoring equipment.
- Long-Term Location 10 (LT-10) was on Catalina Boulevard north of Baypoint Drive. The measurement location was approximately 20 feet west of the Catalina Boulevard southbound centerline. A 24-hour noise measurement was conducted, beginning at the 5:00 pm hour on Thursday, May 2, 2019. The noise environment of this site is characterized primarily by local traffic.



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-1
Approximate Noise Monitoring Locations

Short-Term Noise Monitoring Locations

- Short-Term Location 1 (ST-1) was on Lucas Valley Road east of Huckleberry Road. The measurement location was approximately 20 feet north of the Lucas Valley Road westbound centerline. A 15-minute noise measurement was conducted, beginning at 3:28 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional aircraft flyovers and birds.
- Short-Term Location 2 (ST-2) was on Lucas Valley Road east of Las Gallinas Avenue. The measurement location was approximately 20 feet north of the Lucas Valley Road westbound centerline. A 15-minute noise measurement was conducted, beginning at 3:02 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic.
- Short-Term Location 3 (ST-3) was on Smith Ranch Road west of Yosemite Road. The measurement location was approximately 35 feet south of the Smith Ranch Road eastbound centerline. A 15-minute noise measurement was conducted, beginning at 3:53 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional aircraft flyovers and distant rail crossing noise.
- Short-Term Location 4 (ST-4) was in front of 1054 Las Gallinas Avenue. The measurement location was approximately 30 feet east of the Las Gallinas Avenue northbound centerline. A 15-minute noise measurement was conducted, beginning at 4:39 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included birds and distant highway noise.
- Short-Term Location 5 (ST-5) was on Los Gamos Drive north of Oleander Drive. The measurement location was approximately 30 feet east of the Los Gamos Drive northbound centerline. A 15-minute noise measurement was conducted, beginning at 4:17 pm on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by highway traffic. Secondary noise sources included occasional aircraft flyovers and birds. No car pass-bys were observed on Los Gamos Drive.
- Short-Term Location 6 (ST-6) was in front of 405 North San Pedro Road. The measurement location was approximately 20 feet west of the North San Pedro Road southbound centerline. A 15-minute noise measurement was conducted, beginning at 9:44 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included distant construction, nearby HVAC equipment, and occasional dogs and chickens.
- Short-Term Location 7 (ST-7) was on Manuel T. Freitas Parkway west of Las Gallinas Avenue. The measurement location was approximately 30 feet north of the Manuel T. Freitas Parkway westbound centerline. A 15-minute noise measurement was conducted, beginning at 5:00 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included birds and dogs.
- Short-Term Location 8 (ST-8) was in front of 411 Montecillo Road. The measurement location was approximately 20 feet west of the Montecillo Road southbound centerline. A 15-minute noise measurement was conducted, beginning at 5:24 p.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional aircraft flyovers, and typical residential noises such as children playing.

- Short-Term Location 9 (ST-9) was across from 148 North San Pedro Road. The measurement location was approximately 20 feet south of the North San Pedro Road northbound centerline. A 15-minute noise measurement was conducted, beginning at 9:23 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional birds.
- Short-Term Location 10 (ST-10) was on Fifth Avenue east of Eye Street. The measurement location was approximately 25 feet north of the Fifth Avenue westbound centerline. A 15-minute noise measurement was conducted, beginning at 3:00 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional birds.
- Short-Term Location 11 (ST-11) was in front of 1330 Grand Avenue. The measurement location was approximately 20 feet east of the Grand Avenue northbound centerline. A 15-minute noise measurement was conducted, beginning at 8:56 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway noise. Secondary noise sources included occasional birds.
- Short-Term Location 12 (ST-12) was on Third Street west of Shaver Street. The measurement location was approximately 30 feet north of the Third Street westbound centerline. A 15-minute noise measurement was conducted, beginning at 3:30 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included a nearby car wash.
- Short-Term Location 13 (ST-13) was in front of 1122 Fourth Street. The measurement location was approximately 20 feet north of the Fourth Street westbound centerline. A 15-minute noise measurement was conducted, beginning at 5:01 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic and downtown commercial activity.
- Short-Term Location 14 (ST-14) was on Lincoln Avenue north of Fifth Avenue. The measurement location was approximately 20 feet east of the Lincoln Avenue northbound centerline. A 15-minute noise measurement was conducted, beginning at 6:05 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included occasional birds.
- Short-Term Location 15 (ST-15) was on Second Street west of B Street. The measurement location was approximately 20 feet south of the Second Street eastbound centerline. A 15-minute noise measurement was conducted, beginning at 4:24 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic.
- Short-Term Location 16 (ST-16) was on Fourth Street east of Grand Avenue. The measurement location was approximately 30 feet north of the Fourth Street westbound centerline. A 15-minute noise measurement was conducted, beginning at 6:36 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway traffic. Secondary noise sources included occasional birds.
- Short-Term Location 17 (ST-17) was on D Street north of Ross Street. The measurement location was approximately 30 feet west of the D Street southbound centerline. A 15-minute noise measurement was conducted, beginning at 3:56 p.m. on Tuesday, May 7, 2019. The noise environment of this site is

characterized primarily by local traffic and distant highway traffic. Secondary noise sources included occasional birds.

- Short-Term Location 18 (ST-18) was near the baseball diamond at Albert Park. The measurement location was approximately 65 feet south of the Anderson Drive eastbound centerline. A 15-minute noise measurement was conducted, beginning at 5:37 p.m. on Tuesday, May 7, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway traffic and children playing baseball. Secondary noise sources included occasional birds.
- Short-Term Location 19 (ST-19) was in front of 314 Du Bois Street. The measurement location was approximately 20 feet east of the Du Bois Street northbound centerline. A 15-minute noise measurement was conducted, beginning at 8:26 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic. Secondary noise sources included distant yard maintenance and occasional birds.
- Short-Term Location 20 (ST-20) was on Kerner Boulevard south of Bahia Way. The measurement location was approximately 20 feet east of the Kerner Boulevard northbound centerline. A 15-minute noise measurement was conducted, beginning at 7:51 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway traffic. Secondary noise sources included typical residential neighborhood sounds such as children.
- Short-Term Location 21 (ST-21) was in front of 233 Bellam Boulevard. The measurement location was approximately 25 feet north of the Bellam Boulevard westbound centerline. A 15-minute noise measurement was conducted, beginning at 7:27 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway traffic.
- Short-Term Location 22 (ST-22) was on Shoreline Parkway east of Kerner Boulevard. The measurement location was approximately 20 feet south of the Shoreline Parkway eastbound centerline. A 15-minute noise measurement was conducted, beginning at 7:00 a.m. on Thursday, May 9, 2019. The noise environment of this site is characterized primarily by local traffic and distant highway traffic.

Ambient Noise Results, Long-Term Monitoring

During the ambient noise survey, the L_{dn} noise levels at monitoring locations ranged from 47 to 74 dBA L_{dn}. The long-term noise measurement results are summarized in Table 4.13-4. A summary of the daily trend of long-term noise measurement results are shown in Appendix H, Noise Data, of this Draft EIR.

TABLE 4.13-4 LONG-TERM NOISE MEASUREMENT SUMMARY (DBA)

Monitoring Location	Description	L_{dn}	Lowest L_{eq}, 1-Hour	Highest L_{eq}, 1-Hour
LT-1	Northgate Drive	60	35.1	61.7
LT-2	SMART Rail Crossing	60	37.5	60.5
LT-3	Elizabeth Way	59	31.1	62.3
LT-4	Mountain View Avenue	64	44.7	68.9
LT-5	Point San Pedro Road	58	40.0	61.6
LT-6	Fourth Street	71	56.8	68.5
LT-7	Third Street	74	54.8	75.1
LT-8	Bayview Street	62	41.8	72.2
LT-9	Southern Heights Boulevard	47	29.8	50.0
LT-10	Catalina Boulevard	58	35.0	59.2

Source: PlaceWorks, 2019.

Short-Term Noise Monitoring Results

The short-term noise measurement results are summarized in Table 4.13-5.

TABLE 4.13-5 SHORT-TERM NOISE MEASUREMENT SUMMARY (DBA)

		15-Minute Noise Level, dBA		
Monitoring Location	Description	L_{min}	L_{eq}	L_{max}
ST-1	Lucas Valley Road - 3:28 pm, 5/9/2019	42.4	71.4	80.8
ST-2	Lucas Valley Road - 3:02 pm, 5/9/2019	49.9	72.1	82.6
ST-3	Smith Ranch Road - 3:53 pm, 5/9/2019	45.8	62.1	71.7
ST-4	Las Gallinas Avenue - 4:39 pm, 5/9/2019	44.9	62.4	74.9
ST-5	Los Gamos Road - 4:17 pm, 5/9/2019	50.5	53.9	61.0
ST-6	N. San Pedro Road - 9:44 am, 5/9/2019	42.4	65.4	77.5
ST-7	Manuel T. Freitas Parkway - 5:00 pm, 5/9/2019	43.1	67.9	77.6
ST-8	Montecillo Road - 5:24 pm, 5/9/2019	37.3	55.4	68.3
ST-9	N. San Pedro Road - 9:23 am, 5/9/2019	48.0	66.9	78.6
ST-10	Fifth Avenue - 3:00 pm, 5/7/2019	42.2	62.1	72.0
ST-11	Grand Avenue - 8:56 am, 5/9/2019	50.9	64.6	76.6
ST-12	Third Street - 3:30 pm, 5/7/2019	48.2	70.8	81.1
ST-13	Fourth Street - 5:01 pm, 5/7/2019	54.2	69.9	87.7
ST-14	Lincoln Avenue - 6:05 pm, 5/7/2019	51.9	62.9	74.2
ST-15	Second Street - 4:24 pm, 5/7/2019	51.4	69.0	82.9
ST-16	Fourth Street - 6:36 pm, 5/7/2019	53.0	63.3	78.0
ST-17	D Street - 3:56 pm, 5/7/2019	47.7	63.6	74.7
ST-18	Albert Park - 5:37 pm, 5/7/2019	46.1	58.1	72.3
ST-19	Du Bois Street - 8:26 am, 5/9/2019	42.7	57.4	78.5
ST-20	Kerner Boulevard - 7:51 am, 5/9/2019	49.0	62.2	79.2
ST-21	Bellam Boulevard - 7:27 AM, 5/9/2019	56.1	63.6	75.7
ST-22	Shoreline Parkway - 7:00 AM, 5/9/2019	50.2	63.9	77.7

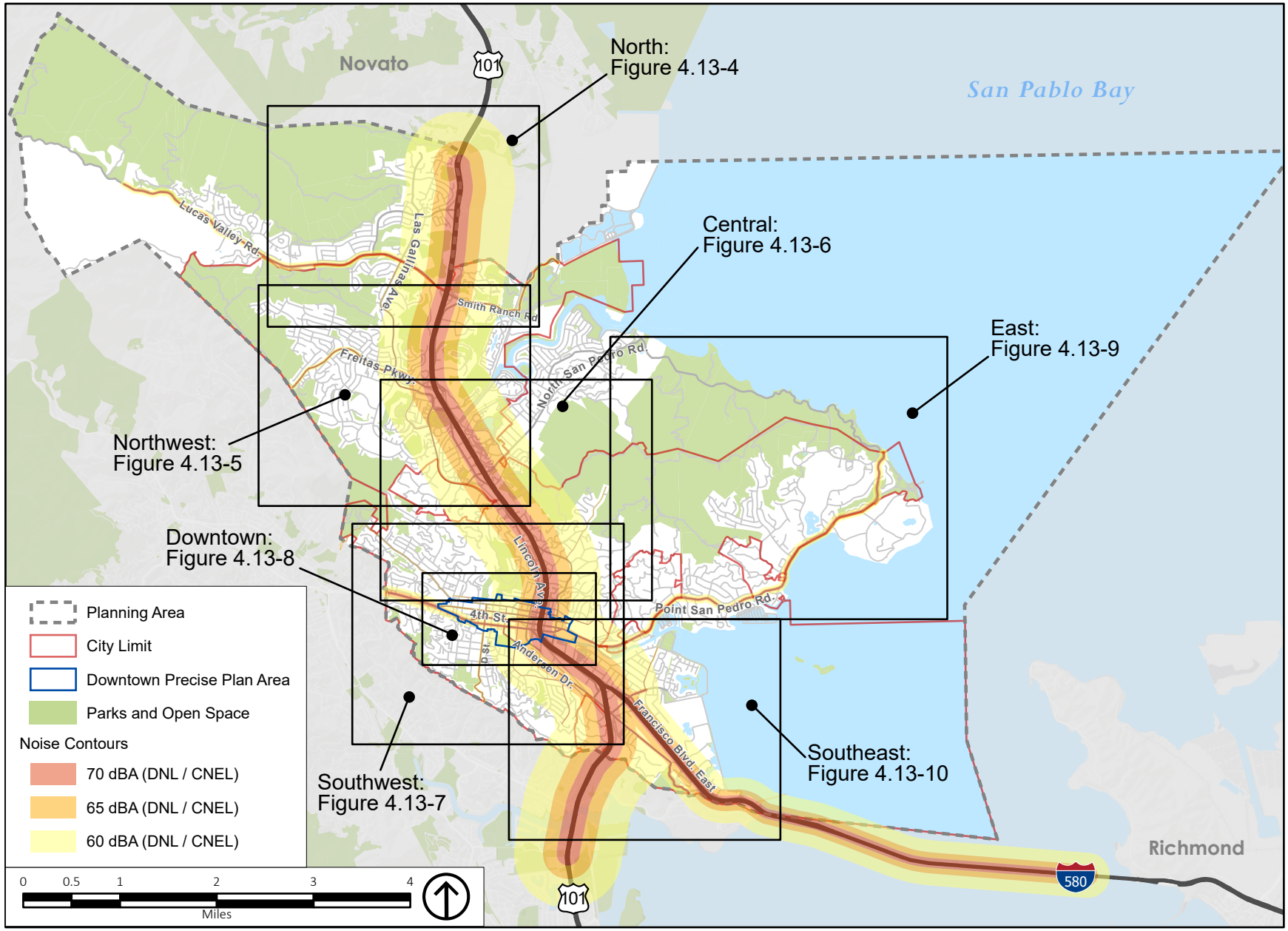
Source: PlaceWorks,2019.

Existing Traffic Noise

Traffic noise levels were estimated using the FHWA Highway Traffic Noise Prediction Model and traffic data provided by Fehr & Peers Transportation Consultants (see Appendix H, Noise Data, of this Draft EIR). The FHWA model predicts noise levels through a series of adjustments to a reference sound level. These adjustments account for distances from the roadway, traffic volumes, vehicle speeds, car/truck mix, number of lanes, and road width. Existing (2019) roadway and highway noise contours of 60, 65, and 70 dBA L_{dn} noise contours are shown on Figures 4.13-2 through 4.13-9.

