5.12 NOISE

This section of the updated Draft Program Environmental Impact Report (PEIR) evaluates the potential for implementation of the General Plan Update (GPU) to result in noise impacts in the City of Santa Ana and its sphere of influence (plan area). This section discusses the fundamentals of sound; examines federal, state, and local noise guidelines, policies, and standards; reviews noise levels at existing receptor locations; evaluates potential noise and vibration impacts associated with the GPU; and provides mitigation to reduce noise and vibration impacts at sensitive locations. Noise monitoring and modeling data is included in Volume III, Appendix I-b.

The analysis in this section is based in part on the following technical report:

- *Santa Ana Noise Existing Conditions Report*, PlaceWorks, July 26, 2019

A complete copy of this study is included in the technical appendices (Appendix I-a).

Glossary

The following are brief definitions of terminology used in this section:

- **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 or a microphone.
- **Noise:** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale.
- **A-Weighted 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 root-mean-square 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), which is half of the sampling time, the changing noise levels are above this value and half of the time they are below it. This is 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 to be equivalent/interchangeable and are treated therefore in this assessment.

- **Peak Particle Velocity (PPV)**. The peak rate of speed at which soil particles move (e.g., inches per second) due to ground vibration.

- **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.

5.12.1 Environmental Setting

5.12.1.1 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). 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.

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.

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 of noise, 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

Sound pressure is measured through the A-weighted measure to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies.

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. A sound as soft as human breathing is about 10 times greater than 0 dBA. 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 dBA 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 pm to 10:00 pm and 10 dBA for the hours from 10:00 pm to 7:00 am. 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.

5. Environmental Analysis
NOISE

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, thereby affecting blood pressure, functions of 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 level of noise 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 5.12-1 shows typical noise levels from familiar noise sources.

Table 5.12-1 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 3 feet		
	90	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	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: Caltrans 2013a.

Vibration Fundamentals

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

Vibration can be natural—such as earthquakes, volcanic eruptions, or landslides—or man-made, such as explosions, heavy machinery, or trains. Both natural and man-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; for the purposes of soil displacement, is typically measured in inches or millimeters. Particle velocity is the rate of speed at which soil particles move in inches per second or millimeters per second. Table 5.12-2 presents the human reaction to various levels of peak particle velocity (PPV).

Table 5.12-2 Human Reaction to Typical Vibration Levels

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

Source: Caltrans 2013b.

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.

The way in which vibration is transmitted through the earth is called propagation. As vibration waves propagate from a source, the energy is spread over an ever-increasing area such that the energy level striking a given point is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced with distance as a result of material damping in the form of internal friction, soil layering, and void spaces. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

5. Environmental Analysis
NOISE

5.12.1.2 REGULATORY BACKGROUND

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-aided highway construction projects at a new location, or the physical alteration of an existing highway that significantly changes the horizontal or vertical alignment or increases the number of through-traffic lanes, require an assessment of noise and consideration of noise abatement per 23 CFR Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." The Federal Highway Administration (FHWA) has adopted noise abatement criteria for sensitive receivers—such as picnic areas, recreation areas, playgrounds, active sport areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals—when "worst-hour" noise levels approach or exceed 67 dBA Leq (Caltrans 2020)

US Environmental Protection Agency

In addition to FHWA standards, the EPA has identified the relationship between noise levels and human response. The EPA 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. These levels are relevant to planning and design and useful for informational purposes, but 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 EPA also set 55 dBA Ldn 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 Ldn, have settled on the 65 dBA Ldn level as their standard. At 65 dBA Ldn, activity interference is kept to a minimum, and annoyance levels are still low. It is also a level that can realistically be achieved.

US Department of Housing and Urban Development

The US Department of Housing and Urban Development (HUD) has set the goal of 65 dBA Ldn as a desirable maximum exterior standard for residential units developed under HUD funding (This level is also generally accepted within the State of California). Although HUD does not specify acceptable interior noise levels, standard construction of residential dwellings typically provides 20 dBA or more of attenuation with the windows closed. Based on this premise, the interior Ldn should not exceed 45 dBA.

Occupational Health and Safety Administration

The federal government regulates occupational noise exposure common in the workplace through the Occupational Health and Safety Administration (OSHA) under the EPA. Noise 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, as required under OSHA, and is therefore not addressed further in this analysis.

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 (OPR, 2017). 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 (CBC) is Title 24 of the California Code of Regulations. CBC Part 2, Volume 1, Chapter 12, Section 1207.11.2, Allowable Interior Noise Levels, requires that interior noise levels attributable to exterior sources not exceed 45 dBA in any habitable room. The noise metric is evaluated as either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL), whichever is consistent with the noise element of the local general plan.

The State of California's noise insulation standards for non-residential uses are codified in the California Code of Regulations, Title 24, Building Standards Administrative Code, Part 11, California Green Building Standards Code (CALGreen). CALGreen 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 (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 are generally incompatible in locations where the aircraft exterior noise level exceeds 65 dBA CNEL, 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.

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Local Regulations

City of Santa Ana Municipal Code

Chapter 18, Article VI, Noise Control, of the municipal code provides criteria for ambient noise measurements as well as noise standards for residential, school, hospital, and church uses. When non-transportation (stationary) noise is the noise source of concern, the City applies performance standards from Section 18.312 of the municipal code to ensure that noise producers do not adversely affect noise-sensitive land uses. Table 5.12-3, *Exterior Noise Standards*, summarizes the City's exterior noise standards.

Table 5.12-3 Exterior Noise Standards

Time Period	Noise Level (dBA)				
	L_{50}	L_{25}	L_8	L_2	L_{max}
7:00 am–10:00 pm	55	60	65	70	75
10:00 pm–7:00 am	50	55	60	65	70

Source: City of Santa Ana Municipal Code.
Note: A 5 dBA penalty shall be applied in the event of an alleged offensive noise such as impact noise, simple tones, speech, music, or any combination of thereof.
If the measured ambient level exceeds any of the first four noise limit categories, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.

Construction

The City of Santa Ana's noise ordinance exempts noise from construction activities that occur during the daytime. No construction is permitted outside of the hours in Section 18-314(e) of the Santa Ana Municipal Code, which restricts construction activities to the daytime hours of 7:00 am to 8:00 pm Monday through Saturday.

Vibration

The City of Santa Ana does not have specific limits or thresholds for construction vibration. The Federal Transit Administration (FTA) provides criteria for acceptable levels of groundborne vibration for various types of buildings. Structures amplify groundborne vibration; wood-frame buildings, such as typical residential structures, are more affected by ground vibration than heavier buildings. The level at which groundborne vibration is strong enough to cause architectural damage has not been determined conclusively, but the standards recommended by the FTA are shown in Table 5.12-4.

Table 5.12-4 Building Architectural Damage Limits

Building Category	PVV (in/sec)
I. Reinforced concrete, steel, or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Nonengineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

Source: FTA 2018.

5.12.1.3 EXISTING CONDITIONS

Ambient Noise Measurements

To determine a baseline noise level at different environments in the planning area, ambient noise monitoring was conducted by PlaceWorks in May of 2019. Measurements were made during weekday periods during peak morning and evening traffic hours, 7:00 am to 10:00 am and 3:00 pm to 7:00 pm. Long-term (24-hour) measurements were conducted at 5 locations, and short-term (15-minute) measurements were conducted at 16 locations in the plan area. All measurements were conducted Monday, May 13, through Wednesday, May 15, 2019.

The primary noise sources around the measurements were traffic, aircraft overflights, and rail noise. Commercial, industrial and government operations, and urban and rural activity noise (such as dogs barking and birds chirping) also contributed to the overall noise environment at some locations in the planning area. Meteorological conditions during the measurement periods were favorable for outdoor sound measurements and were noted to be typical for the season. Noise measurement locations are shown in Figure 5.12-1, *Approximate Noise Monitoring Locations*.

Ambient Noise Monitoring Results

During the ambient noise survey, the CNEL noise levels at monitoring locations ranged from 69 to 80 dBA CNEL. The long-term noise measurement results are summarized in Table 5.12-5, and a graphical summary of the daily trend during long-term noise measurements is provided in Appendix I-b. The short-term noise measurement results are summarized in Table 5.12-6.

Table 5.12-5 Long-Term Noise Measurements Summary (dBA)

Monitoring Location	Description	CNEL	Lowest Leq, 1-hr	Highest Leq, 1-hr
LT-1	2944 Fernwood Drive	69	56.5	72.9
LT-2	1406 N Harbor Boulevard	78	64.8	79.0
LT-3	1507 North Fairmont Street	73	58.6	73.4
LT-4	Normandy and Lyon Street	79	52.9	78.4
LT-5	7 Hutton Center Drive, east of Double Tree Hotel	80	66.4	77.5

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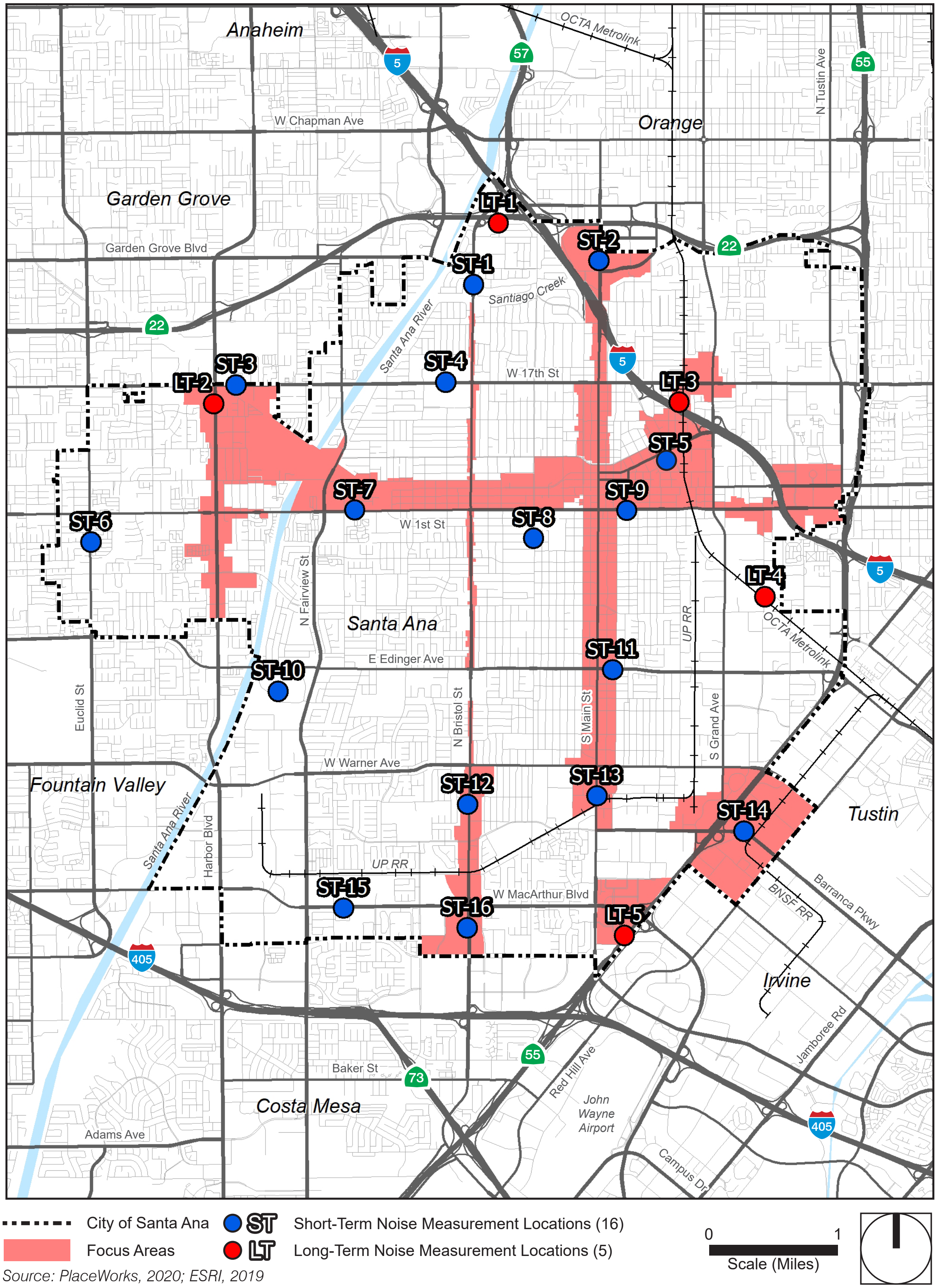
Table 5.12-6 Short-Term Noise Measurements Summary (dBA)