Aircraft Noise

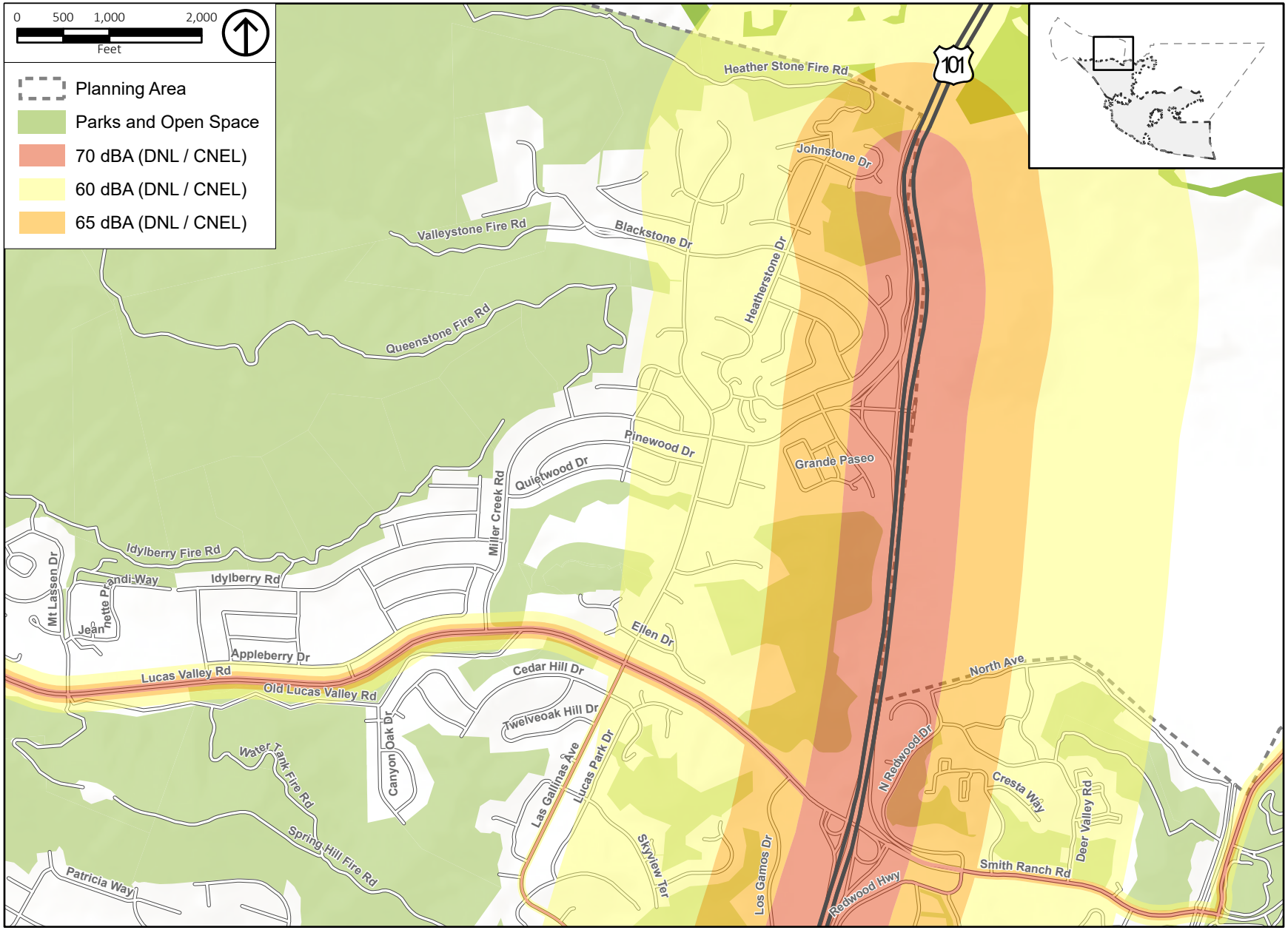
Aircraft noise in the EIR Study Area is characterized as rare but can be intrusive to nearby sensitive receptors. There is one airport in the EIR Study Area, the San Rafael Airport, which is in the northeastern portion of the EIR Study Area. The nearest heliport is the San Rafael Private Heliport located on Kerner Boulevard in San Rafael. The San Rafael Airport is a private airstrip with minimal air traffic. As shown on Figure 4.13-10, airport noise contours from 2003 do not extend much beyond the runway, and aircraft noise does not substantially affect nearby sensitive receptors. Figure 4.13-11 shows the San Rafael Private Heliport noise contours. The heliport is in a commercial area of the EIR Study Area.



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

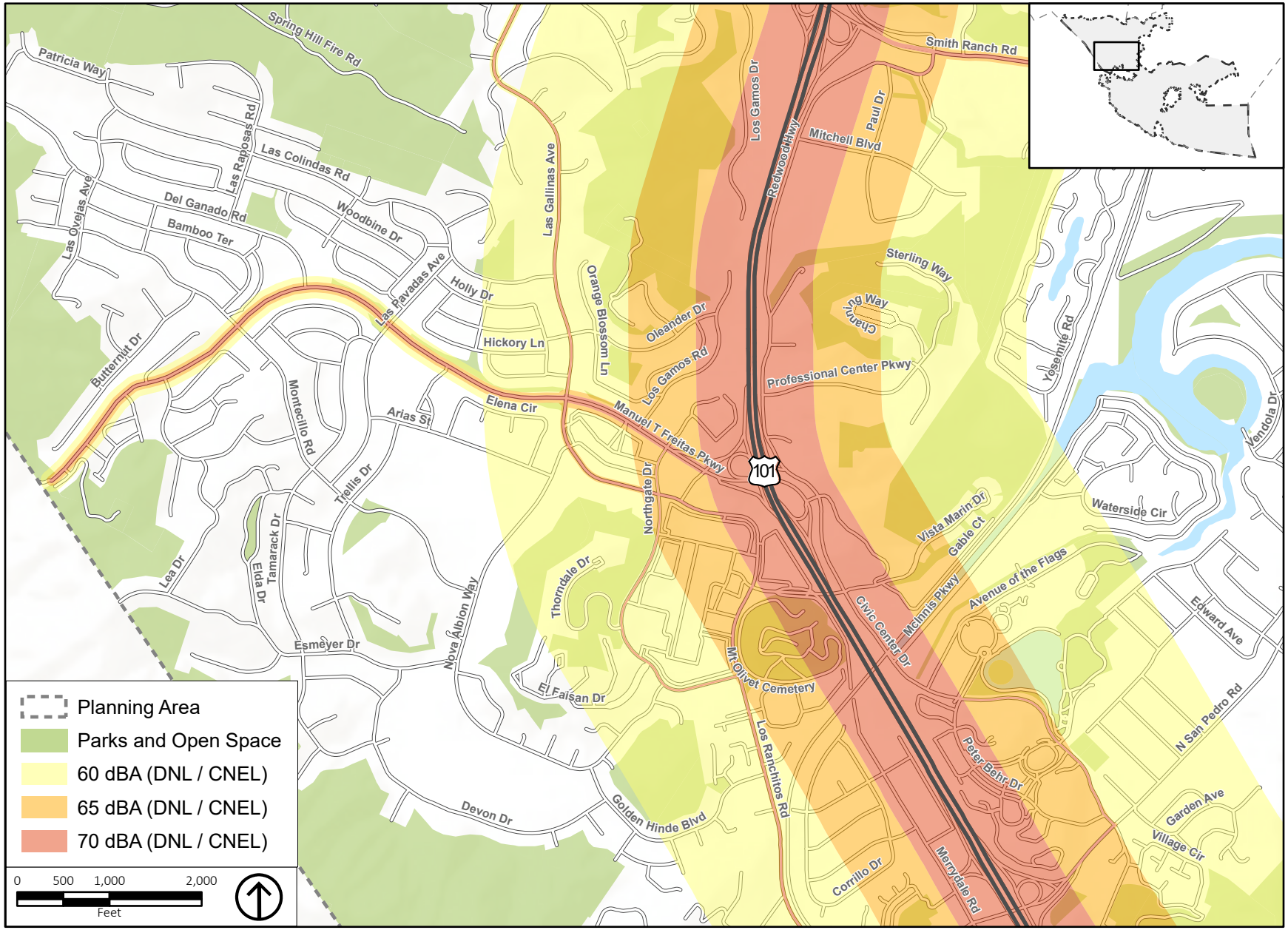
Figure 4.13-2

Existing Traffic Noise Contours-Planning Area



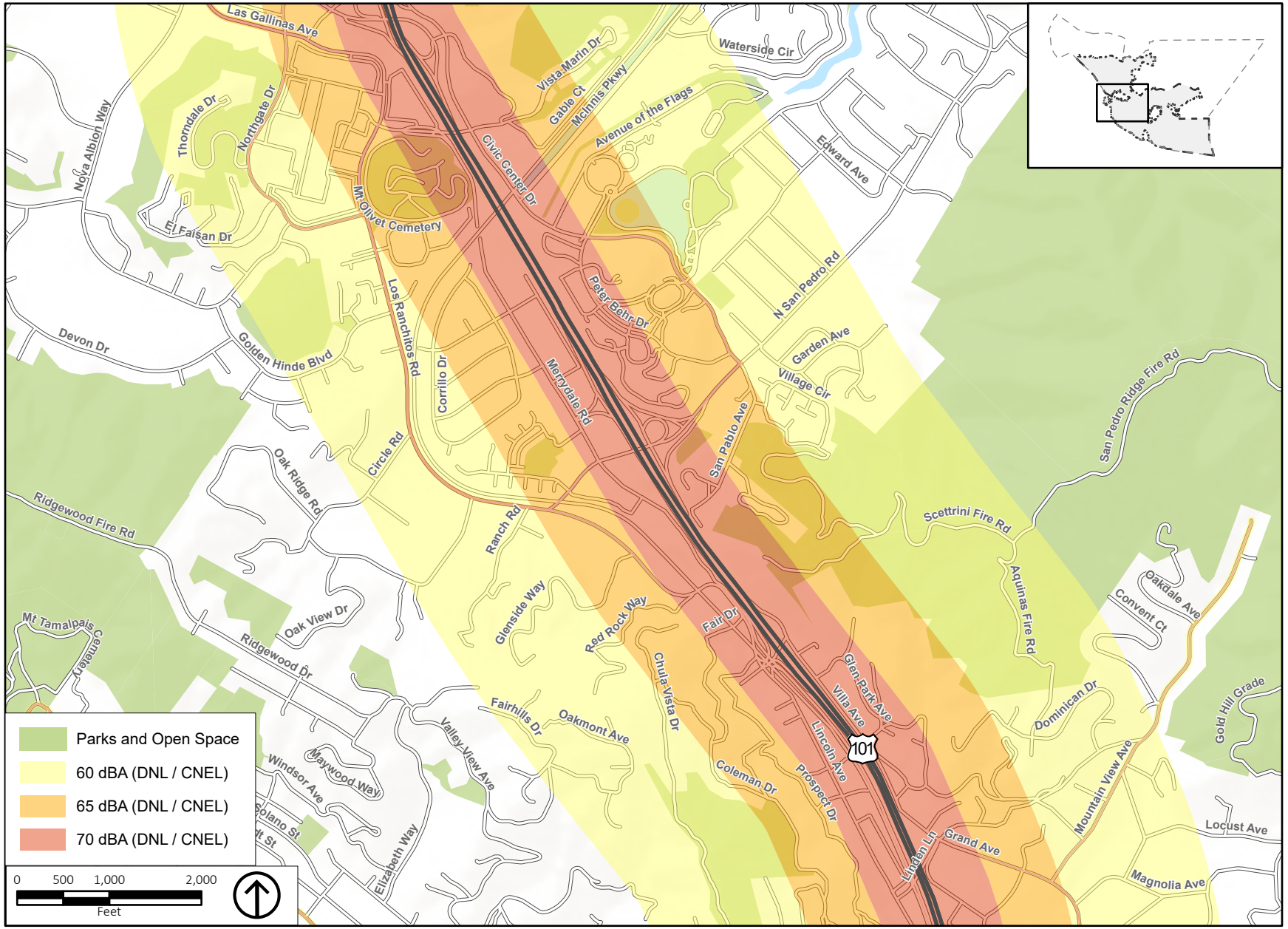
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-3
Existing Traffic Noise Contours-North



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

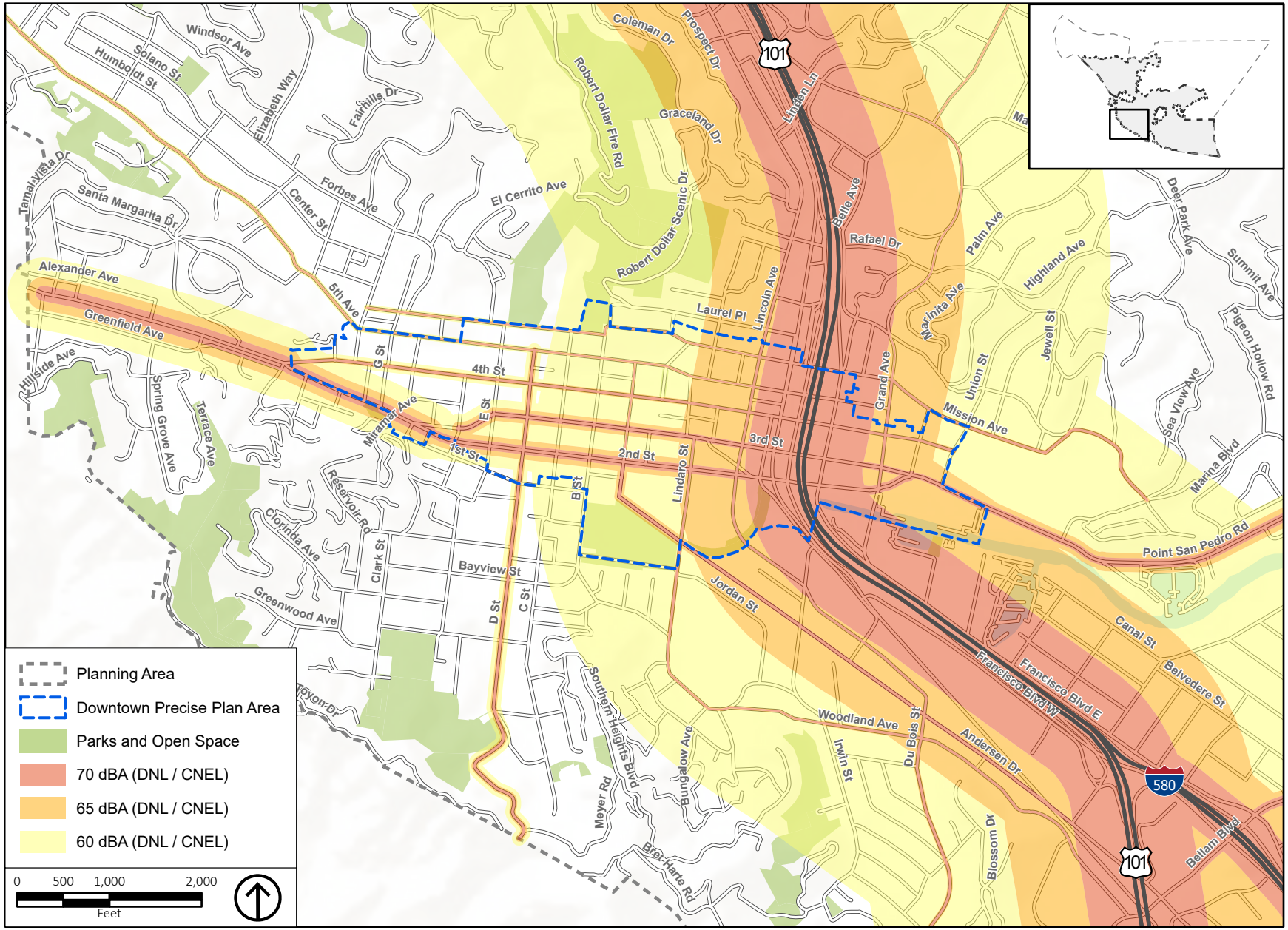
Figure 4.13-4
Existing Traffic Noise Contours-Northwest



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-5

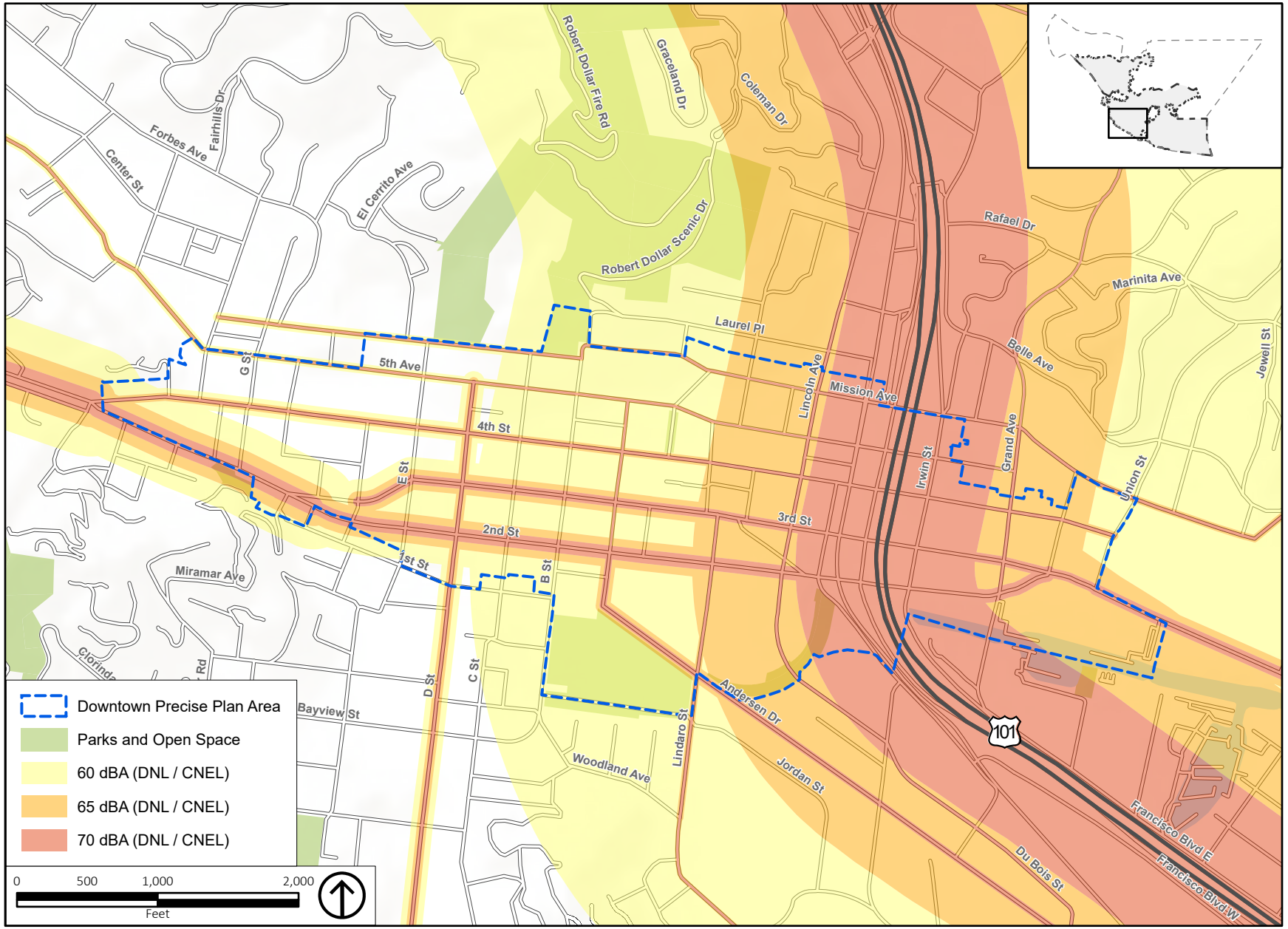
Existing Traffic Noise Contours-Central



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

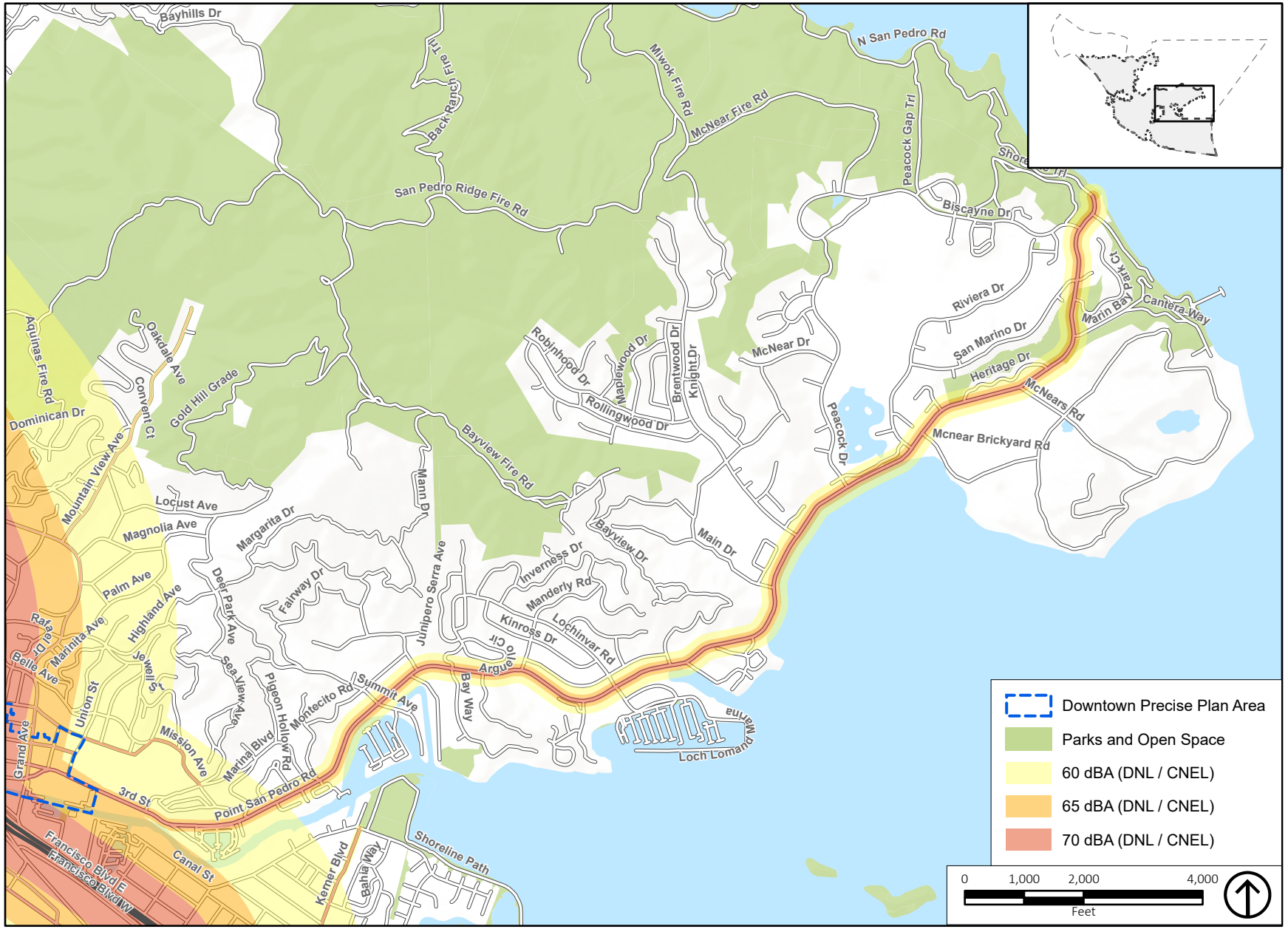
Figure 4.13-6

Existing Traffic Noise Contours-Southwest



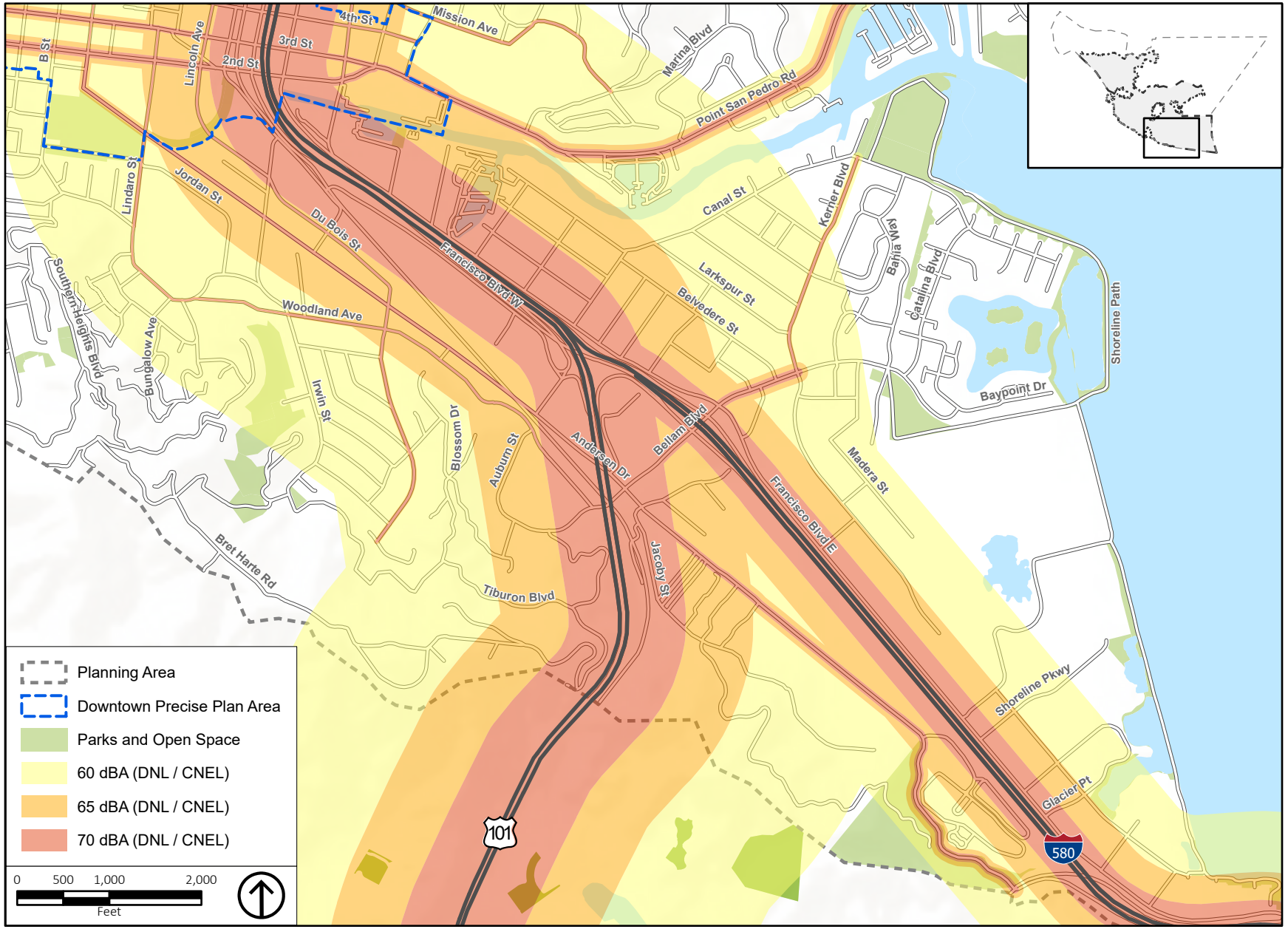
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-7
Existing Traffic Noise Contours -Downtown



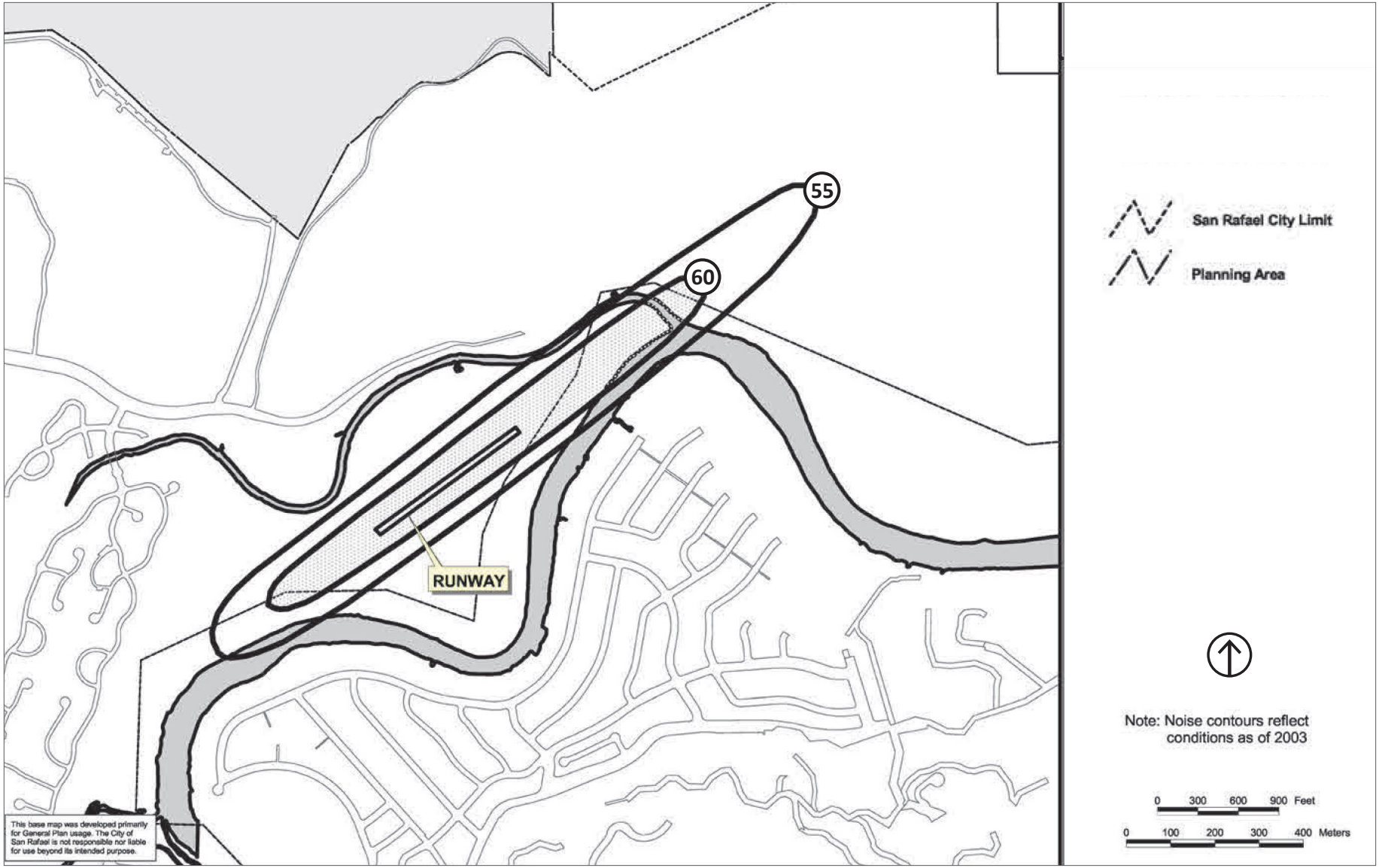
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-8
Existing Traffic Noise Contours-East