Monitoring Location	Description	15-minute Noise Level, dBA						
		L_{eq}	L_{max}	L_{min}	L_2	L_8	L_{25}	L_{50}
ST-1	Bristol Street south of Park Lane ≈ 45 ft east of NB centerline 7:17 AM, 5/14/2019	78.5	87.9	62.4	83.5	82.1	79.8	77.5
ST-2	Main Street north of Memory Lane ≈ 35 ft west of SB centerline 7:54 AM, 5/14/2019	73.2	82.6	52.5	79.9	77.9	75.0	69.4
ST-3	Westminster near Nautilus Drive ≈ 42 ft north of WB centerline 4:59 PM, 5/14/2019	70.1	89.0	55.1	77.3	73.1	70.5	67.5
ST-4	17th Street west of Bristol Street ≈ 37 ft south of EB centerline 3:16 PM, 5/14/2019	73.3	90.9	51.2	79.6	77.2	74.5	70.5
ST-5	Santiago Street, Near Santa Ana Regional Transportation Center ≈ 30 ft west of SB centerline 8:29 AM, 5/14/2019	65.0	79.8	50.4	73.3	69.6	64.1	60.1
ST-6	Near 330 Euclid Street ≈ 45 ft west of SB centerline 5:58 PM, 5/14/2019	76.9	87.6	60.7	83.3	80.7	77.8	74.9
ST-7	Near 2335 1st Street ≈ 45 ft north of WB centerline 4:03 PM, 5/14/2019	73.6	87.5	59.0	80.5	77.3	74.3	71.6
ST-8	412 Flower Street ≈ 45 ft west of SB centerline 9:36 AM, 5/14/2019	68.7	80.2	48.3	75.9	73.7	70.0	64.7
ST-9	1st Street near Maple Street ≈ 40 ft south of EB centerline 8:59 AM, 5/14/2019	75.5	88.3	59.4	82.3	80.1	76.6	71.8
ST-10	Centennial Regional Park 3:19 PM, 5/15/2019	54.6	73.5	46.1	60.9	57.4	54.2	52.0
ST-11	Near 218 Edinger Street ≈ 40 ft north of WB centerline 4:03 PM, 5/15/2019	72.2	87.2	49.7	78.5	76.1	73.3	70.4
ST-12	Near 2620 South Bristol Street ≈ 40 ft west of SB centerline 8:49 AM, 5/15/2019	69.8	88.0	53.2	75.9	73.6	70.8	67.1
ST-13	Near 2519 Main Street ≈ 42 ft west of SB centerline 9:27 AM, 5/15/2019	70.8	80.7	51.0	77.1	75.2	72.4	68.9
ST-14	Near 1821 Dyer Street ≈ 42 ft north of WB centerline 4:41 PM, 5/15/2019	70.0	83.9	56.8	77.3	74.1	70.8	65.4
ST-15	Near 2500 MacArthur Boulevard ≈ 45 ft south of EB centerline 7:31 AM, 5/15/2019	76.4	84.3	59.3	81.8	80.5	78.0	75.0
ST-16	Near 3650 South Bristol Street ≈ 55 ft west of SB centerline 8:11 AM, 5/15/2019	76.1	86.9	55.2	82.3	80.5	78.0	73.1

Notes: ft = feet, NB = northbound, SB = southbound, EB = eastbound, WB = westbound

Figure 5.12-1 - Approximate Noise Monitoring Locations



Source: PlaceWorks, 2020; ESRI, 2019

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Summary of Ambient Noise Monitoring

The noise environment in the plan area varies with location. However, freeway, rail, and local roadway traffic noise tend to dominate the noise environment, with the exception of ST-10 (Centennial Park) and ST-8 (412 Flower Street). The majority of Centennial Park is set back from adjacent roadways, and Flower Street is a lower-capacity roadway.

Existing Traffic Noise

On-road vehicles are the most prominent source of noise in the plan area. Figures 5.12-2 through 5.12-5 illustrate the modeled roadways and existing noise contours for 60 dBA CNEL, 65 dBA CNEL, and 70+ dBA CNEL. Appendix I-b contains the inputs and outputs used in existing traffic noise modeling.

Aircraft Noise

Aircraft noise is typically characterized as "occasional" throughout the plan area but can be intrusive to nearby sensitive receptors. There is one airport in Santa Ana, John Wayne Airport, whose noise contours are shown in Figure 5.12-6, *John Wayne Airport Noise Contours*. John Wayne Airport services commercial and private aircraft.

John Wayne Airport participates in a noise abatement program as part of California Airport Noise Standards and generates quarterly reports of long-term CNEL dB values. The noise abatement program has 10 noise monitoring sites (NMS) within the airport's neighboring cities, and one of them, NMS-9N, is at 1300 S Grand Avenue in Santa Ana.

Railroad Noise

Railroad operations are also a substantial source of noise in some parts of the plan area. Day-night average noise levels vary throughout the city depending on the number of trains per day along a given rail line, the timing and duration of train pass-by events, and whether or not trains must sound their warning whistles near "at-grade" crossings. Noise levels commonly range from 65 to 75 dBA CNEL at land uses adjoining a railroad right-of-way. When trains approach a passenger station or at-grade crossing, they are required to sound their warning whistle within a quarter mile. Train warning whistles typically generate maximum noise levels of 105 to 110 dBA at 100 feet. The day-night average noise level at locations immediately adjacent to at-grade crossings and exposed to multiple train pass-by events per day can exceed 85 dBA Ldn/CNEL.

There are several crossings in Santa Ana that are designated "quiet zones"—from 4th Street north to Santa Clara Avenue. In these locations, trains are not required to sound their warning whistle (though still may if the conductor deems it necessary for safety reasons). Table 5.12-7 contains the calculated distances to the 65 dBA CNEL contours from existing railroad noise, both from the main line and within a quarter mile of grade crossings where horn warnings are required. The noise contours are displayed graphically in Figures 5.12-2 through 5.12-5.

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Table 5.12-7 Existing Railroad Noise Levels

Operator	Subdivision	Distance (feet) to 65 dBA CNEL Contour (Main Line)	Distance (feet) to 65 dBA CNEL Contour (Within ¼ Mile of Grade Crossing)
BNSF	Irvine Industrial Lead	20	266
UP	Santa Ana Industrial Lead	30	361
SCRRA	Orange Subdivision	210	978

Source: Calculated using the FTA CREATE Model and FRA Grade Crossing Horn Model. See Appendix I-b.

Stationary Source Noise

Stationary sources of noises 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, and air conditioning (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 (such as at the Santa Ana Stadium), and public parks are other common noise sources.

Existing Vibration

Commercial and industrial operations in the plan area can generate varying degrees of ground vibration, depending on the operational procedures and equipment. Such equipment-generated vibrations 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. In addition, future sensitive receptors could be placed within close proximity to existing railroad lines through buildout in the plan area.