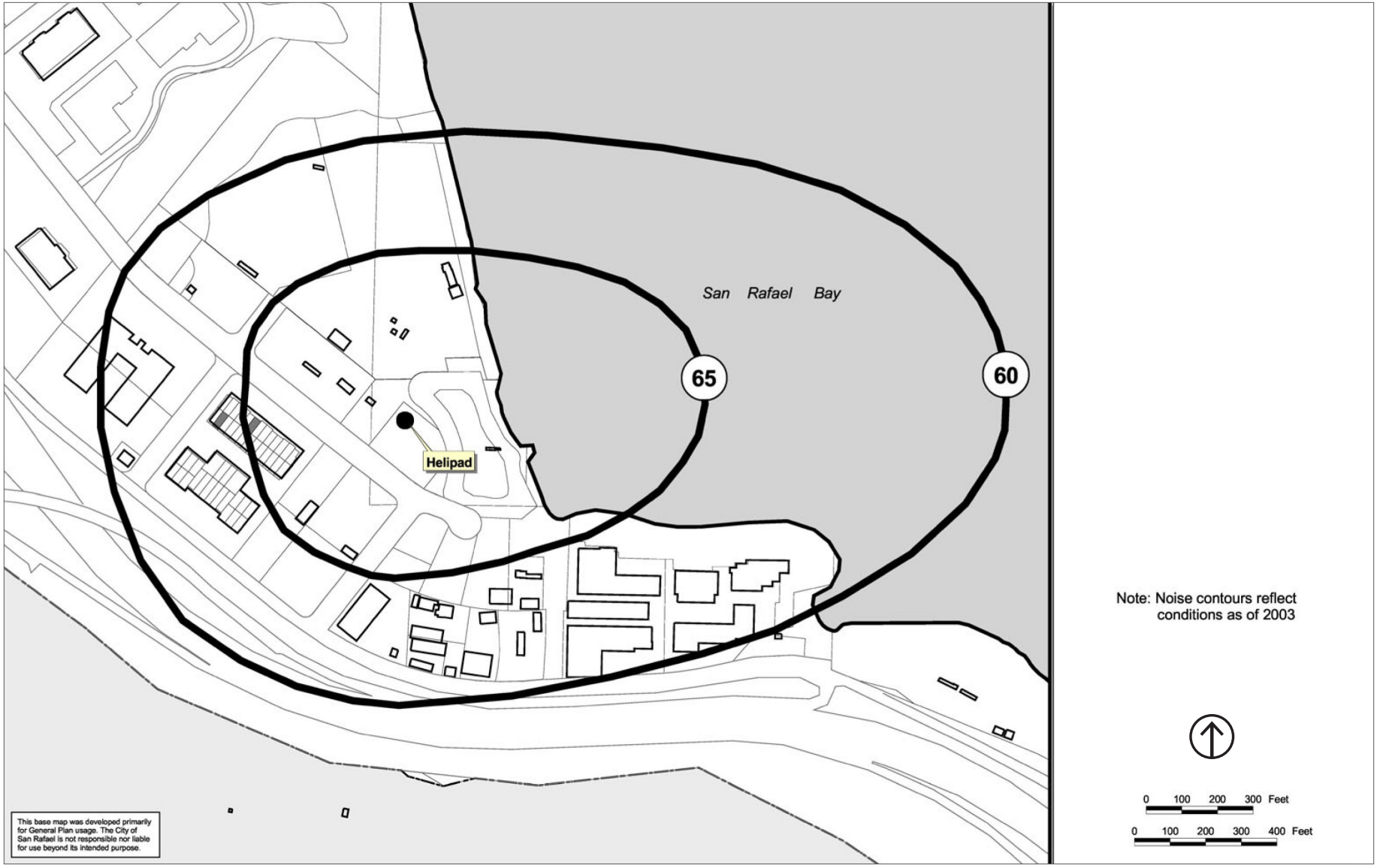
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-9
Existing Traffic Noise Contours-Southeast



Source: City of San Rafael General Plan 2020, Exhibit 32.

Figure 4.13-10
San Rafael Airport Noise Contours



Source: City of San Rafael General Plan 2020, Exhibit 33.

Figure 4.13-11
Heliport Noise Contours

Railroad Noise

The SMART rail is the only source of rail noise in the EIR Study Area. There is no freight service along the rail line. Due to the establishment of a Quiet Zone in Marin County, noise from the SMART rail is not substantial much beyond the rail right-of-way. Train operators are not required to sound their horn at grade crossings due to the Quiet Zone. However, the train operator may still sound their horn in the case of emergencies at their discretion. Ambient noise monitoring at the long-term monitoring location LT-2 indicates that the 60 L_{dn} noise contour from SMART rail activity does not extend beyond 50 feet from the railroad centerline. Although there were a few locations near the SMART tracks with ambient noise levels exceeding 60 L_{dn}, the higher ambient noise is associated with proximity to local roadways and US-101 rather than SMART rail activity alone.

Stationary Source Noise

Stationary sources of noises may occur on all types of land uses. Residential uses generate noise from landscaping, maintenance activities, and air conditioning systems. Commercial uses generate noise from heating, ventilation, air conditioning (HVAC) systems, loading docks, and other sources. Industrial uses may generate HVAC systems, loading docks, and possibly machinery. Noise generated by residential or commercial uses are generally short and intermittent. Industrial uses may generate noise on a more continual basis due to the nature of the activities. Nightclubs, outdoor dining areas, gas stations, car washes, fire stations, drive-throughs, swimming pool and hot tub pumps, school playgrounds, athletic and music events, and public parks are other common noise sources.

Emergency backup generators are also a common outdoor noise source. As discussed in Section 4.13.1.4, Regulatory Framework, effective November 2019, the City has approved an ordinance allowing residents and businesses to use generators during power failures, even when the resulting noise levels exceed adopted limits. This is in response to recent public safety power shutoffs issued by Pacific Gas & Electric that were instituted for wildfire prevention in 2019 and are anticipated to continue to be used as a wildfire prevention mechanism in the future.

The San Rafael Rock Quarry and McNear Brickworks is a major stationary source of noise. Located in unincorporated Marin County adjacent to the city at 1000 Point San Pedro Road, noise sources from the quarry include on-site machinery, truck movements, periodic rock blasting, and on-road haul trucks traveling to and from the site. General Plan 2040 Program NH-5.6A seeks to minimize the effects of quarry noise through cooperative efforts with the County of Marin.

Existing Vibration

Existing sources of operational vibration in the EIR Study Area include vehicle traffic on roadways and the SMART rail. Caltrans has studied the effects of propagation of vehicle vibration on sensitive land uses and notes that “heavy trucks, and quite frequently buses, generate the highest earthborn vibrations of normal traffic.” Caltrans further notes that the highest traffic-generated vibrations are along freeways and state routes. Their study finds that “vibrations measured on freeway shoulders (five meters from the centerline of the nearest lane) have never exceeded 0.08 in/sec, with the worst combinations of heavy trucks and poor roadway conditions (while such trucks were moving at freeway speeds). This level coincides with the

maximum recommended safe level for ruins and ancient monuments (and historic buildings)."[3] The 2014 Draft EIR for SMART found that residences located more than 40 feet from the railroad centerline (outside the rail right-of-way) would not experience perceptible vibration.[4] Construction vibration levels have the potential to be significant when equipment such as impact and vibratory pile drivers, rock blasting, and vibratory rollers is used during project construction.

4.13.2 STANDARDS OF SIGNIFICANCE

Pursuant to Appendix G, Environmental Checklist Form, of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would result in significant noise impacts if it would:

1. Result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards.
2. Result in generation of excessive groundborne vibration or groundborne noise levels.
3. For a project located within the vicinity of a private airstrip or an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.
4. Result in significant cumulative noise-related impacts.

4.13.2.1 CITY OF SAN RAFAEL NOISE LIMITS

Construction Noise

As discussed in Section 4.13.1.4, Regulatory Framework, under the subheading "San Rafael Municipal Code" the SRMC Section 8.13.050 establishes the construction noise thresholds that limits the noise level from construction activity to 90 dBA L_{max} outside the property line.[5] PlaceWorks interprets this to be at the property line of the nearest noise-sensitive receptor.

Stationary Noise

As with construction noise, the SRMC sets operational noise limits from stationary sources. The SRMC Section 8.13.040 operational noise limits are shown in Section 4.13.1.4, Regulatory Framework, under the subheading "San Rafael Municipal Code" in in Table 4.13-3. These limits are used to determine impact significance for operational noise from stationary noise sources.

[3] Caltrans, 2013, *Transportation and Construction Vibration Guidance Manual*.

[4] Sonoma-Marin Area Rail Transit, 2014, *Downtown San Rafael to Larkspur Extension Environmental Assessment*.

[5] Personal correspondence between Josh Carman, PlaceWorks, and Raffi Boloyan, Planning Manager, City of San Rafael, June 15, 2020, confirmed L_{max} is the appropriate noise level metric.

Mobile Noise

A project will normally have a significant effect on the environment related to mobile noise sources such as traffic if it will substantially increase the ambient noise levels for adjoining areas. Most people can detect changes in sound levels of approximately 3 dBA under normal, quiet conditions, and changes of 1 to 3 dBA are detectable under quiet, controlled conditions. Changes of less than 1 dBA are usually undetectable. A change of 5 dBA is readily audible to most people in an exterior environment. Based on this, the following thresholds of significance are used to assess mobile noise impacts from traffic at sensitive receptor locations:

- Greater than 1.5 dBA increase for ambient noise environments of 65 dBA L_{dn} and higher
- Greater than 3 dBA increase for ambient noise environments of 60 to 64 dBA L_{dn}
- Greater than 5 dBA increase for ambient noise environments of less than 60 dBA L_{dn}

4.13.2.2 FEDERAL TRANSIT ADMINISTRATION VIBRATION LIMITS

Vibration

As described in Section 4.13.1.3, Vibration Fundamentals, there are two types of vibration related impacts; vibration damage to buildings and vibration annoyance to people. The City does not have specific limits or thresholds for vibration.

Vibration Damage from Construction

The Federal Transit Administration (FTA) provides criteria for acceptable levels of groundborne vibration for various types of buildings identified as Category I, II, and III buildings based on the type of materials they are constructed from. These criteria are used for this analysis and shown in Table 4.13-6. A Category III, non-engineered timber and masonry buildings, threshold of 0.20 in/sec PPV would apply to typical residential structures.

TABLE 4.13-6 GROUNDBORNE VIBRATION CRITERIA: ARCHITECTURAL DAMAGE

Building Category	PPV (in/sec)
I. Reinforced concrete, steel, or timber (no plaster)	0.50
II. Engineered concrete and masonry (no plaster)	0.30
III. Nonengineered timber and masonry buildings	0.20
IV. Buildings extremely susceptible to vibration damage	0.12

Note: PPV = peak particle velocity
Source: Federal Transit Administration (FTA) 2018. *Transit Noise and Vibration Impact Assessment Manual*.

Vibration Annoyance from Operation

For vibration annoyance from operational sources, the FTA recommends the following criteria for frequent events: 65 VdB for highly sensitive uses with vibration-sensitive equipment (e.g., microscopes in hospitals and research facilities) and 72 VdB for residences.

4.13.3 IMPACT DISCUSSION

NOISE-1 **Implementation of the proposed project could result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the EIR Study Area in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards.**

General Plan 2040: Construction Noise

Potential future development could result in two types of temporary noise impacts during construction.

- The transport of workers and movement of materials to and from the site could incrementally increase noise levels along local access roads.
- Noise would be generated from activities related to demolition, site preparation, grading, and/or physical construction.

Construction is performed in phases, each of which has its own mix of equipment, and, consequently, its own noise characteristics. Table 4.13-7 lists typical construction equipment noise levels recommended for noise-impact assessments, based on a distance of 50 feet between the equipment and noise receptor.

TABLE 4.13-7 CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Construction Equipment	Typical Max Noise Level (dBA Lmax) [a]	Construction Equipment	Typical Max Noise Level (dBA Lmax) [a]
Air Compressor	81	Pile-Driver (Impact)	101
Backhoe	80	Pile-Driver (Sonic)	96
Ballast Equalizer	82	Pneumatic Tool	85
Ballast Tamper	83	Pump	76
Compactor	82	Rail Saw	90
Concrete Mixer	85	Rock Drill	98
Concrete Pump	71	Roller	74
Concrete Vibrator	76	Saw	76
Crane, Derrick	88	Scarifier	83
Crane, Mobile	83	Scraper	89
Dozer	85	Shovel	82
Generator	81	Spike Driver	77
Grader	85	Tie Cutter	84
Impact Wrench	85	Tie Handler	80
Jack Hammer	88	Tie Inserter	85
Loader	85	Truck	88
Paver	89		

Notes:
[a] Measured 50 feet from the source.
Source: Federal Transit Administration (FTA) 2018. *Transit Noise and Vibration Impact Assessment Manual*.

As shown, construction equipment generates high levels of noise, with maximums ranging from 71 dBA to 101 dBA. Construction of individual developments associated would temporarily increase the ambient noise environment and would have the potential to affect noise-sensitive land uses in the vicinity of an individual project. According to SRMC Section 8.13.050, construction activities are exempt from the noise standards between 7:00 a.m. and 6:00 p.m. Monday through Friday, 9:00 a.m. to 6:00 p.m. on Saturdays, and no construction activities are to take place on Sundays and holidays unless approved by the City. Construction activities are exempt provided noise levels do not exceed 90 dBA L_{max}.

Implementation of the proposed General Plan 2040 anticipates an increase in development intensity to accommodate new population and employment growth. Construction noise levels are highly variable and dependent upon the specific locations, site plans, and construction details of individual projects. Significant noise impacts may occur from operation of heavy earth-moving equipment and truck haul operations associated with construction of individual development projects, particularly if construction techniques such as impact or vibratory pile driving are proposed. The time of day that construction activity is conducted would also determine the significance of each project, particularly during the more sensitive nighttime hours. However, construction would be localized and would occur intermittently for varying periods of time.

The proposed Noise (N) Element contains a goal, policies, and programs that require local planning and development decisions to consider noise-related impacts, including during construction. The following General Plan 2040 goal, policies, and program would minimize potential adverse noise-related impacts:

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.9: Maintaining Peace and Quiet. Minimize noise conflicts resulting from everyday activities such as construction, sirens, yard equipment, business operations, night-time sporting events, and domestic activities.
  - Program N-1.9B: Construction Noise. Use the environmental review process to identify measures to reduce the exposure of neighboring properties to excessive noise levels from construction activity.