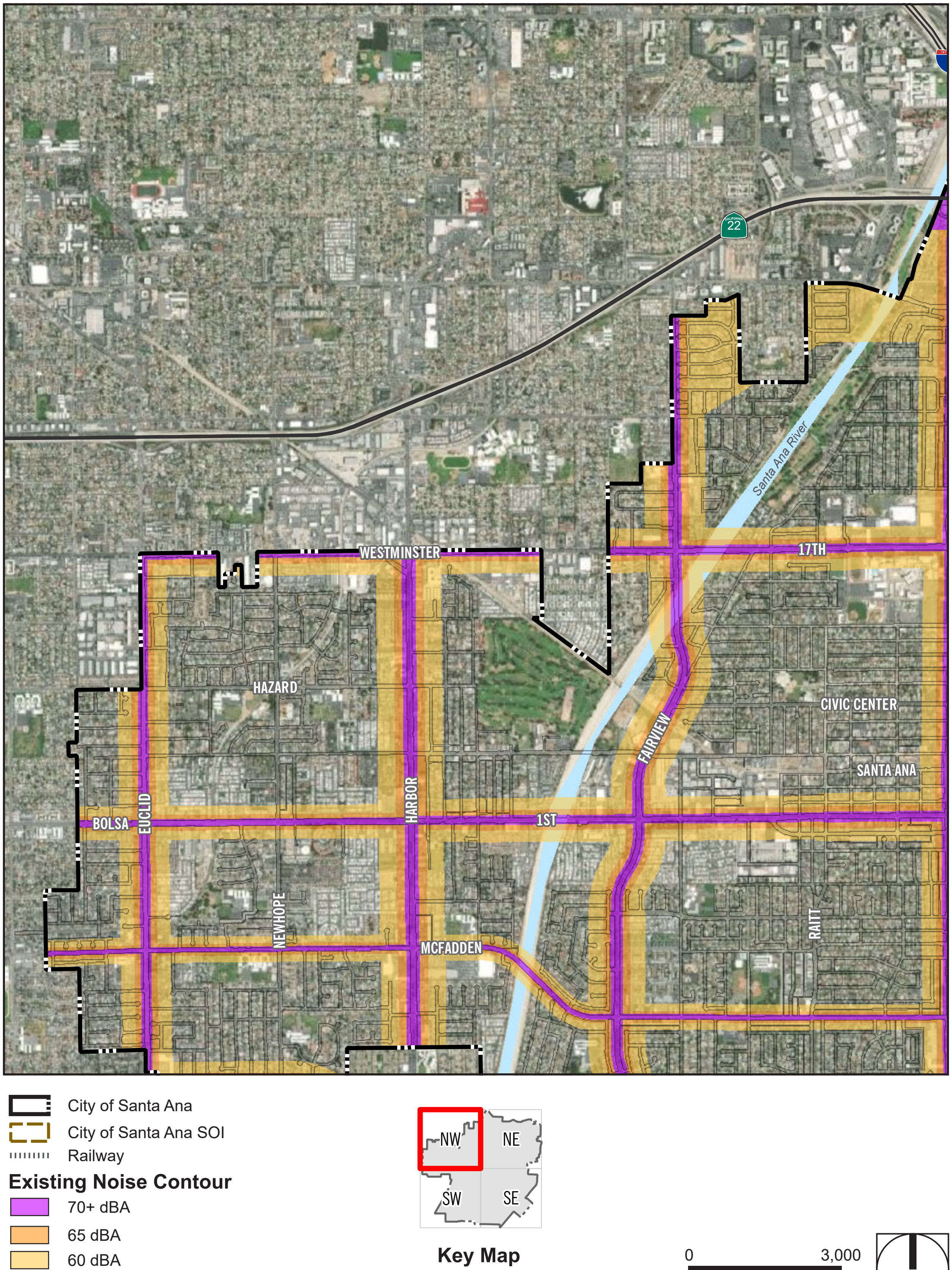
5.12.2 Thresholds of Significance

According to Appendix G of the California Environmental Quality Act (CEQA) Guidelines, a project would normally have a significant effect on the environment if the project would result in:

N-1 Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

N-2 Generation of excessive groundborne vibration or groundborne noise levels.

Figure 5.12-2 - Existing Transportation CNEL Noise Levels (Northwest Quadrant)



Source: PlaceWorks, 2020; IBI, 2020

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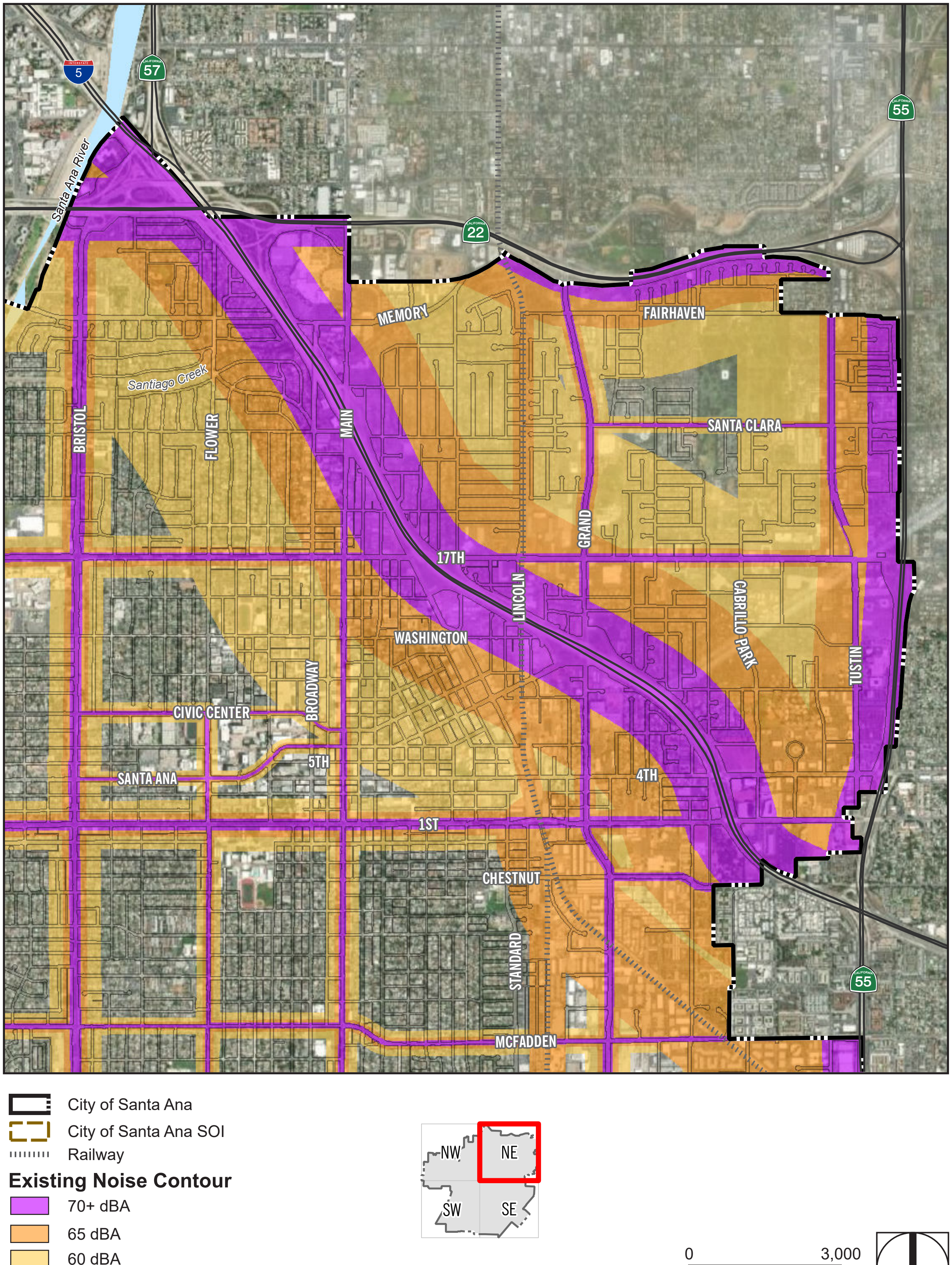
Figure 5.12-3 - Existing Transportation CNEL Noise Levels (Northeast Quadrant)



Source: PlaceWorks, 2020; IBI, 2020

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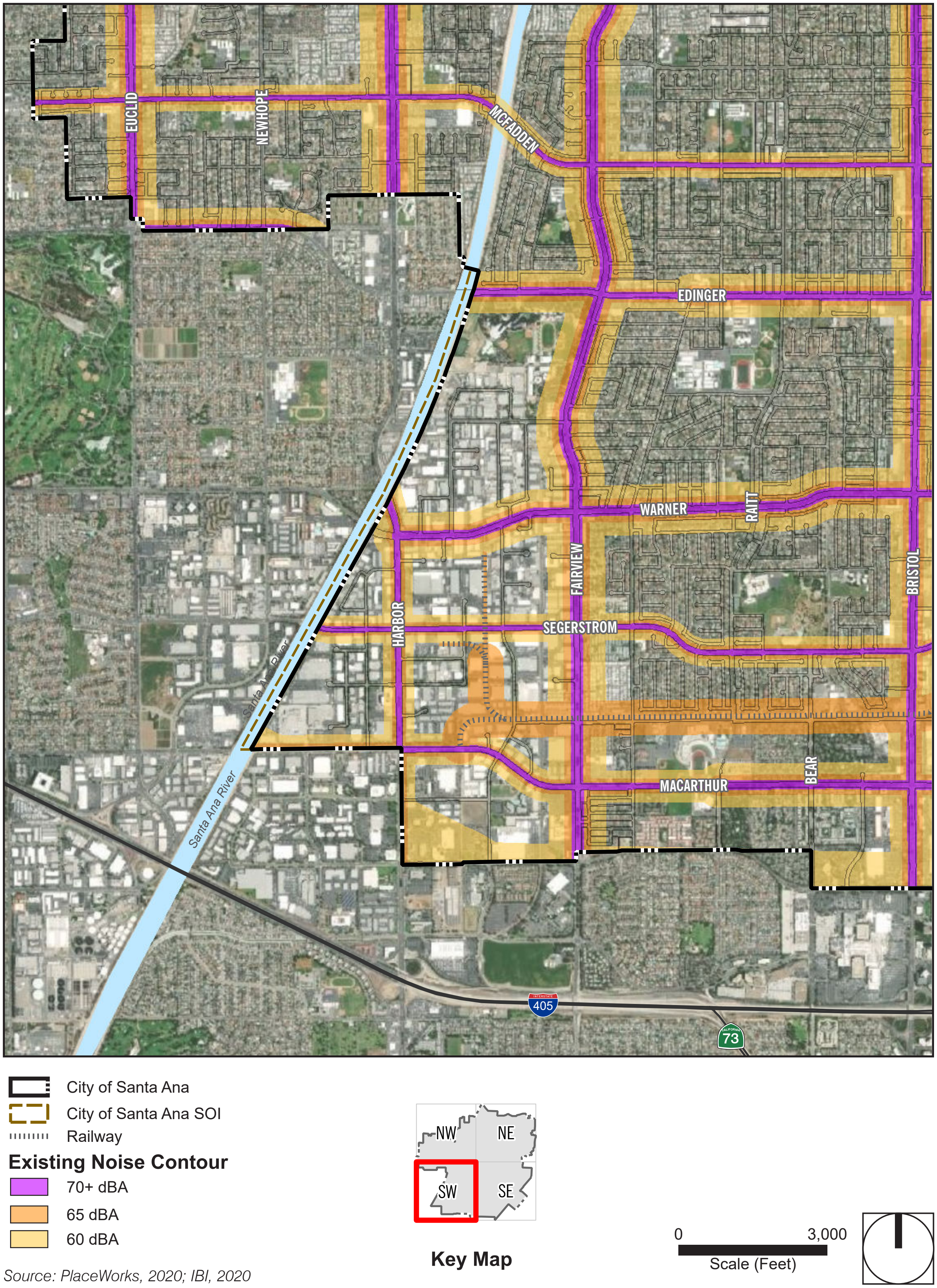
Figure 5.12-4 - Existing Transportation CNEL Noise Levels (Southwest Quadrant)