In most cases, construction of individual developments associated with implementation of the proposed General Plan 2040 would temporarily increase the ambient noise environment in the vicinity of each individual project, potentially affecting existing and future nearby sensitive uses. The implementation of construction best management practices throughout the entire active construction period would also help to ensure that construction noise is minimized to the extent feasible. Some common construction best management practices include requiring projects to:

- Utilize the best available noise control techniques (e.g., improved mufflers, use of intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds) wherever feasible on equipment and trucks used for project construction shall.
- Require the contractor to use impact tools (e.g., jack hammers and hoe rams) that are hydraulically or electrically powered wherever possible. Where the use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used along with external noise jackets on the tools.

- Locate stationary equipment such as generators and air compressors as far as feasible from nearby noise-sensitive uses.
- Locate stockpiling as far as feasible from nearby noise-sensitive receptors.
- Limit construction traffic shall be limited—to the extent feasible—to haul routes approved in advance of issuing building permits by the City.
- Require the telephone numbers of the authorized representatives for the City and the contractor that are assigned to respond in the event of a noise or vibration complaint to be displayed on construction signs posted at the construction site. If the authorized contractor's representative receives a complaint, he/she shall investigate, take appropriate corrective action, and report the action to the City.
- Post signs at the job site entrance(s), within the on-site construction zones, and along queueing lanes (if any) to reinforce the prohibition of unnecessary engine idling. All other equipment shall be turned off if not in use for more than 5 minutes.
- Require the use of noise-producing signals, including horns, whistles, alarms, and bells, shall be for safety warning purposes only, to the extent feasible. The construction manager shall use smart back-up alarms, which automatically adjust the alarm level based on the background noise level or switch off back-up alarms and replace with human spotters in compliance with all safety requirements and laws.
- Erect temporary noise barriers (at least as high as the exhaust of equipment and breaking line-of-sight between noise sources and sensitive receptors), as necessary and feasible, to maintain construction noise levels at or below the performance standard of 90 dBA L_{max} and/or when the anticipated construction duration is greater than is typical (two years or greater). Barriers shall be constructed with a solid material that has a density of at least 4 pounds per square foot with no gaps from the ground to the top of the barrier.

While the City has established noise limits during the construction phase of potential future projects and General Plan Program N-1.9B, Construction Noise, requires the City to use the environmental review process to identify measures to reduce the exposure of neighboring properties to excessive noise levels from construction activity, these do not address the use routine construction best management practices that would further ensure that noise impacts from construction are reduced to acceptable levels. Therefore, construction noise impacts associated with implementation of the proposed General Plan 2040 are considered *potentially significant.*

Impact NOISE-1: Construction activities associated with potential future development could expose sensitive receptors in close proximity to a construction site to noise that exceed the City's noise limits established in San Rafael Municipal Code Chapter 8.13, Noise.

Mitigation Measure NOISE-1: To ensure receptors that are sensitive to construction noise are not exposed to unacceptable construction noise levels as defined in San Rafael Municipal Code Chapter 8.13, Noise, for discretionary development projects that are subject to CEQA the City shall amend Program N-1.9B (Construction Noise) as follows:

- Modified Program: Construction Best Management Practices. The City shall establish a list of construction best management practices to be implemented during the construction phase and incorporated into San Rafael Municipal Code Chapter 8.13, Noise. The City of San Rafael Building Division shall verify that construction best management practices, as appropriate, are on the demolition, grading, and construction plans prior to issuance of demolition, grading and/or building permits.

Significance with Mitigation: Less than significant.

Downtown Precise Plan: Construction Noise

Same as potential future development in the remainder of the city, the potential future development in the Downtown Precise Plan Area would result in the construction of future projects that could expose sensitive receptors to noise that exceed the City's noise limit. The proposed Downtown Precise Plan has no specific policies, and the Downtown Code has no specific regulations to reduce noise from construction; therefore, the impacts and mitigation described for the proposed General Plan 2040 would also apply in the Downtown Precise Plan Area. Accordingly, impacts would be *less than significant*.

Significance with Mitigation: Less than significant.

General Plan 2040: Operational Noise

Traffic Noise

Future development from implementation of the proposed General Plan 2040 would cause increases in traffic along local roadways. Traffic noise levels were estimated using the FHWA Highway Traffic Noise Prediction Model. Traffic volumes for existing and 2040 conditions were obtained from Fehr & Peers (see Appendix H, Noise Data, of this Draft EIR). The FHWA model predicts noise levels through a series of adjustments to a reference sound level. These adjustments account for distances from the roadway, traffic volumes, vehicle speeds, car/truck mix, number of lanes, and road width.

Table 4.13-8 presents the noise level increases on roadways over existing conditions at 50 feet from the centerline of the nearest travel lane. Figures 4.13-12 through 4.13-19 show the 60, 65, and 70 dBA L_{dn} noise contours from roadways and highways.

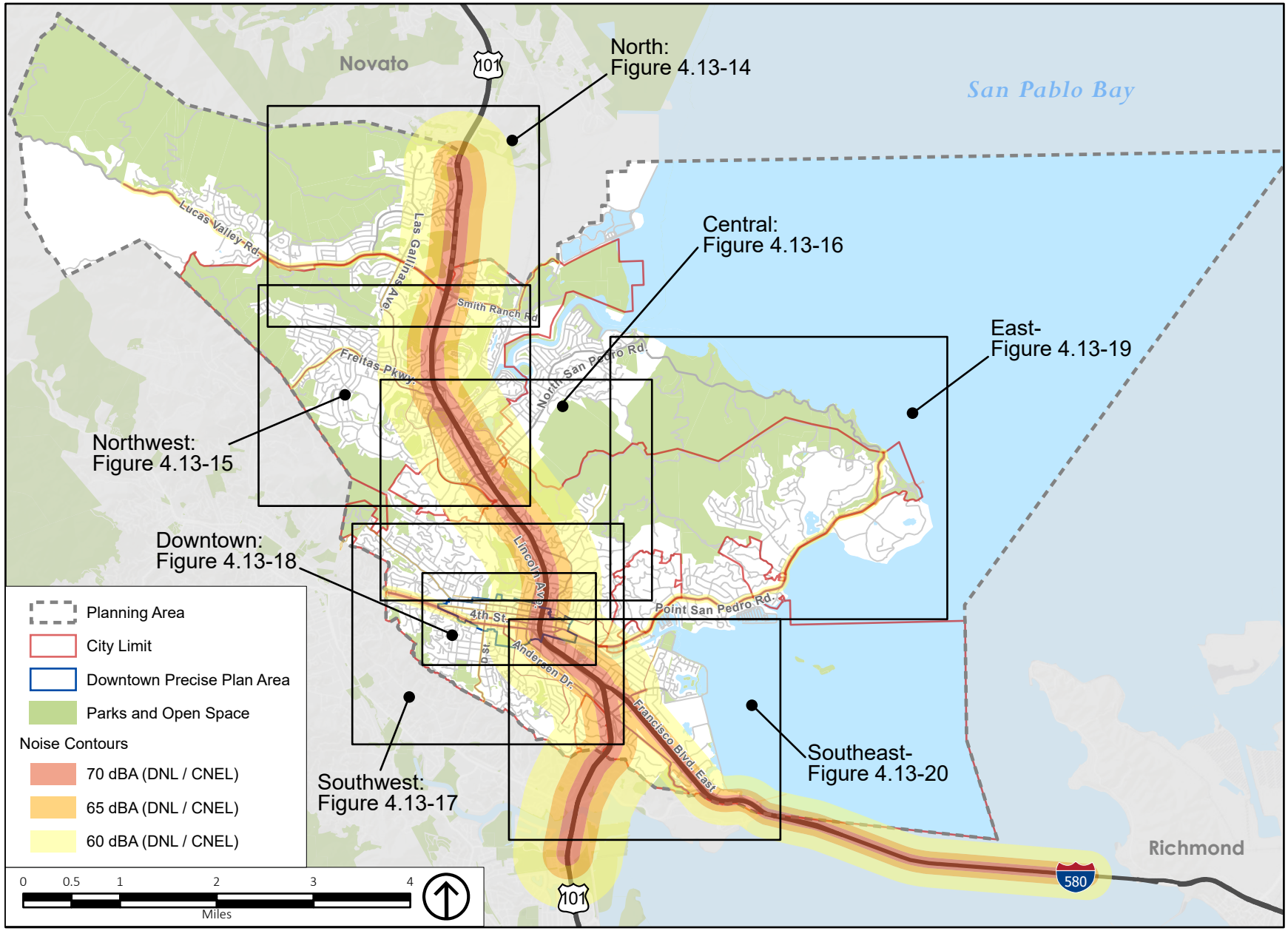
As shown in Table 4.13-8, traffic noise increases along roadways are generally in the range of 0 to 1.5 dBA CNEL with implementation of the proposed 2040 General Plan, and therefore, traffic noise increases would be *less than significant*.

Increases over 1.5 CNEL are indicated in a few locations, but these areas are subject to a higher threshold of significance (see Section 4.13.2.1, City of San Rafael Noise Limits, under the subheading "Traffic Noise") based on existing ambient noise levels, and thus would result in a *less than significant impact*.

TABLE 4.13-8 TRAFFIC NOISE INCREASES IN THE EIR STUDY AREA

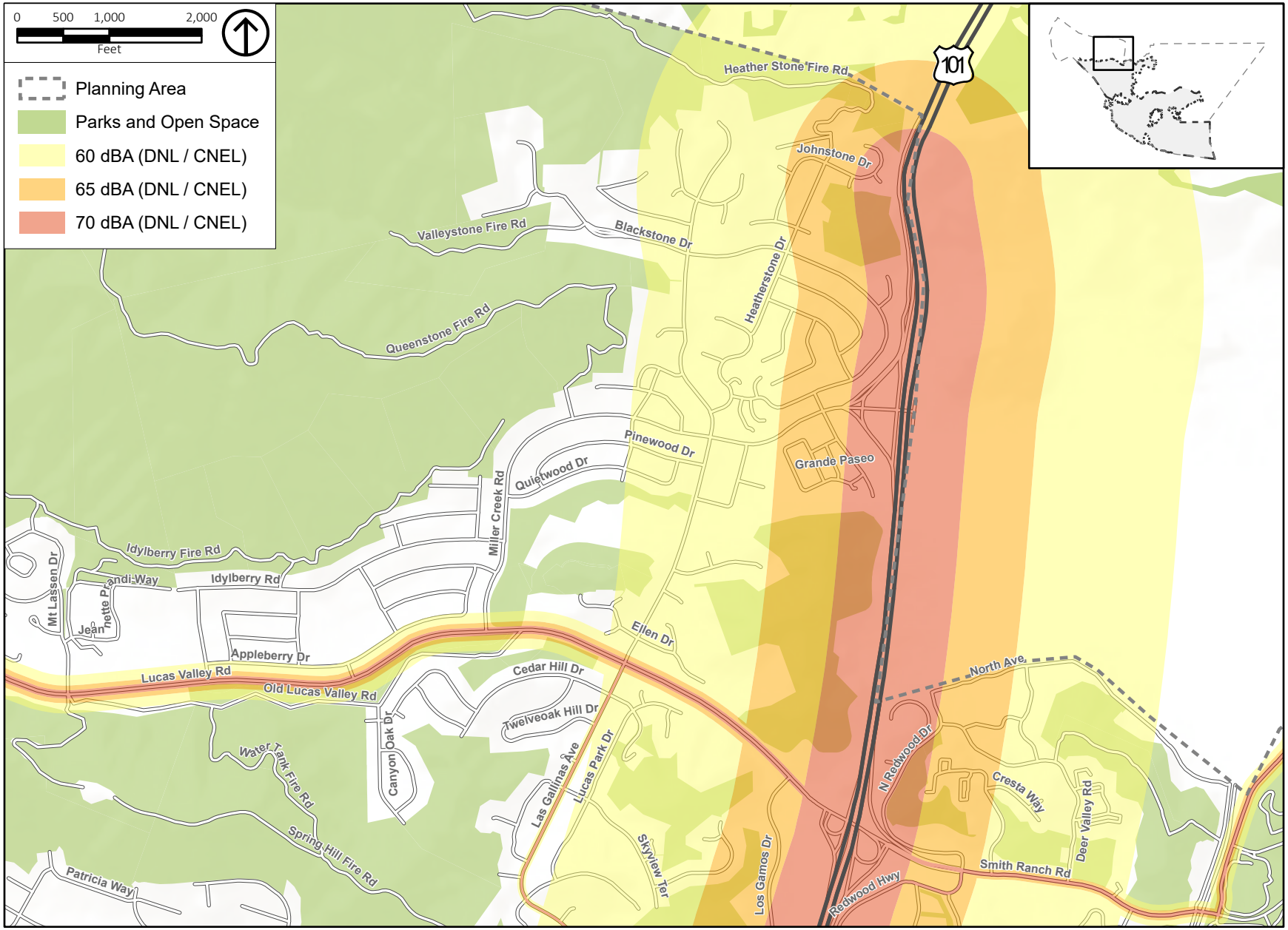
Roadway Segment	Existing L_{dn} (dBA) at 50 Feet	2040 General Plan L_{dn} (dBA) at 50 Feet	Increase	Threshold	Significant?
2nd St from 2nd-4th-Marquard to Hayes St	71.8	72.4	0.6	1.5	no
2nd St from Hayes St to Grand Ave	69.8	70.3	0.5	1.5	no
3rd St from Shaver St to Union St	67.5	68.4	0.8	1.5	no
3rd St from Union St to Mooring St	68.7	68.7	0.0	1.5	no
4th St from Ross Valley to 2nd-4th-Marquard	73.4	73.4	0.0	1.5	no
4th St from 2nd-4th-Marquard to Grand Ave	61.6	61.7	0.1	3	no
5th Ave from H St to Grand Ave	57.5	58.0	0.5	5	no
A St from 2nd St to 5th St	57.4	57.6	0.1	5	no
Andersen Dr from 2nd St to Bellam Blvd	65.2	65.5	0.3	1.5	no
Andersen from Bellam to Sir Francis Drake	69.2	69.3	0.0	1.5	no
Bellam from Andersen to Kerner	70.2	70.4	0.2	1.5	no
Civic Center Dr from Freitas to Merrydale O/C	63.9	64.9	1.0	3	no
Civic Center from Merrydale O/C to N San Pedro	59.5	61.0	1.6	5	no
D St from 4th to Bayview	62.9	63.0	0.1	3	no
Francisco Blvd East from Grand Ave to Bellam	65.8	66.3	0.5	1.5	no
Francisco East from Bellam to Main	67.2	68.0	0.9	1.5	no
Francisco West from 2nd St to Andersen	59.5	61.1	1.6	5	no
Freitas from Montecillo to Las Gallinas	65.8	66.2	0.4	1.5	no
Freitas from Las Gallinas to Del Presidio	69.3	70.2	1.0	1.5	no
Grand Ave from Villa to Mission Ave	58.0	58.3	0.3	5	no
Grand Ave from Mission to 2nd St	62.0	62.0	0.0	3	no
Hetherton from Mission to 2nd St	68.0	69.2	1.1	1.5	no
Irwin from Mission to 2nd St	67.2	68.1	0.9	1.5	no
Kerner from Canal to Bellam	61.0	61.0	0.0	3	no
Las Gallinas from Lucas Valley to Freitas	59.1	59.5	0.4	5	no
Las Gallinas from Freitas to Northgate	62.8	63.8	1.0	3	no
Lincoln from US-101 SB-Hammondale to Mission	62.3	63.8	1.4	3	no
Lincoln from Mission to Irwin	61.6	64.0	2.5	3	no
Lindaro from 3rd to Andersen	60.5	60.9	0.4	3	no
Los Ranchitos from Northgate to N San Pedro	60.0	60.9	0.9	3	no
Los Ranchitos from N San Pedro to Lincoln	59.9	62.1	2.3	5	no
Lucas Valley from Las Gallinas to US-101 SB Ramps	69.1	69.2	0.1	1.5	no
Mission from H St to Lincoln	57.9	58.4	0.5	5	no
Mission from Lincoln to Grand Ave	60.7	62.9	2.2	3	no
N San Pedro from Los Ranchitos to Civic Center	62.4	63.1	0.7	3	no
Northgate from Freitas to Los Ranchitos	56.9	57.9	1.0	5	no
Point San Pedro from Mooring to end	69.7	69.8	0.1	1.5	no
Redwood Highway from Smith Ranch to Freitas	63.9	63.9	0.0	3	no
Smith Ranch from US-101 NB Ramps to Silvera	65.5	65.5	0.0	1.5	no
Woodland from Lindaro to Irwin	58.1	59.4	1.3	5	no
Woodland from Irwin to Bellam	61.3	62.6	1.3	3	no

Source: Based on FHWA's traffic noise prediction model methodology using roadway volumes, vehicle mix, time of day splits, and number of lanes provided by Fehr & Peers, 2020 (see Appendix H, Noise Data, of this Draft EIR).



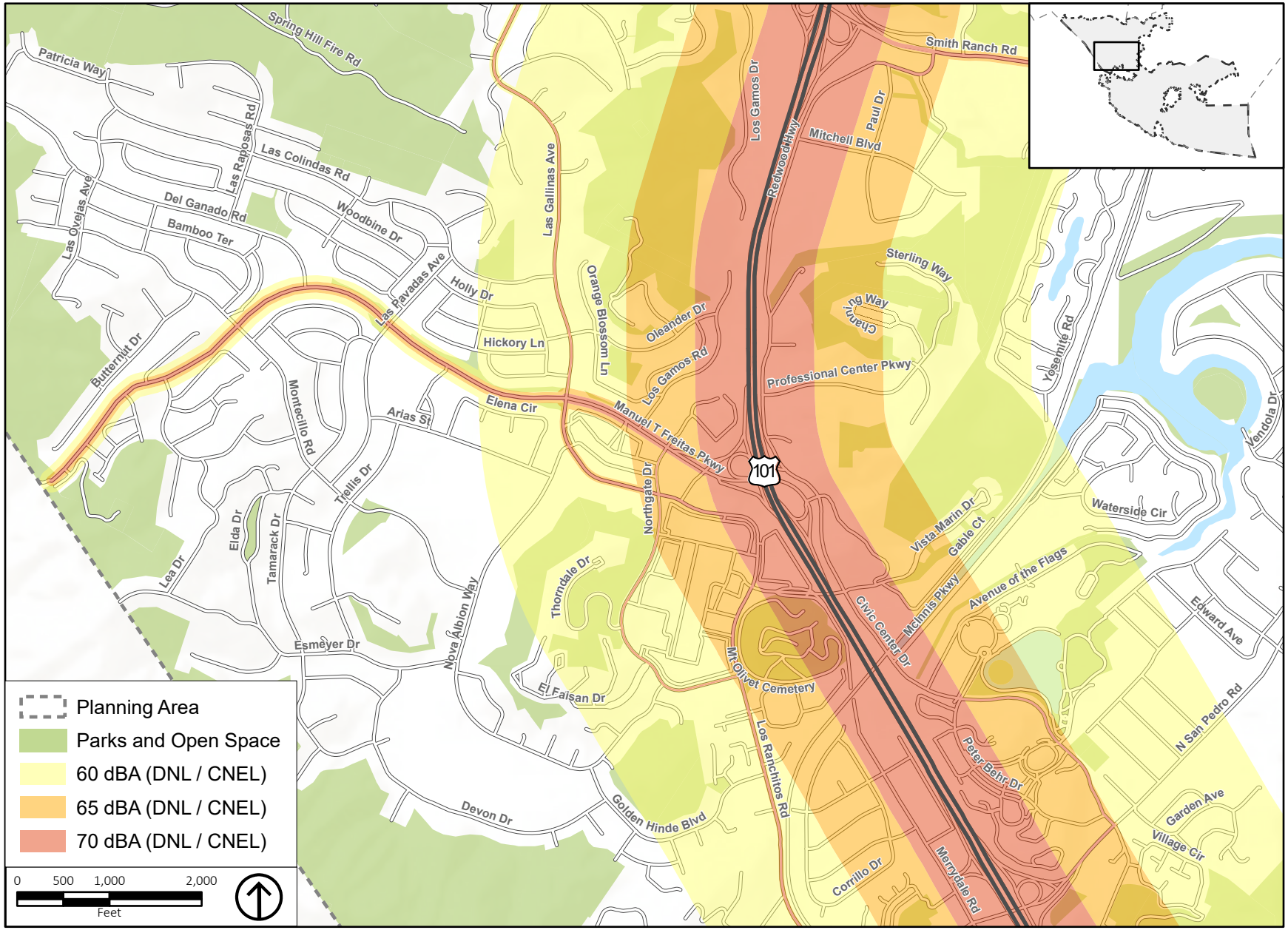
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-12
2040 Traffic Noise Contours-Planning Area



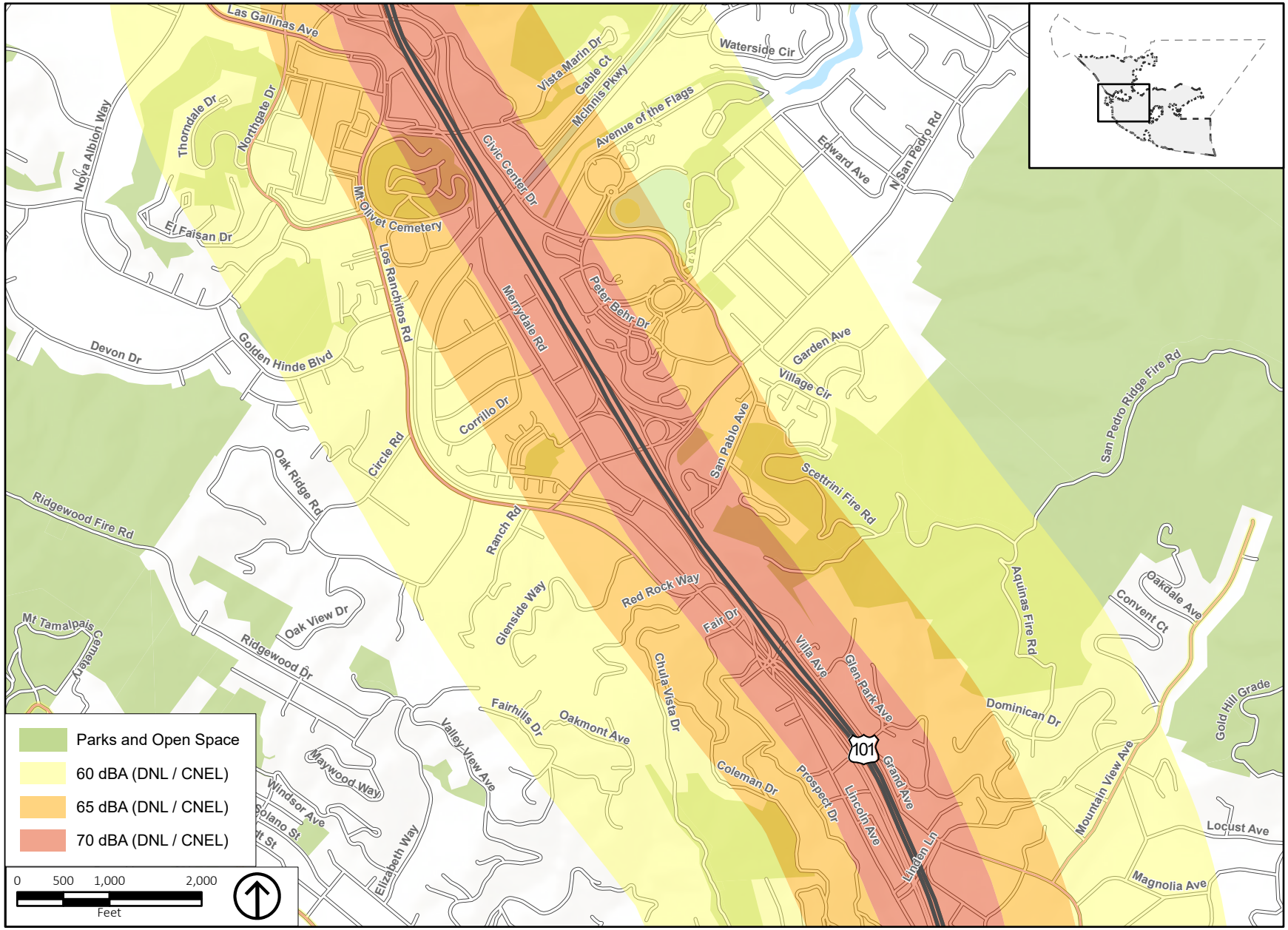
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-13
2040 Traffic Noise Contours-North



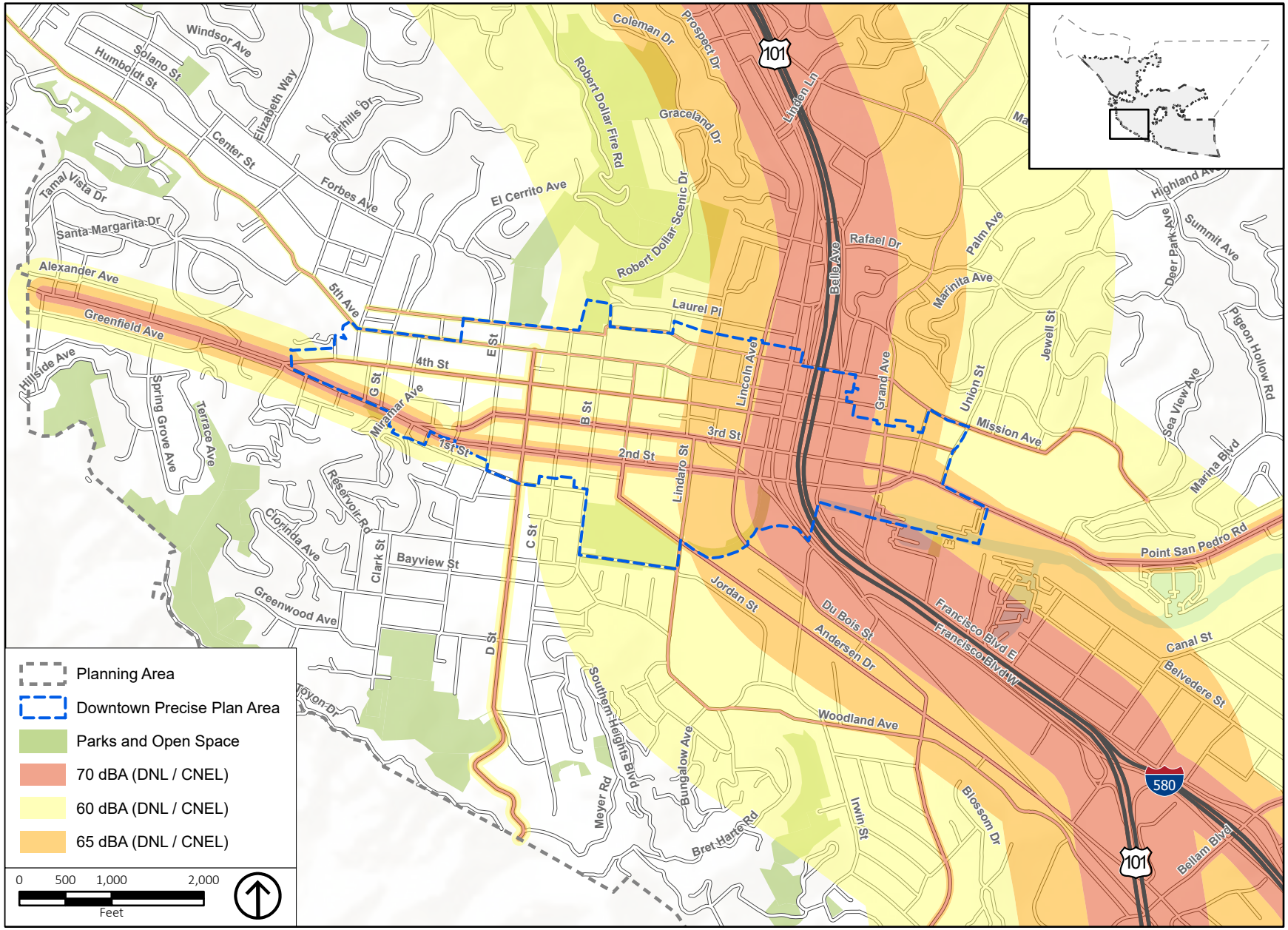
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-14
2040 Traffic Noise Contours-Northwest



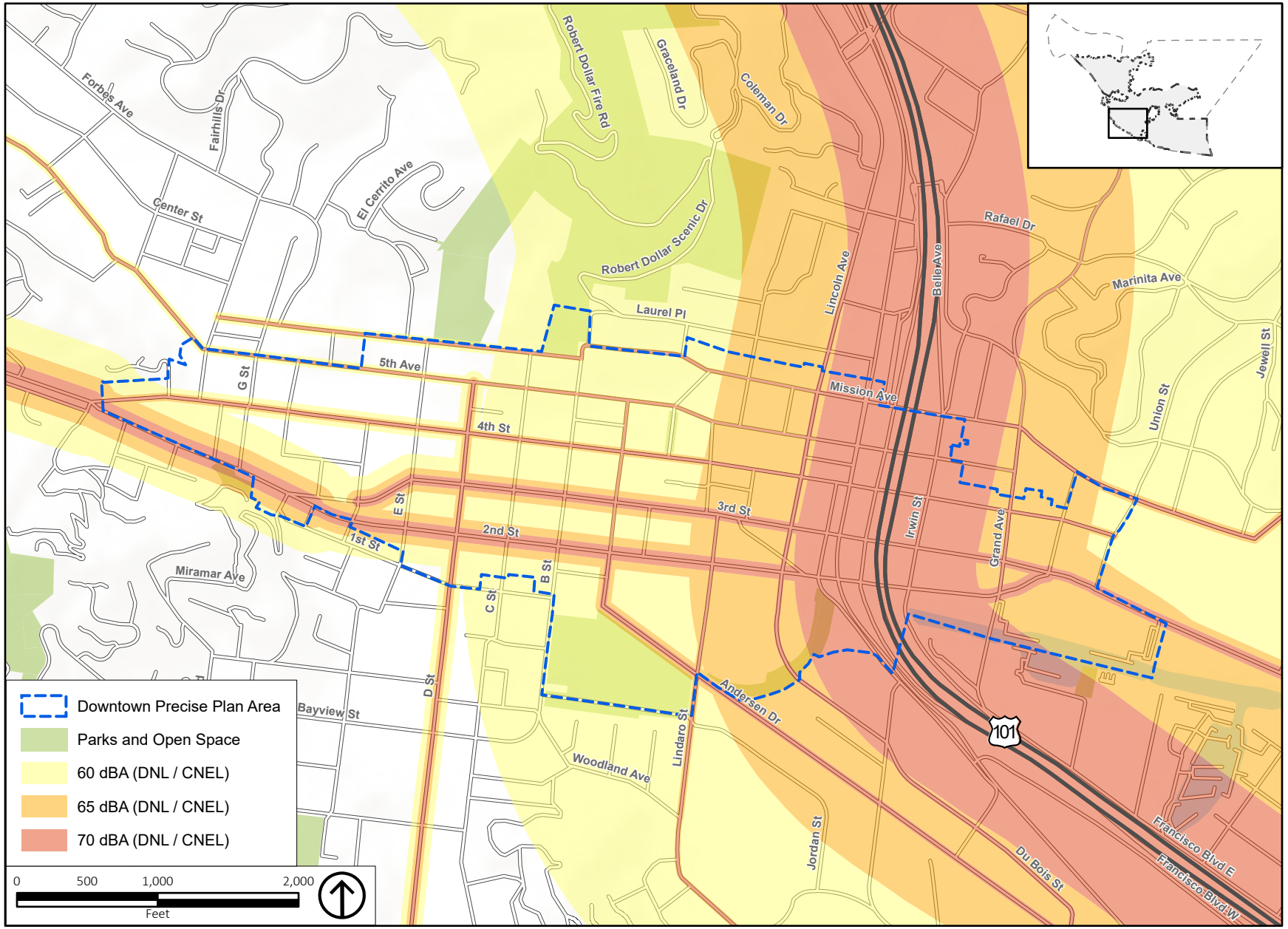
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-15
2040 Traffic Noise Contours-Central