Source: PlaceWorks, 2020; IBI, 2020

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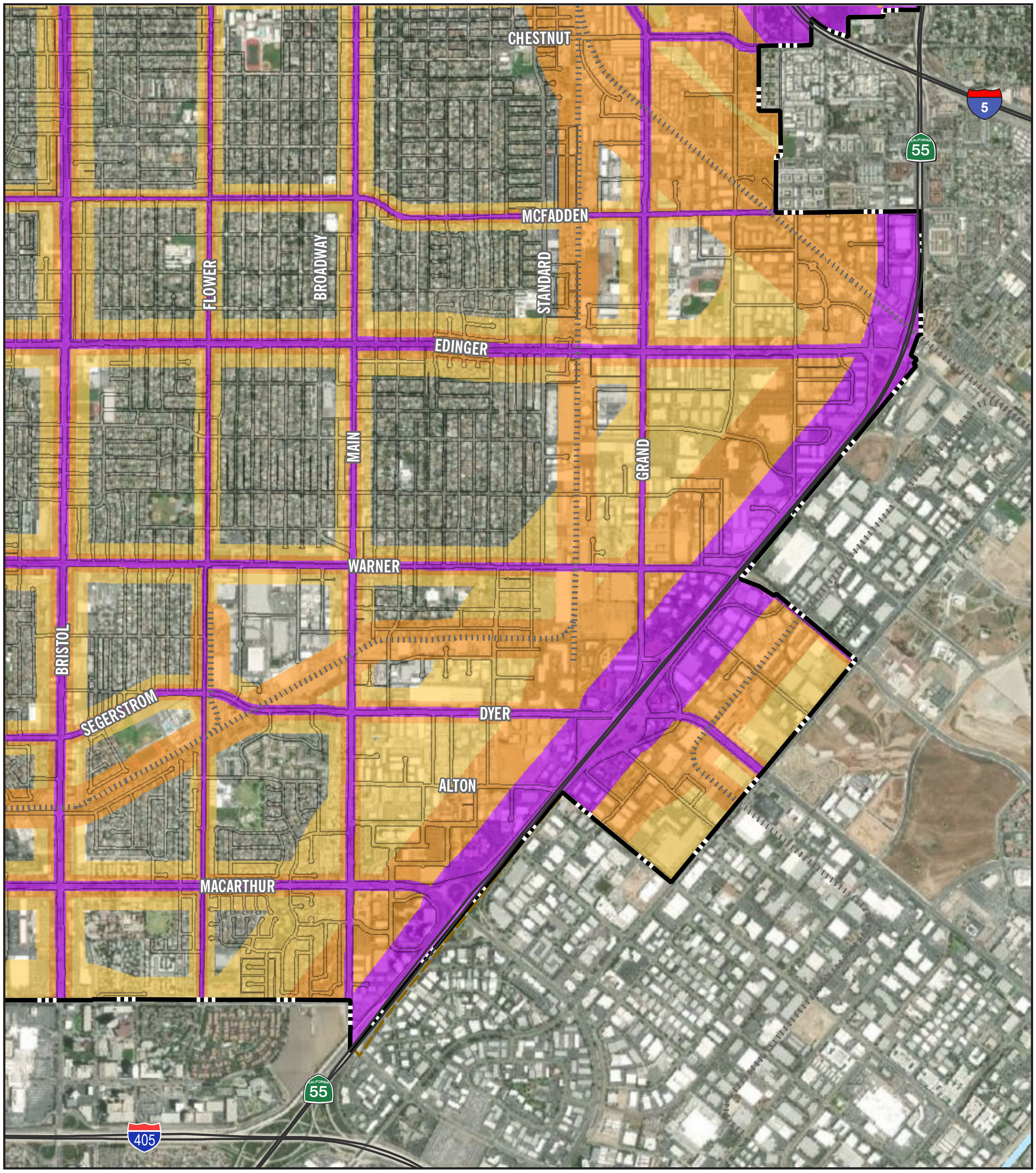
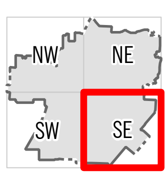
Figure 5.12-5 - Existing Transportation CNEL Noise Levels (Southeast Quadrant)





Key Map

Source: PlaceWorks, 2020; IBI, 2020

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Figure 5.12-6 - John Wayne Airport Noise Contours

Source: John Wayne Airport, 2019

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N-3 For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

5.12.2.1 THRESHOLD OF SIGNIFICANCE CRITERIA

Construction Noise Thresholds

The City of Santa Ana's noise ordinance exempts noise from construction activities that occur during the daytime. No construction is permitted outside of the hours specified in Section 18-314(e) of the Santa Ana Municipal Code, which restricts construction activities to the hours of 7:00 AM to 8:00 PM Monday through Saturday. The City has not established noise limits for temporary construction. Therefore, the FTA construction noise criterion of 80 dBA $L_{eq(8hr)}$ for will be used in this analysis to assess construction noise impacts at sensitive receptors.

Stationary Noise Thresholds

The Municipal Code provides noise standards for stationary sources that would be analyzed at the project level in Section 18.312 and summarized in Table 5.12-3.

Transportation Noise Thresholds

A project will normally have a significant effect on the environment related to noise 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 indiscernible. A change of 5 dBA is readily discernible to most people in an exterior environment. Based on this, the following thresholds of significance are used to assess traffic noise impacts at sensitive receptor locations:

- Greater than 1.5 dBA increase for ambient noise environments of 65 dBA CNEL and higher;
- Greater than 3 dBA increase for ambient noise environments of 60 -64 CNEL; and
- Greater than 5 dBA increase for ambient noise environments of less than 60 dBA CNEL.

Vibration Thresholds

Architectural Damage

The City of Santa Ana does not have specific limits or thresholds for construction vibration. Therefore, the standards recommended by the FTA shown in Table 5.12-4 are used in this analysis.

5.12.3 Regulatory Requirements and General Plan Update Policies

5.12.3.1 REGULATORY REQUIREMENTS

RR-NOI-1 **California Building Code:** The California Building Code (CBC), Title 24, Part 2, Volume 1, Chapter 12, Interior Environment, 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 day-night average sound level (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.

The State of California's noise insulation standards for non-residential uses are codified in the California Code of Regulations, Title 24, Building Standards Administrative Code, Part 11, California Green Building Standards Code (CALGreen). CALGreen 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 $L_{eq(1hr)}$.

RR-NOI-2 **Construction Noise Sources:** Section 18-314(e) of the Santa Ana Municipal Code prohibits construction activities to the hours of 7:00 AM to 8:00 PM Monday through Saturday.

RR-NOI-3 **Stationary Noise Sources:** Section 18.312 of the Santa Ana Municipal Code establishes standards for stationary noise sources (see Table 5.12-3).

5.12.3.2 GENERAL PLAN UPDATE POLICIES

Noise Element

The noise element aims to establish measures that address current and future noise problems. The proposed GPU includes goals and policies intended to avoid or reduce noise-related impacts. In most cases, no one goal or policy itself is expected to completely avoid or reduce an identified potential environmental impact. However, the collective, cumulative mitigating benefits of the policies listed below are intended to reduce noise-related impacts. Specific goals and policies are discussed in Section 5.12.4, *Environmental Impacts*, to demonstrate how the policy would avoid or reduce the impact.

Goal 1: Ensure that existing and future land uses are compatible with current and projected local and regional noise conditions.

- **Policy 1.1. Noise Standards:** Utilize established Citywide Noise Standards and guidelines to inform land use decisions and guide noise management strategies.
- **Policy 1.2. Sound Design:** Encourage ~~Require~~ functional and attractive designs to mitigate excessive noise levels. ~~to the City's acceptable interior and exterior noise limits (e.g., through the use of noise barriers, setbacks, sound-rated building materials, or other methods). In designing such mitigation, encourage attractive designs.~~

- **Policy 1.3. Regional Noise Impacts:** Collaborate with local and regional transit agencies and other jurisdictions to minimize regional traffic noise and other sources of noise in the City.
- **Policy 1.4. Sensitive Uses:** Protect noise sensitive land uses from excessive, unsafe, or otherwise disruptive noise levels.

GOAL 2: Reduce the impact of known sources of noise and vibration.

- **Policy 2.1**. **Transportation Related Noise:** Reduce noise generated from traffic, railroads, transit, and airports to the extent feasible.
- **Policy 2.2. Stationary Related Noise:** Minimize noise impacts from commercial and industrial facilities adjacent to residential uses or zones where residential uses are permitted.
- **Policy 2.3. Temporary and/or Nuisance Noise**: Minimize the effects of intermittent, short-term, or other nuisance noise sources.

GOAL 3: Protect sensitive land uses from airport related noise impacts.

- **Policy 3.1. Residential Development:** Residential development within the John Wayne Airport (JWA) 65 dB(A) CNEL Noise Contour or greater is not supported.
- **Policy 3.2. Flight Paths:** Advocate that future flight path selection be directed away from existing noise sensitive land uses.
- **Policy 3.3. Residential Mitigation:** Require all residential land uses in 60 dB(A) CNEL or 65 dB(A) CNEL Noise Contours to be sufficiently mitigated so as not to exceed an interior standard of 45 dB(A) CNEL.

The proposed noise and land use compatibility standards for various land uses are shown in Table 5.12-8, *Interior and Exterior Noise Compatibility Standards (dBA CNEL)*.

Table 5.12-8 Interior and Exterior Noise Compatibility Standards (dBA CNEL)

Categories	Land Use Categories	Interior[1]	Exterior[2]
Residential	Single-Family, Duplex, Multifamily	45[3]	65
Institutional	Hospital, School Classroom/Playgrounds	45	65
	Religious Facility, Library	45	--
Open Space	Parks	--	65

Notes:
[1] Interior areas (to include but are not limited to: bedrooms, bathrooms, kitchens, living rooms, dining rooms, private offices, and conference rooms).
[2] Exterior areas shall mean: private yards of single-family homes, park picnic areas, school playgrounds, common areas. Private open space, such as atriums on balconies, shall be excluded form exterior noise requirements provided sufficient common area is included within the project.
[3] Interior noise level requirements contemplate a closed window condition. Mechanical ventilation system or other means of natural ventilation shall be provided per Chapter 12 of the Uniform Building Code, as necessary.

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~~Circulation~~ Mobility Element

- **Policy CE-1.7. Proactive Mitigation**: Proactively mitigate potential air quality, noise, congestion, safety, and other impacts from the transportation network on residents and business.
- **Policy CE-1.8. Environmental Sustainability**: Consider air and water quality, noise reduction, neighborhood character, and street-level aesthetics when making improvements to travelways.
- **Policy CE-4.8. Noise Mitigation**: Encourage physical and operational improvements to reduce noise levels around major roads, freeways, and rail corridors, in particular around sensitive land uses.
- **Policy CE-5.2. Rail Corridors**: Coordinate with rail service providers to improve and maintain the aesthetics of rail corridors, ~~and~~ reduce noise levels, and mitigate traffic conflicts and other environmental hazards.

Safety Element

- **Policy 4.6 Deed Disclosure Notice.** Provide notice of airport in the vicinity where residential development is being proposed within the 60 dBA CNEL noise contours for the John Wayne Airport.