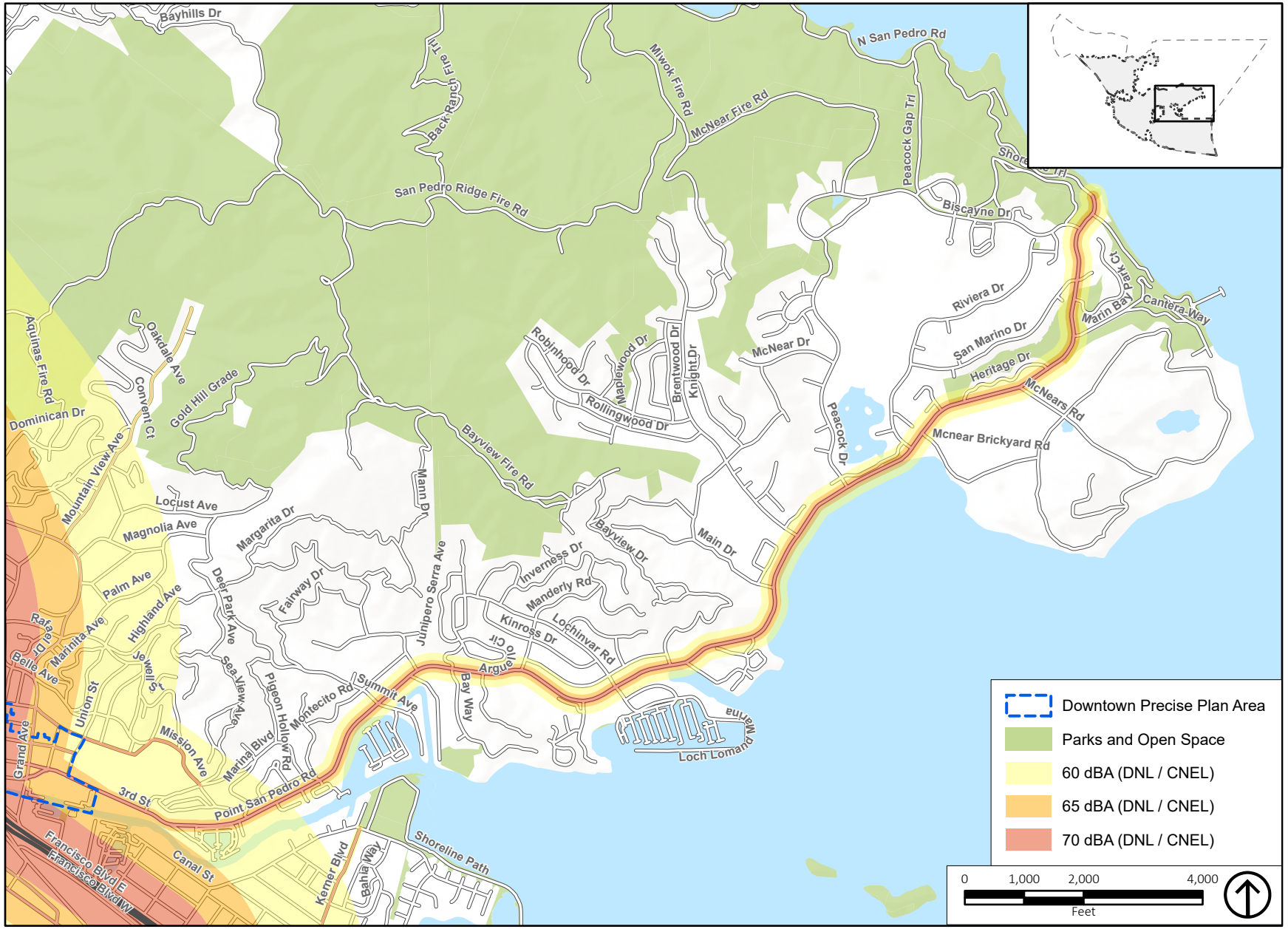
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-16
2040 Traffic Noise Contours-Southwest



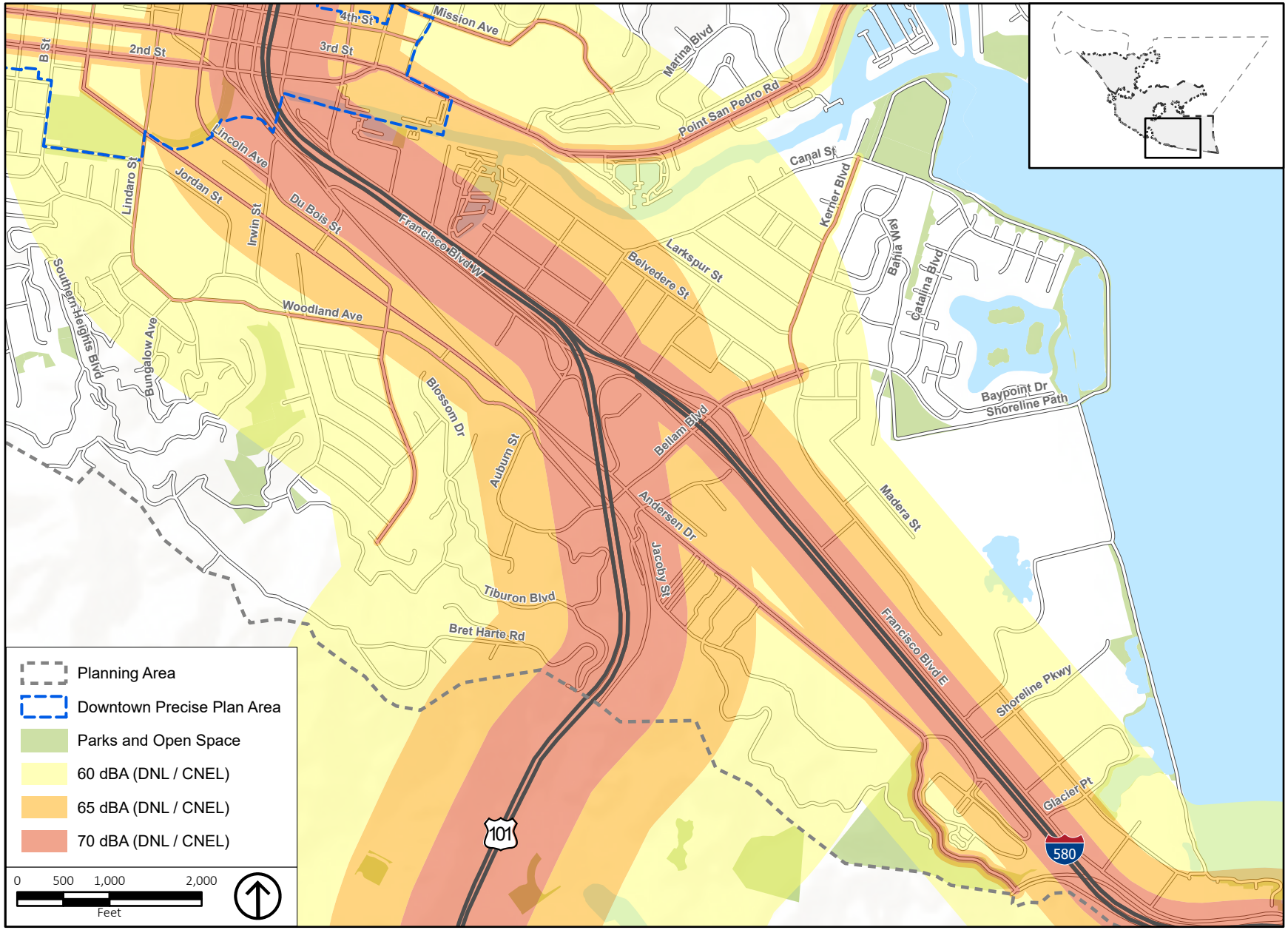
Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-17
2040 Traffic Noise Contours -Downtown



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-18
2040 Traffic Noise Contours-East



Source: ESRI, 2017; County of Marin, 2009; City of San Rafael, 2019; PlaceWorks, 2019.

Figure 4.13-19
2040 Traffic Noise Contours-Southeast

The proposed Noise (N) Element contains a goal, policies, and a program that require local planning and development decisions to consider noise-related impacts from transportation. The following General Plan 2040 goal, policies, and programs would further minimize potential adverse noise-related impacts from traffic:

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.2: Maintaining Acceptable Levels of Noise. Use the following performance standards to maintain an acceptable noise environment in San Rafael:
  - New development shall not increase noise levels by more than 3 dB Ldn in a residential area, or by more than 5 dB Ldn in a non-residential area.
  - New development shall not cause noise levels to increase above the "normally acceptable" levels shown in Table N-1.
  - For larger projects, the noise levels in (a) and (b) should include any noise that would be generated by additional traffic associated with the new development.
  - Projects that exceed the thresholds above may be permitted if an acoustical study determines that there are mitigating circumstances (such as higher existing noise levels) and nearby uses will not be adversely affected.
- Program N-1.3C: Noise Barriers. Where appropriate, use absorptive noise barriers to reduce noise levels from ground transportation and industrial noise sources. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.
- Policy N-1.4: Sound Walls. Discourage the use of sound walls when other effective noise reduction measures are available. Vegetation, berms, and the mitigation measures in Policy N-1.3 are the preferred methods of absorbing sound along roads, rail, and other transportation features. Where there are no other feasible options (for example, along many sections of US Highway 101), the City will review and comment on sound wall design. Any sound walls should be aesthetically pleasing, regularly maintained, and designed to minimize the potential displacement of sound.
- Policy N-1.6: Traffic Noise. Minimize traffic noise through land use policies, law enforcement, street design and improvements, and site planning and landscaping.
- Program N-1.6A: Interagency Coordination. Work with Caltrans, Marin County, the Transportation Authority of Marin, and other agencies to achieve noise reduction along freeways and major arterials in San Rafael. This shall include noise mitigation measures in any redesign plan for the I-580/US 101 interchange.
- Program N-1.6B: California Vehicle Code. Enforce applicable sections of the California Vehicle Code relating to noise.
- Program N-1.6C: Paving and Transit Improvements. Pursue cost-effective paving technologies to minimize traffic noise and support the use of quieter buses and other mass transit vehicles. Noise reduction should be considered an important benefit as the City and its transit service providers transition to electric vehicles.

Rail Noise

Due to the establishment of a Quiet Zone in Marin County, noise from the SMART rail is not substantial much beyond the rail right-of-way. Train operators are not required to sound their horn at grade crossings due to the Quiet Zone. However, the train operator may still sound their horn in the case of emergencies at their discretion. Ambient noise monitoring at the long-term monitoring location LT-2 indicates that the 60 L_{dn} noise contour from SMART rail activity does not extend beyond 50 feet from the railroad centerline. Furthermore, the proposed Noise (N) Element contains a goal, policy, and program that require local planning and development decisions to consider noise-related impacts from rail. The following General Plan 2040 goal, policy, and program would further minimize potential adverse noise-related impacts from trains.

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.8: Train Noise. Work with Sonoma Marin Area Rail Transit (SMART) to minimize noise and vibration associated with train service and to reduce the potential for impacts on nearby residences.
  - Program N-1.8A: Quiet Zones. Maintain the Marin County designated "Quiet Zone" along the rail line. The Zone ensures that train horns are not sounded except when trains are leaving the station, or if there is an emergency.

Stationary Source Noise

Stationary sources of noises may occur on all types of land uses. Residential uses would generate noise from landscaping, maintenance activities, and air conditioning systems. Commercial uses would generate noise from HVAC systems, loading docks, and other sources. Industrial uses may generate noise from HVAC systems, loading docks, and possibly machinery. Noise generated by residential or commercial uses is generally short and intermittent. Industrial uses may generate noise on a more continual basis. Nightclubs, outdoor dining areas, gas stations, car washes, fire stations, drive-throughs, swimming pool pumps, school playgrounds, athletic and music events, and public parks are other common noise sources. Stationary noise sources are controlled by SRMC Chapter 8.13, Noise. Furthermore, the proposed Noise (N), Land Use (LU), Parks, Recreations and Open Space (PROS), and Equity, Diversity, and Inclusion (EDI) Elements contain goals, policies, and programs that require local planning and development decisions to consider noise-related impacts from stationary sources. The following General Plan 2040 goals, policies, and programs would further minimize potential adverse noise-related impacts from stationary sources.

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.3: Reducing Noise Through Planning and Design. Use a range of design, construction, site planning, and operational measures to reduce potential noise impacts.
  - Program N-1.3A: Site Planning. Where appropriate, require site planning methods that minimize potential noise impacts. By taking advantage of terrain and site dimensions, it may be possible to arrange buildings, parking, and other uses to reduce and possibly eliminate noise conflicts. Site planning techniques include:
    - Maximizing the distance between potential noise sources and the receiver.

  - Placing non-sensitive uses such as parking lots, maintenance facilities, and utility areas between the source and receiver.
  - Using non-sensitive uses such as garages to shield noise sensitive areas.
  - Orienting buildings to shield outdoor spaces from noise sources.
  - Incorporating landscaping and berms to absorb sound.
- Program N-1.3B: Architectural Design. Where appropriate, reduce the potential for noise conflicts through the location of noise-sensitive spaces. Bedrooms, for example, should be placed away from freeways. Mechanical and motorized equipment (such as air conditioning units) should be located away from noise-sensitive rooms. Interior courtyards with water features can mask ambient noise and provide more comfortable outdoor spaces.
- Program N-1.3C: Noise Barriers. Where appropriate, use absorptive noise barriers to reduce noise levels from ground transportation and industrial noise sources. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.
- Policy N-1.9: Maintaining Peace and Quiet. Minimize noise conflicts resulting from everyday activities such as construction, sirens, yard equipment, business operations, night-time sporting events, and domestic activities.