5.12.4 Environmental Impacts

5.12.4.1 METHODOLOGY

Traffic noise levels for existing and project conditions were estimated using the FHWA traffic noise prediction model methodology. Traffic volumes vehicle mix (auto, medium-duty truck, heavy-duty truck), time of day split (day, evening, night), speeds, and number of lanes data were provided by IBI for highway and roadway segments in the City for existing and 2045 General Plan buildout conditions (IBI 2020). 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. The complete distances to the 70, 65, and 60 dBA CNEL noise contours for roadway segments in the City are included in Appendix I-b.

As a result of the Supreme Court decision regarding the assessment of the environment's impacts on projects (*California Building Industry Association (CBIA) v. Bay Area Air Quality Management District (BAAQMD)*, 62 Cal. 4th 369 (No. S 213478) issued 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 no typically longer a required topic for impact evaluation under CEQA. Generally, no determination of significance is required except for certain school projects, project's affected by airport noise, and project's that would exacerbate existing conditions (i.e., projects that would have a significant operational impact). As required by noise element policy 1.1, noise levels will be considered in land use planning decisions to prevent future noise and land use incompatibilities. At the discretion of the Santa Ana Planning and Building Agency, considerations may include, but not necessarily be limited to, standards that specify acceptable noise limits for various land uses, noise-reduction features, acoustical design in new construction, and enforcement of the California Uniform Building Code and City provisions for indoor and outdoor noise levels.

5.12.4.2 IMPACT ANALYSIS

The following impact analysis addresses thresholds of significance and applicable thresholds are identified in brackets after the impact statement.

Impact 5.12-1: Construction activities associated with buildout of the plan area would result in temporary noise increases at sensitive receptors. [Threshold N-1]

As part of implementation of the proposed project, various individual land use development projects would be constructed over the duration of the General Plan buildout. Construction is performed in distinct steps, each of which has its own mix of equipment, and, consequently, its own noise characteristics. Table 5.12-9 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 5.12-9 Construction Equipment Noise Emission Levels

Construction Equipment	Typical Max Noise Level (dBA L_{max})[1]	Construction Equipment	Typical Max Noise Level (dBA L_{max})[1]
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		

Source: FTA 2018.
1 Measured 50 feet from the source

As shown, construction equipment generates high levels of noise, with maximums ranging from 71 to 101 dBA. Construction of individual developments associated with implementation of the proposed project would temporarily increase the ambient noise environment and would have the potential to affect noise-sensitive land

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uses in the vicinity of an individual project. According to Santa Ana Municipal Code Section 18-314(e), construction noise is prohibited between the hours of 8:00 PM and 7:00 AM, Monday through Saturday.

Implementation of the project would result in an increase in development intensity to accommodate populations 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 that would occur with construction of individual development projects, which have not yet been developed, 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.

Because specific project-level information is inherently not available at this time, it is not possible nor appropriate to quantify the construction noise impacts at specific sensitive receptors. In most cases, construction of individual developments associated with implementation of the project would temporarily increase the ambient noise environment in the vicinity of each individual project, potentially affecting existing and future nearby sensitive uses. RR-NOI-2 and noise element policy 2.3 would help minimize the effects of intermittent and short-term construction noise. However, because construction activities associated with any individual development may occur near noise-sensitive receptors and because, depending on the project type, equipment list, time of day, phasing, and overall construction durations, noise disturbances may occur for prolonged periods of time or during the more sensitive nighttime hours, construction noise impacts associated with implementation of the project are considered potentially significant.

Level of Significance Before Mitigation: Impact 5.12-1 would be considered potentially significant.

Impact 5.12-2: Buildout of the plan area would cause a substantial traffic noise increase on local roadways and could locate sensitive receptors in areas that exceed established noise standards. [Threshold N-1]

Buildout of the GPU would result in an increase in traffic along local roadways proximate to existing sensitive receptors. Figures 5.12-7 through 5.12-10 illustrate the modeled roadways and future 2045 noise contours for 60 dBA CNEL, 65 dBA CNEL, and 70 dBA CNEL. The complete distances to the 70, 65, and 60 dBA CNEL noise contours for roadway segments in the City are included in Appendix I-b. Table 5.12-10 shows the estimated traffic noise increase along study roadway segments. The traffic noise increase is the difference between the projected future noise level and the existing noise level. As shown in Table 5.12-10, significant traffic noise increases are estimated along several of the study roadway segments from implementation of the GPU. Of the roadway segments with significant traffic noise increases, Warner Avenue – Grand Avenue to Red Hill Avenue is in the 55 Freeway / Dyer Road focus area. Along several roadway segments, a decrease in traffic noise levels is anticipated from implementation of the GPU. Noise element policies 1.2, 1.3, 1.4, and 2.1, and ~~circulation~~ mobility element policies ~~CE~~M-1.7, ~~CE~~M-1.8, and ~~CE~~M-4.8 would help minimize and mitigate traffic noise impacts. However, traffic noise increases on the roadway segments shown in bold in Table 5.12.-10 are conservatively considered to remain significant.

Table 5.12-10 Traffic Noise Increases Along Study Roadway Segments

Roadway	Segment	Existing ADT	Future 2045 ADT	Existing Traffic Noise Level at 50 feet (dBA CNEL)	Future 2045 Traffic Noise Level at 50 feet (dBA CNEL)	Traffic Noise Increase, dBA CNEL
1st Street	Euclid Street to Ward Street	25,233	18,700	72.4	71.7	-0.7
Euclid Street	1st Street to McFadden Avenue	40,731	34,000	75.0	74.3	-0.7
Westminster Avenue	Harbor Boulevard to Fairview Street	30,459	17,400	74.1	72.4	-1.7
Harbor Boulevard	Westminster Avenue/17th Street to Hazard Avenue	54,137	36,200	76.6	74.5	-2.1
1st Street	Harbor Boulevard to Jackson	32,736	23,100	73.8	72.6	-1.3
Edinger Avenue	Harbor Boulevard to Fairview Street	27,838	23,300	73.9	73.7	-0.2
Warner Avenue	Harbor Boulevard to Fairview Street	31,945	26,300	74.6	74.2	-0.4
Harbor Boulevard	Segerstrom Avenue to MacArthur Boulevard	15,622	56,900	71.9	77.6	**5.7**
Fairview Street	1st Street to Willits Street	42,605	38,600	75.5	75.9	0.4
1st Street	Sullivan Street to Raitt Street	36,377	26,600	74.1	73.2	-1.0
Bristol Street	17th Street to Santa Clara Avenue	45,676	41,500	76.8	76.2	-0.6
17th Street	College Avenue to Bristol Street	37,345	29,500	73.8	73.6	-0.1
Bristol Street	17th Street to Washington Avenue	42,005	45,100	75.3	75.5	0.2
Fairview Street	Trask Avenue to 17th Street	40,432	48,100	76.2	76.9	0.6
Bristol Street	1st Street to Bishop Street	42,663	49,000	75.2	75.8	0.6

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Table 5.12-10 Traffic Noise Increases Along Study Roadway Segments

Roadway	Segment	Existing ADT	Future 2045 ADT	Existing Traffic Noise Level at 50 feet (dBA CNEL)	Future 2045 Traffic Noise Level at 50 feet (dBA CNEL)	Traffic Noise Increase, dBA CNEL
Civic Center Drive	Bristol Street to Flower Street	17,589	18,600	69.1	70.2	1.1
Flower Street	1st Street to Bishop Street	15,622	6,900	69.2	65.8	-3.5
Main Street	17th Street to 20th Street	32,044	43,000	72.5	74.1	**1.6**
Main Street	Washington Street to Civic Center Drive	33,489	19,000	71.6	69.0	-2.6
Civic Center Drive	Flower Street to Ross Street	17,427	10,200	66.1	64.9	-1.2
Santa Ana Boulevard	Flower Street to Ross Street	14,689	15,800	67.3	68.2	0.9
1st Street	Main Street to Standard Avenue	42,699	32,900	75.3	73.9	-1.4
Main Street	1st Street to Bishop Street	30,125	30,500	72.2	72.4	0.1
Grand Avenue	Santa Clara Avenue to Fairhaven Street	30,206	31,100	73.3	73.9	0.6
Grand Avenue	Santa Ana Boulevard to 4th Street	36,678	35,000	74.3	74.4	0.1
Santa Clara Avenue	Grand Avenue to Tustin Avenue	10,585	8,700	67.8	68.0	0.1
Tustin Avenue	Santa Clara Avenue to Fairhaven Street	35,410	20,400	73.6	72.0	-1.6
17th Street	Cabrillo Park Drive to Tustin Avenue	32,080	34,600	72.8	74.3	1.5
Tustin Avenue	Fruit Street to 4th Street	25,174	28,100	71.9	73.4	1.5
1st Street	Grand Avenue to Elk Lane	28,638	30,800	73.5	73.6	0.0
1st Street	Cabrillo Park Drive to Tustin Avenue	22,083	14,600	71.9	70.3	-1.6

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NOISE

Table 5.12-10 Traffic Noise Increases Along Study Roadway Segments

Roadway	Segment	Existing ADT	Future 2045 ADT	Existing Traffic Noise Level at 50 feet (dBA CNEL)	Future 2045 Traffic Noise Level at 50 feet (dBA CNEL)	Traffic Noise Increase, dBA CNEL
Fairview Street	Edinger Avenue to Harvard Street	37,524	45,100	75.8	76.6	0.8
Fairview Street	Warner Avenue to Segerstrom Avenue	39,878	41,800	76.0	76.2	0.2
MacArthur Boulevard	Harbor Boulevard to Fairview Street	26,235	32,600	72.1	74.1	2.0 [1]
Edinger Avenue	Fairview Street to Greenville Street	29,115	22,200	72.0	71.2	-0.8
McFadden Avenue	Fairview Street to Raitt Street	20,997	8,200	70.6	66.5	-4.1
MacArthur Boulevard	Fairview Street to Raitt Street	28,809	28,900	72.3	73.5	1.2
Segerstrom Avenue	Fairview Street to Raitt Street	19,326	29,600	71.2	73.6	**2.4**
Bristol Street	Edinger Avenue to Warner Avenue	37,238	54,500	74.4	76.3	**1.9**
Bristol Street	Warner Avenue to Segerstrom Avenue	38,007	44,800	74.5	75.4	0.9
Warner Avenue	Raitt Street to Bristol Street	34,555	22,300	75.1	73.5	-1.6
Bristol Street	MacArthur Boulevard to Sunflower Avenue	34,731	50,800	74.3	76.0	1.7 [2]
Flower Street	Warner Avenue to Segerstrom Avenue	15,378	33,300	70.1	73.9	**3.8**
Edinger Avenue	Flower Street to Main Street	36,534	25,200	74.2	72.9	-1.2
Main Street	McFadden Avenue to Edinger Avenue	28,622	27,500	72.0	71.9	-0.1
Main Street	Edinger Avenue to Warner Avenue	27,972	38,200	72.2	73.4	1.2

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Table 5.12-10 Traffic Noise Increases Along Study Roadway Segments

Roadway	Segment	Existing ADT	Future 2045 ADT	Existing Traffic Noise Level at 50 feet (dBA CNEL)	Future 2045 Traffic Noise Level at 50 feet (dBA CNEL)	Traffic Noise Increase, dBA CNEL
Main Street	Warner Avenue to Dyer Rd	30,484	38,600	73.6	74.8	1.2
Segerstrom Avenue	Bristol Street to Flower Street	22,959	25,900	72.0	73.1	1.1
MacArthur Boulevard	Flower Street to Main Street	37,946	39,800	74.3	74.9	0.6
Main Street	MacArthur Boulevard to Sunflower Avenue	23,692	29,000	73.1	74.7	**1.6**
Grand Avenue	Edinger Avenue to Warner Avenue	17,735	37,300	71.1	75.7	**4.7**
Edinger Avenue	Richie Street to Newport Avenue	40,435	49,700	76.1	77.0	0.9
Warner Avenue	Grand Avenue to Red Hill Avenue	22,435	34,600	73.1	75.4	**2.4**
Warner Avenue	Main Street to Standard Avenue	27,391	23,900	72.9	72.7	-0.2
McFadden Avenue	Newhope Street to Harbor Boulevard	18,495	8,700	70.7	68.1	-2.6
McFadden Avenue	Standard Avenue to Grand Avenue	20,188	8,600	70.6	66.7	-3.9
Dyer Road	Red Hill Avenue to Pullman Street	31,248	80,700	74.1	78.0	**3.9**
McFadden Avenue	Bristol Street to Flower Street	14,951	11,800	68.0	66.8	-1.2

Table 5.12-10 Traffic Noise Increases Along Study Roadway Segments

Roadway	Segment	Existing ADT	Future 2045 ADT	Existing Traffic Noise Level at 50 feet (dBA CNEL)	Future 2045 Traffic Noise Level at 50 feet (dBA CNEL)	Traffic Noise Increase, dBA CNEL
Main Street	La Veta Avenue to Memory Lane	31,004	50,200	73.8	75.9	**2.1**
1st Street	Bristol Street to Flower Street	39,006	25,700	74.8	72.8	-2.0

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 IBI 2020.
Note: **Bold** values = significant traffic noise increase
[1] The closest noise-sensitive receptor to the MacArthur Blvd. – Harbor Blvd. to Fairview St. segment is a park approximately 250 feet from the roadway. At this distance, future noise levels would attenuate to approximately 60 dBA CNEL and would be less than significant.
[2] The closest noise-sensitive receptors to the Bristol St. – MacArthur Blvd. to Sunflower Ave. segment are residences approximately 375 feet from the roadway. At this distance, future noise levels would attenuate to approximately 58 dBA CNEL and would be less than significant.

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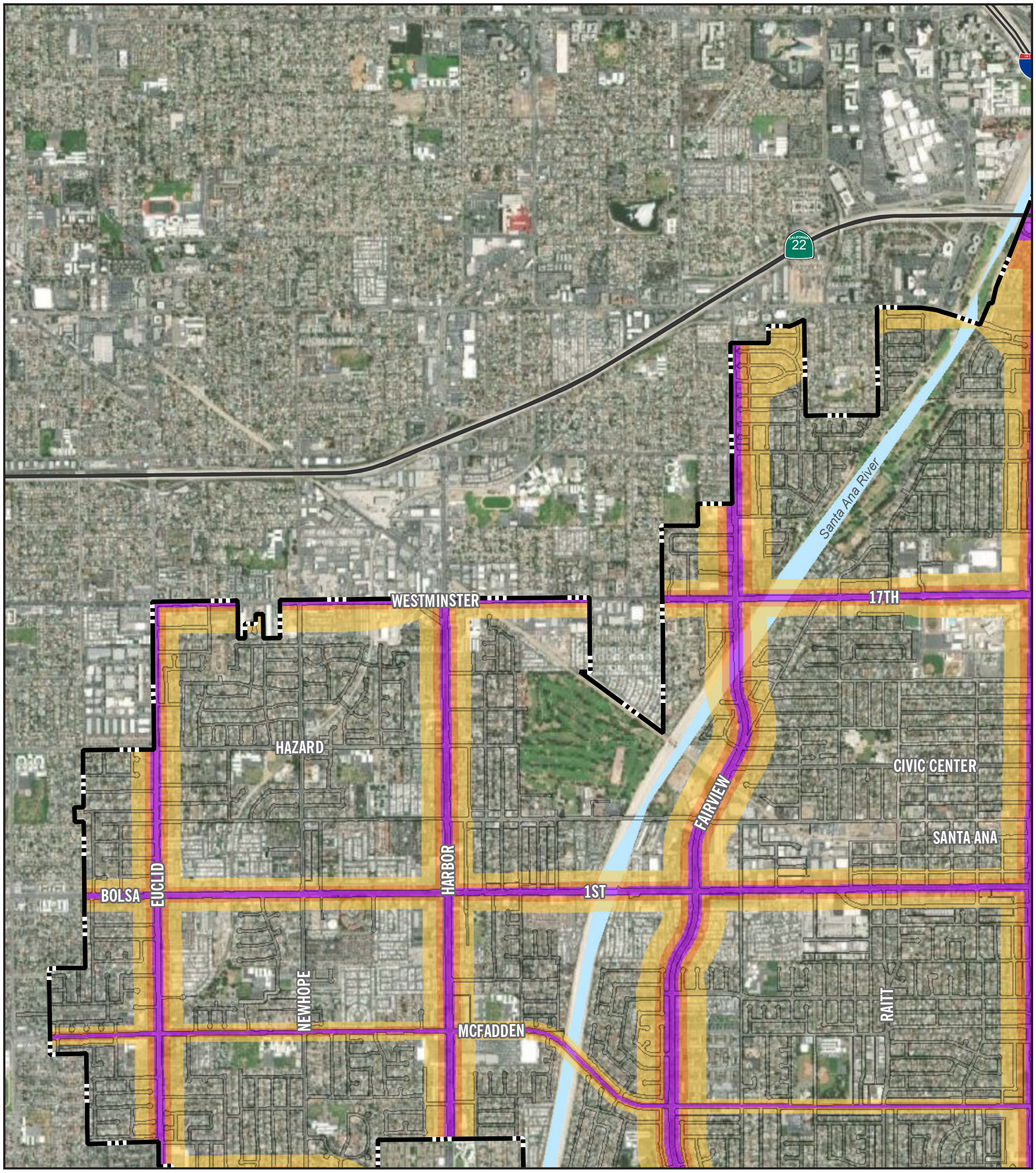
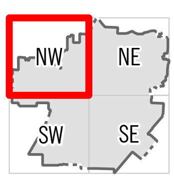
Figure 5.12-7 - Future 2045 Transportation CNEL Noise Levels (Northwest Quadrant)



City of Santa Ana
City of Santa Ana SOI
Railway

Future 2045 Noise Contour

70+ dBA
65 dBA
60 dBA



Key Map

0 3,000
Scale (Feet)

Source: PlaceWorks, 2020; IBI, 2020

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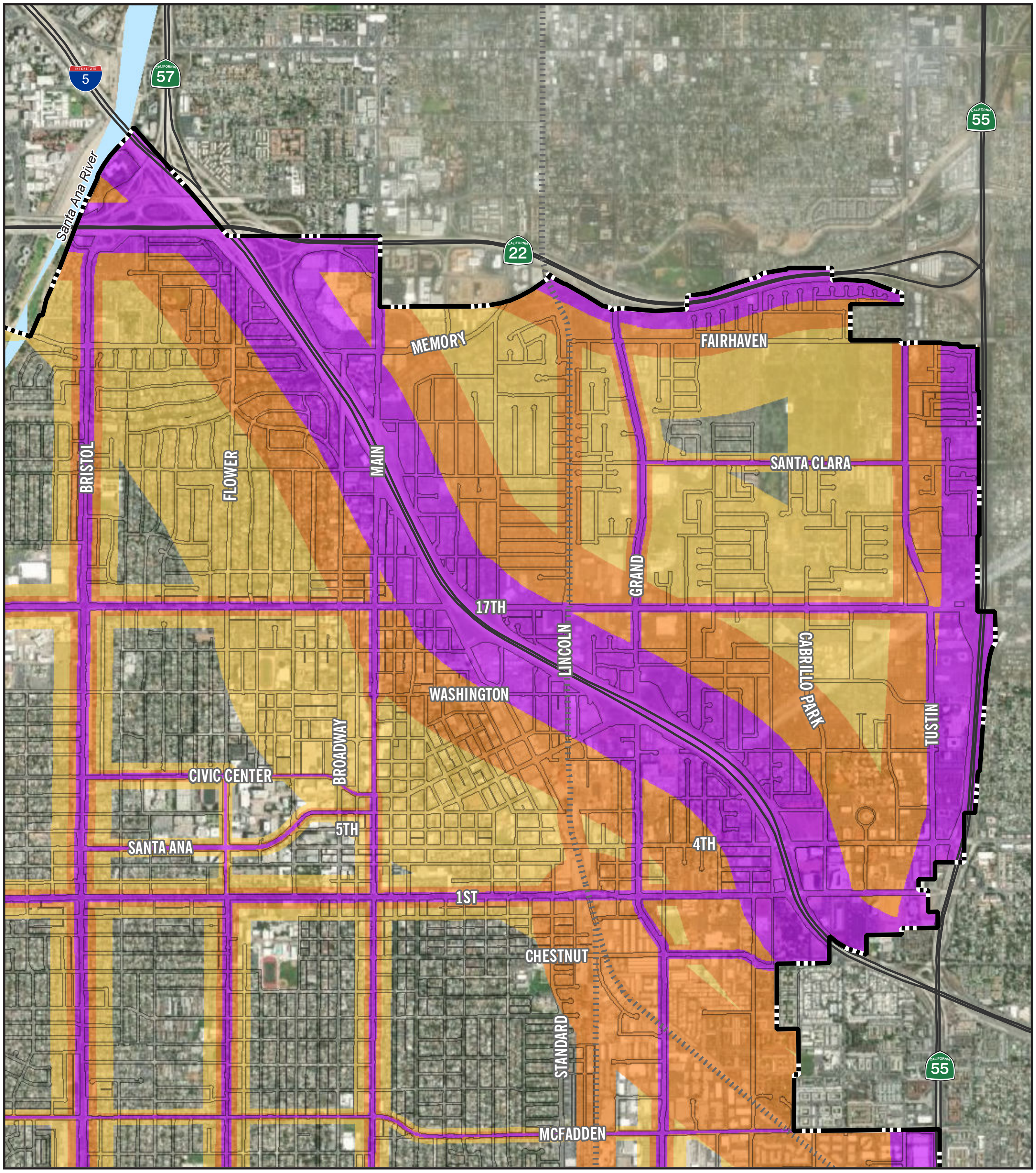
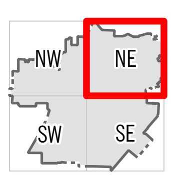
Figure 5.12-8 - Future 2045 Transportation CNEL Noise Levels (Northeast Quadrant)