In addition, the General Plan 2040 includes programs that support a reduced noise environment, such as Programs LU-2.7A, PROS-1.13B, and EDI-2.5A.

Land Use Compatibility

As a result of the Supreme Court decision regarding the assessment of the environment's impacts on projects (*California Building Industry Association v. Bay Area Air Quality Management District*, 62 Cal. 4th 369 (No. S 213478), December 17, 2015), it is generally no longer the purview of the CEQA process to evaluate the impact of existing environmental conditions on any given project. As a result, while the noise from existing sources is taken into account as part of the baseline, the direct effects of exterior noise from nearby noise sources relative to land use compatibility of a future project as a result of General Plan buildout is typically no longer a required topic for impact evaluation under CEQA. Generally, no determination of significance is required with the exception of certain school projects, projects affected by airport noise, and projects that would exacerbate existing conditions (i.e., projects that would have a significant operational impact). As required by General Plan 2040 Policy N-1.1, the noise and land use compatibility standards would be applied in land use decisions, including maintaining the maximum noise standards for outdoor and common use areas, as specified in General Plan 2040 Program N-1.1A. At the discretion of the San Rafael Building Division, requirements may include, but not necessarily be limited to, acoustical studies that show noise reduction features, acoustical design in new construction, and other methods that provide compliance with the California Building Code (adopted in SRMC Chapter 12.12, California Building Code) and City provisions for acceptable indoor and outdoor noise levels.

Significance without Mitigation: Less than significant.

Downtown Precise Plan: Operational Noise

As previously stated, roughly half of the anticipated potential future development by 2040 is expected to occur within the boundaries of the Downtown Precise Plan Area. As with the previous discussion for potential future development in other parts of the city, the operation of future projects in the Downtown Precise Plan Area would be required to comply with the General Plan goals, policies, and programs that would minimize operational noise impacts associated with traffic, trains, stationary uses, and land use compatibility. Future development in the Downtown Precise Plan Area would also be required to comply with the California Building Code (adopted in SRMC Title 12, Building Regulations) and City provisions for acceptable indoor and outdoor noise levels Therefore, impacts from development in the Downtown Precise Plan Area are likewise *less than significant*.

Significance without Mitigation: Less than significant.

NOISE-2 Implementation of the proposed project could result in generation of excessive groundborne vibration or groundborne noise levels.

General Plan 2040: Construction Vibration

Construction of future projects within the EIR Study Area could generate varying degrees of ground vibration, depending on the construction procedures and equipment. Operation of construction equipment generates vibration that spreads through the ground and diminishes with distance from the source. The effect on buildings in the vicinity of a construction site varies depending on soil type, ground strata, and the type of materials the buildings constructed from. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to slight structural damage at the highest levels. Vibration from construction activities rarely reaches the levels that can cause architectural damage but can annoy people in buildings close to the construction site. Table 4.13-9 lists typical vibration levels for construction equipment in terms of Peak Particle Velocity (PPV), which as previously described is the peak rate of speed at which soil particles move due to ground vibration. PPV is measured in inches per second or in/sec.

TABLE 4.13-9 VIBRATION LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Approximate PPV Vibration Level at 25 Feet (inches per second)
Pile Driver, Impact (Upper Range)	1.518
Pile Driver, Impact (Typical)	0.644
Pile Driver, Sonic (Upper Range)	0.734
Pile Driver, Sonic (Typical)	0.170
Vibratory Roller	0.210
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozer	0.003

Notes: Peak Particle Velocity (PPV) is the peak rate of speed at which soil particles move (e.g., inches per second or in/sec) due to ground vibration.
Source: Federal Transit Administration, 2018.

As shown in Table 4.13-9, vibration generated by construction equipment has the potential to be substantial, since it has the potential to exceed the FTA criteria for architectural damage (e.g., 0.12 in/sec PPV for fragile or historical resources, 0.20 in/sec PPV for non-engineered timber and masonry buildings, and 0.30 in/sec PPV for engineered concrete and masonry).

The proposed Noise (N) Element contains a goal, policy, and program that would require local planning and development decisions to consider vibration-related impacts. The following General Plan 2040 goal, policy, and program would minimize potential adverse noise-related impacts from construction vibration.

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.11: Vibration. Ensure that the potential for vibration is addressed when transportation, construction, and non-residential projects are proposed, and that measures are taken to mitigate potential impacts.
  - Program N-1.11A: Vibration-Related Conditions of Approval. Adopt standard conditions of approval to reduce the potential for vibration-related construction impacts for development projects near sensitive uses such as housing and schools. Vibration impacts shall be considered as part of project level environmental evaluation and approval for individual future projects.

While General Plan Program N-1.11A requires the City to adopt standard conditions of approval to reduce the potential of vibration related construction impacts near sensitive receptors, it does not include performance standards because the City has no adopted thresholds for vibration impacts. As described in Section 4.13.2.2, Federal Transit Administration Vibration Limits, establishes vibration limits from construction activities in order for impacts to be less than significant on a project-by-project basis. Therefore, without modifications to Program N-1.11A impacts are considered *potentially significant*.

Impact NOISE-2a: Construction activities associated with potential future development could generate excessive short-term vibration levels during project construction.

Mitigation Measure NOISE-2a: To ensure receptors, both buildings and people, that are sensitive to vibration from construction noise are not exposed to unacceptable vibration levels from discretionary development projects that are subject to CEQA the City shall revise General Plan Program N-1.11A (Vibration-Related Conditions of Approval) to support Policy N-1.11 (Vibration) be implemented as part of the project approval process. Revisions to Program N-1.11A are shown in double-underlined text:

- Modified Program N-1.11A: Construction Vibration-Related Conditions of Approval. Adopt standard conditions of approval in San Rafael Municipal Code Chapter 8.13, Noise, that require the Federal Transit Administration (FTA) criteria for acceptable levels of groundborne vibration for various types of buildings be applied to reduce the potential for vibration-related construction impacts for development projects near sensitive uses such as older or historically significant buildings and structures, housing, and schools. If vibration levels exceed the FTA limits, the condition of approval shall identify alternative uses, such as drilling piles instead of pile driving and static rollers instead of vibratory rollers. Construction vibration impacts shall be considered as part of project level environmental evaluation and approval for individual future projects.

Significance with Mitigation: Less than significant.

Downtown Precise Plan: Construction Vibration

As discussed in Chapter 4.5, Cultural Resources, of this Draft EIR, the Downtown Precise Plan Area has a 200-year legacy of being the cultural hub of Marin County and includes most of the historic buildings in the city. Because roughly half of the anticipated potential future development by 2040 is expected to occur within the boundaries of the Downtown Precise Plan Area, there is the potential for future projects to cause adverse impacts to buildings or structures that are identified as being extremely susceptible to vibration damage during the construction phase. The proposed Downtown Precise Plan has no specific policies, and the Downtown Code has no specific regulations to reduce vibration from construction; therefore, the impacts and mitigation described for the proposed General Plan 2040 would also apply in the Downtown Precise Plan Area. As with the previous discussion for potential future development in other parts of the city, future projects in the Downtown Precise Plan Area would be required to comply with the General Plan goal, policy, and program in the Noise Element that would require local planning and development decisions to consider vibration-related impacts and with the short-term vibration condition of approval to reduce vibration impacts to sensitive buildings and structures during construction following the adoption of the condition of approval as required by Mitigation Measure NOISE-2a. Therefore, impacts from potential future development in the Downtown Precise Plan Area would be likewise *less than significant* with implementation of Mitigation Measure NOISE-2a.

Significance with Mitigation: Less than significant.

General Plan 2040: Operational Vibration

Commercial and industrial operations in the EIR Study Area would generate varying degrees of ground vibration, depending on the operational procedures and equipment. Such equipment-generated vibrations would spread through the ground and diminish with distance from the source. The effect on buildings in the vicinity of the vibration source varies depending on soil type, ground strata, and receptor-building construction. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to slight structural damage at the highest levels. As discussed above, the 2014 Draft EIR for SMART found that residences located more than 40 feet from the railroad centerline (outside the rail right-of-way) would not experience perceptible vibration.[6]

Like construction vibration, the City does not have any adopted standards for operational vibration. As described in Section 4.13.2.2, Federal Transit Administration Vibration Limits, establishes vibration limits from operational activities in order for impacts to be less than significant on a project-by-project basis. For vibration annoyance from operational sources, the FTA recommends the following criteria for frequent events: 65 VdB for highly sensitive uses with vibration-sensitive equipment (e.g., microscopes in hospitals and research facilities) and 72 VdB for residences. Therefore, without a Program to address vibration from opertion impacts are considered *potentially significant*.

[6] Sonoma-Marin Area Rail Transit, 2014, *Downtown San Rafael to Larkspur Extension Environmental Assessment*.

Impact NOISE-2b: Operational activities associated with potential future development could generate excessive long-term vibration levels.

Mitigation Measure NOISE-2b: To ensure receptors that are sensitive to operational vibration from commercial or industrial uses are not exposed to unacceptable vibration levels from discretionary development projects that are subject to CEQA the City shall, shall adopt the following General Plan Program to support Policy N-1.11 (Vibration) be implemented as part of the project approval process:

- New Program: Adopt standard conditions of approval in San Rafael Municipal Code Chapter 8.13, Noise, that require the Federal Transit Administration (FTA) criteria for acceptable levels of groundborne vibration from commercial or industrial uses to reduce long-term vibration impacts at existing or potential future sensitive uses such as uses with vibration-sensitive equipment (e.g., microscopes in hospitals and research facilities) or residences. Operational vibration impacts shall be considered as part of project level environmental evaluation and approval for individual future projects.

Significance with Mitigation: Less than significant.

Downtown Precise Plan: Operational Vibration

Like construction impacts, the impacts from future projects in the Downtown Precise Plan Area could result in vibration-related impacts during operation to the numerous historic buildings located in this area of which some could be identified as being extremely susceptible to vibration damage. As with development in other parts of the city, future projects in the Downtown Precise Plan Area would be required to comply with the General Plan goal, policy, and program in the Noise Element that requires local planning and development decisions to consider vibration-related impacts as well as with and with the long-term vibration condition of approval to reduce vibration impacts to sensitive buildings and structures during operation following the adoption of the condition of approval as required by Mitigation Measure NOISE-2b. Therefore, long-term vibration impacts from the operation of potential future development in the Downtown Precise Plan Area are likewise *less than significant* with implementation of Mitigation Measure NOISE-2b.

Significance with Mitigation: Less than significant.

NOISE-3 Implementation of the proposed project could expose people residing or working within two miles of a private airstrip or airport to excessive noise levels.

General Plan 2040

As discussed in Section 4.13.1.5 under "Aircraft Noise," the San Rafael Airport is a private airstrip with minimal air traffic. As shown on Figure 4.13-10, airport noise contours do not extend much beyond the

runway, and airport noise does not significantly affect nearby sensitive receptors (i.e., all residences are outside of the 55 and 60 dBA L_{dn} noise contours).

The proposed Noise (N) Element contains one goal and policy that would require local planning and development decisions to consider noise-related impacts from the San Rafael Airport. The following General Plan 2040 goal and policy would minimize potential adverse noise-related impacts from the airport.

Goal N-1: Acceptable Noise Levels. Protect the public from excessive, unnecessary, and unreasonable noise.

- Policy N-1.7: Aviation-Related Noise. To the extent allowed by federal and state law, ensure that the noise impacts of any changes in facilities or operations are considered when granting or modifying use permits at the San Rafael Airport in North San Rafael and the heliport in East San Rafael.

Because the proposed General Plan 2040 would not cause a direct increase in flights and all residences are outside of the 55 and 60 dBA L_{dn} noise contours, impacts from future potential projects in the EIR Study Area would be *less than significant*.

Significance without Mitigation: Less than significant.

Downtown Precise Plan

Like potential future development in other parts of the city, potential future development in the Downtown Precise Plan Area is outside of the 55 and 60 dBA L_{dn} noise contours, and impacts from potential future projects in this area would likewise be *less than significant*.

NOISE-4 Implementation of the proposed project could result in a cumulatively considerable impact to noise impacts.

The analysis of the proposed project, discussed above, addresses cumulative impacts with regard to noise, groundborne noise, and vibration. Although multiple simultaneous nearby noise sources may, in combination, result in higher overall noise levels, this effect is captured and accounted for by the ambient noise level metrics that form the basis of the thresholds of significance for noise analysis. Any measurement of sound or ambient noise, whether for the purpose of evaluating land use compatibility, establishing compliance with exterior and interior noise standards, or determining point-source violations of a noise ordinance, necessarily will incorporate noise from all other nearby perceptible sources.

Additionally, although noise attenuation is influenced by a variety of topographical, meteorological, and other factors, noise levels decrease rapidly with distance, and vibration impacts decrease even more rapidly. Therefore, site-level cumulative noise or vibration impacts across city boundaries occur only infrequently. The city of San Rafael shares borders with other incorporated and unincorporated communities and similarly urbanized areas, which makes cross-border cumulative noise and vibration impacts possible. Nevertheless, given the Noise Element policies and SRMC requirements discussed above, it is unlikely that operations-related noise would, in combination with noise sources from adjacent

cities, result in cumulative noise impacts. Additionally, because any noise measurements taken in conjunction with Noise Element policies or SRMC requirements would necessarily account for noises received from outside the boundaries of the city of San Rafael, the ongoing implementation of these policies and regulations under the proposed project would serve to prevent site-based cumulative noise impacts. Furthermore, impacts related to construction and operational noise were found to be less than significant with implementation of Mitigation Measure NOISE-1, NOISE-2a and NOISE-2b.

Similarly, the noise contours and traffic-related noise levels developed for the proposed project include and account for regional travel patterns as they affect traffic levels in San Rafael. Noise contours were based upon both existing and projected future traffic volumes that incorporate cumulative regional effects and trends. Existing noise contours were derived from traffic volumes based on counts of current traffic, and these traffic counts inherently include cumulative traffic, as generated by regional trips. With regard to future noise, projected noise contours were determined using projected 2040 traffic volumes; these data account for growth in San Rafael under the proposed project as well as anticipated regional growth. The future noise modeling that served as the foundation for the overall project analysis was therefore based on future, cumulative conditions. Additionally, the proposed Mobility (M) Element, which would be adopted as part of the proposed project, contains goals, policies, and programs that would require local planning and development decisions to consider reductions in vehicle trips by providing for a circulation system that accommodates alternative modes of transportation. Additionally, the proposed project includes an update to the City's Zoning Ordinance for the Downtown Precise Plan Area that would promote travel patterns oriented to pedestrian, transit, and bicycle use; thus further reducing noise from motorized transportation sources.

Impacts NOISE-1 through NOISE-3 therefore encompass and address cumulative noise impacts from implementation of the proposed project. As discussed under Impact NOISE-1, NOISE-2a, and NOISE-2b, with the uniform application of pertinent policies and programs of the General Plan, as well as all mitigation measures, the proposed project would not result in a cumulatively considerable impact related to noise and vibration and cumulative impacts would be *less than significant.*

Significance with Mitigation: Less than significant.

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