City of Santa Ana
City of Santa Ana SOI
Railway

Future 2045 Noise Contour

70+ dBA
65 dBA
60 dBA



Key Map

0 3,000
Scale (Feet)

Source: PlaceWorks, 2020; IBI, 2020

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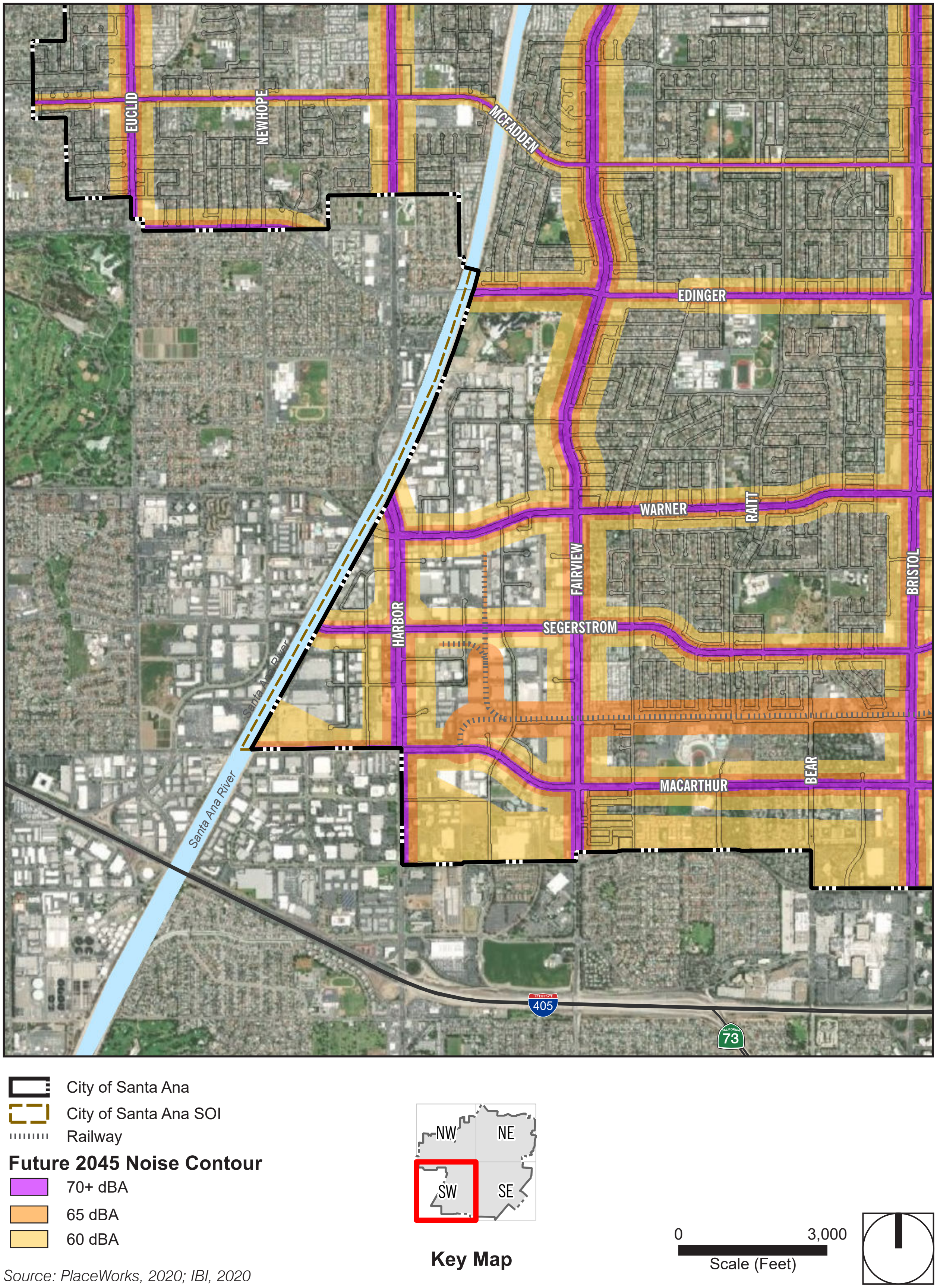
Figure 5.12-9 - Future 2045 Transportation CNEL Noise Levels (Southwest Quadrant)



Source: PlaceWorks, 2020; IBI, 2020

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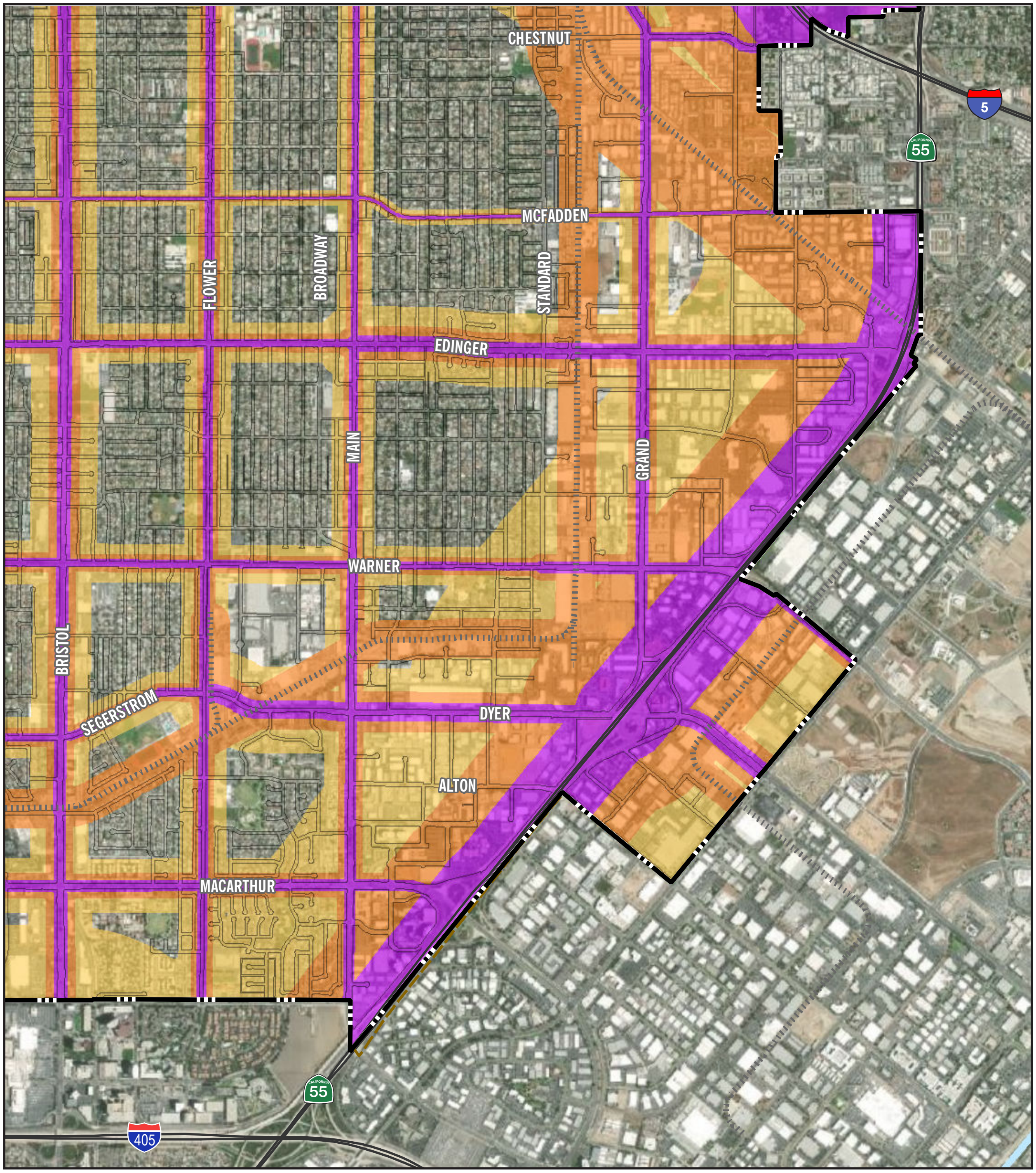
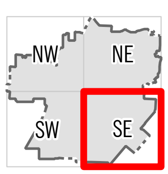
Figure 5.12-10 - Future 2045 Transportation CNEL Noise Levels (Southeast Quadrant)



City of Santa Ana
City of Santa Ana SOI
Railway

Future 2045 Noise Contour

70+ dBA
65 dBA
60 dBA



Key Map

0 3,000
Scale (Feet)

Source: PlaceWorks, 2020; IBI, 2020

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In addition, future noise-sensitive land uses could be in areas that exceed the "Normally Acceptable" noise standards due to airport operations (see Figure 5.12-6 for airport noise contours) and due to railroad activity. Table 5.12-11 contains the calculated distances to the 65 dBA Ldn/CNEL contours from future railroad noise. The railroad noise contours are displayed graphically in Figures 5.12-7 through 5.12-10. The same methodology that was used to estimate existing railroad noise contours was used for future railroad activity. Though implementation of the proposed General Plan would not cause a direct increase in rail activity, future residential development could be placed within areas that would expose sensitive receptors to noise levels exceeding established standards. RR-NOI-1 and noise element policies 1.1, 1.2, 1.4, 2.1, 3.1, 3.2, and 3.3, and ~~circulation~~ mobility element policies ~~CE~~M-4.8 and ~~CE~~M-5.2 would ensure that airplane and railroad noise affecting future noise-sensitive land uses is mitigated to acceptable levels. Furthermore, all future residential development projects or noise-sensitive land uses that are adjacent to SCRRA or other rail lines shall provide disclosure information to tenants or residents of potential noise issues.

In addition to the future railroad noise levels summarized in Table 5.12-11, the Santa Ana and Garden Grove Fixed Guideway Corridor project is anticipated to be operational in 2022. Noise and vibration impacts from this streetcar project were found to be less than significant with mitigation (OCTA 2014). Stationary source noise, such as from HVAC units and commercial loading docks, is controlled by the City's Municipal Code. RR-NOI-3 and noise element policy 2.2 would ensure that new stationary noise sources, such as mechanical equipment from HVAC, industrial facilities, and commercial uses are mitigated to acceptable noise limits as established by the City.

Table 5.12-11 2045 Railroad Noise Levels

Operator	Subdivision	Distance (feet) to 65 dBA CNEL Contour (Mainline)	Distance (feet) to 65 dBA CNEL Contour (Within 0.25 Mile of Grade Crossing)
Burlington North Santa Fe (BNSF)	Irvine Industrial Lead	20	266
Union Pacific (UP)	Santa Ana Industrial Lead	30	361
Southern California Regional Rail Authority	Orange Subdivision	220	1,136

Source: Calculated using the FTA CREATE Model and FRA Grade Crossing Horn Model. See Appendix I-b.

Level of Significance Before Mitigation: The proposed project would result in significant traffic noise increases.

Impact 5.12-3: Buildout of the individual land uses and projects for implementation of the GPU may expose sensitive uses to excessive levels of groundborne vibration. [Threshold N-2]

Construction Vibration Impacts

Construction activity at projects within the plan area would generate varying degrees of ground vibration, depending on the construction procedures and equipment. Operation of construction equipment generates vibrations that spread through the ground and diminish with distance from the source. The effect on buildings

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in the vicinity of the construction site 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. Vibration from construction activities rarely reaches the levels that can damage structures but can achieve the audible and perceptible ranges in buildings close to the construction site. Table 5.12-12 lists reference vibration levels for construction equipment.

Table 5.12-12 Vibration Levels for Construction Equipment

Equipment	Approximate PPV Vibration Level at 25 Feet (in/sec)
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

Source: FTA 2018.
PPV = peak particle velocity.

As shown in Table 5.12-12, 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 inches per second [in/sec] PPV for fragile or historical resources, 0.2 in/sec PPV for non-engineered timber and masonry buildings, and 0.3 in/sec PPV for engineered concrete and masonry). Construction details and equipment for future project-level developments under the GPU are not known at this time but may cause vibration impacts. As such, this would be a potentially significant impact.

Operational Vibration Impacts

Commercial and industrial operations within the plan 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. In addition, future sensitive receptors could be placed within close proximity to existing railroad lines through buildout in the plan area.

Because specific project-level information is not available at this time, it is not possible to quantify future vibration levels at vibration-sensitive receptors that may be near existing and future vibration sources. Therefore, with the potential for sensitive uses within the plan area to be exposed to annoying and/or interfering levels of vibration from commercial or industrial operations and existing railroad lines, operations-related vibration impacts associated with implementation of the GPU are considered potentially significant.

Level of Significance Before Mitigation: The proposed project would result in potentially significant impacts related to groundborne vibration.

Impact 5.12-4: The proximity of the plan area to an airport or airstrip would not result in exposure of future residents and/or workers to excessive airport-related noise. [Threshold N-3]

As discussed previously, there is one airport in Santa Ana, John Wayne Airport, whose noise contours are shown in Figure 5.12-6, *John Wayne Airport Noise Contours*. Future development of noise-sensitive land uses could be located in areas that exceed the 60 dBA CNEL. Noise element policies 3.1, 3.2, and 3.3 would require new development located within the airport's noise contours to be sufficiently mitigated to acceptable interior noise levels.

Level of Significance Before Mitigation: With implementation of the noise element policies listed above, Impact 5.12-4 would be less than significant.

5.12.5 Level of Significance Before Mitigation

With the implementation of GPU Policies, the following impacts would be **less than significant**:

- **Impact 5.12-4**

The following impacts would be **potentially significant:**

- **Impact 5.12-1** Because construction activities associated with any individual development may occur near noise-sensitive receptors and because, depending on the project type, equipment list, time of day, phasing and overall construction durations, noise disturbances may occur for prolonged periods of time or during the more sensitive nighttime hours, construction noise impacts associated with implementation of the GPU are considered potentially significant.

- **Impact 5.12-2** Traffic noise increases would be significant along several roadway segments throughout the City.

- **Impact 5.12-3** The potential for sensitive receptors within the plan area to be exposed to annoying and/or interfering levels of vibration from commercial or industrial operations and existing railroad lines, operations-related vibration impacts associated with implementation of the GPU are considered potentially significant.

5.12.6 Mitigation Measures

Impact 5.12-1

N-1 Construction contractors shall implement the following measures for construction activities conducted in the City of Santa Ana. Construction plans submitted to the City shall identify these measures on demolition, grading, and construction plans submitted to the City: The City of Santa Ana Planning and Building Agency shall verify that grading, demolition, and/or construction plans submitted to the City include these notations prior to issuance of demolition, grading, and/or building permits.

- Construction activity is limited to the hours: Between 7 AM to 8 PM Monday through Saturday, as prescribed in Municipal Code Section 18-314(e). Construction is prohibited on Sundays.
- During the entire active construction period, equipment and trucks used for project construction shall use the best-available noise control techniques (e.g., improved mufflers, equipment re-design, use of intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds), wherever feasible.
- Impact tools (e.g., jack hammers and hoe rams) shall be 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.
- Stationary equipment, such as generators and air compressors shall be located as far as feasible from nearby noise-sensitive uses.
- Stockpiling shall be located as far as feasible from nearby noise-sensitive receptors.
- Construction traffic shall be limited, to the extent feasible, to approved haul routes established by the City Planning and Building Agency.
- At least 10 days prior to the start of construction activities, a sign shall be posted at the entrance(s) to the job site, clearly visible to the public, that includes permitted construction days and hours, as well as the telephone numbers of the City's and contractor's authorized representatives that are assigned to respond in the event of a noise or vibration complaint. If the authorized contractor's representative receives a complaint, he/she shall investigate, take appropriate corrective action, and report the action to the City.
- Signs shall be posted 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.
- During the entire active construction period and to the extent feasible, the use of noise-producing signals, including horns, whistles, alarms, and bells, shall be for safety warning purposes only. 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 80 dBA Leq. 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.

Impact 5.12-3

N-2 Prior to issuance of a building permit for a project requiring pile driving during construction within 135 feet of fragile structures, such as historical resources, 100 feet of non-engineered timber and masonry buildings (e.g., most residential buildings), or within 75 feet of engineered concrete and masonry (no plaster); or a vibratory roller within 25 feet of any structure, the project applicant shall prepare a noise and vibration analysis to assess and mitigate potential noise and vibration impacts related to these activities. This noise and vibration analysis shall be conducted by a qualified and experienced acoustical consultant or engineer. The vibration levels shall not exceed Federal Transit Administration (FTA) architectural damage thresholds (e.g., 0.12 inches per second [in/sec] peak particle velocity [PPV] for fragile or historical resources, 0.2 in/sec PPV for non-engineered timber and masonry buildings, and 0.3 in/sec PPV for engineered concrete and masonry). If vibration levels would exceed this threshold, alternative uses such as drilling piles as opposed to pile driving and static rollers as opposed to vibratory rollers shall be used. If necessary, construction vibration monitoring shall be conducted to ensure vibration thresholds are not exceeded.

N-3 New residential projects (or other noise-sensitive uses) located within 200 feet of existing railroad lines shall be required to conduct a groundborne vibration and noise evaluation consistent with Federal Transit Administration (FTA)-approved methodologies.

N-4 During the project-level California Environmental Quality Act (CEQA) process for industrial developments under the General Plan Update or other projects that could generate substantial vibration levels near sensitive uses, a noise and vibration analysis shall be conducted to assess and mitigate potential noise and vibration impacts related to the operations of that individual development. This noise and vibration analysis shall be conducted by a qualified and experienced acoustical consultant or engineer and shall follow the latest CEQA guidelines, practices, and precedents.

Without other mitigation measures, existing noise-sensitive uses would be exposed to elevated traffic noise levels that would result in substantial impacts at some time in the GPU buildout. The following potential mitigation measures were considered.

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Mitigation Measures Considered for Impact 5.12-2

In compliance with CEQA, "each public agency shall mitigate or avoid the significant effects on the environment of project it carries out or approves whenever it is feasible to do so" (Public Resources Code Section 21002.1(b)). The term "feasible" is defined in CEQA to mean "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors" (Public Resources Code Section 21061.1). A number of measures were considered for mitigating or avoiding traffic noise impacts (Impact 5.12-2).

Special Roadway Paving

Notable reductions in tire noise have been achieved via the implementation of special paving materials, such as rubberized asphalt or open-grade asphalt concrete overlays. For example, the California Department of Transportation conducted a study of pavement noise along Interstate 80 in Davis (Caltrans 2011) and found an average improvement of 6 to 7 dBA compared to conventional asphalt overlay.

Although this amount of noise reduction from rubberized/special asphalt materials would be sufficient to avoid the predicted noise increase due to traffic in some cases, the potential up-front and ongoing maintenance costs are such that the cost versus benefits ratio[1] may not be feasible and reasonable and would not mitigate noise to a level of less than significant in all cases. In addition, the study found that noise levels increased over time due to pavement raveling, with the chance of noise-level increases higher after a 10-year period.

Sound Barrier Walls

With a cursory review of aerial depictions of the impacted segments, the majority (if not all) residences around the plan area have direct access (via driveways) to the associated roadway. Therefore, barrier walls would prevent access to individual properties and would be infeasible. Further, these impacted homes are on private property outside of the control of future project developers, so there may be limited admittance onto these properties to construct such walls. Lastly, the costs versus benefits ratio in relation to the number of benefitted households may not be feasible and reasonable in all cases.

Sound Insulation of Existing Residences and Sensitive Receptors

Exterior-to-interior noise reductions depend on the materials used, the design of the homes, and their conditions. To determine what upgrades would be needed, a noise study would be required for each house to measure exterior-to-interior noise reduction. Sound insulation may require upgraded windows, upgraded doors, and a means of mechanical ventilation to allow for a "windows closed" condition. There are no funding mechanisms and procedures that would guarantee that the implementation of sound insulation features at each affected home would offset the increase in traffic noise to interior areas and ensure that the state's 45 dBA CNEL standard for multifamily residences would be achieved.

[1] Cost versus benefit considerations are in terms of the number of households benefited, per the general methodology employed by Caltrans in the evaluation of highway sound walls.

5.12.7 Level of Significance After Mitigation

Impact 5.12-1

Implementation of Mitigation Measure N-1 would reduce potential noise impacts during construction to the extent feasible. However, due to the potential for proximity of construction activities to sensitive uses, the number of construction projects occurring simultaneously, and the potential duration of construction activities, Impact 5.12-1 (construction noise) could result in a temporary substantial increase in noise levels above ambient conditions. Therefore, impacts would remain ***significant and unavoidable***. It should be noted that the identification of this program-level impact does not preclude the finding of less-than-significant impacts for subsequent projects analyzed at the project level.

Impact 5.12-2

As demonstrated under the heading "Mitigation Measures Considered for Impact 5.12-2," there are no feasible or practical mitigation measures available to reduce project-generated traffic noise to less-than-significant levels for existing residences along the affected roadway. No individual measure and no set of feasible or practical mitigation measures are available to reduce project-generated traffic noise to less-than-significant levels in all cases. Thus, traffic noise would remain a ***significant and unavoidable*** impact in the plan area. It should be noted that the identification of this program-level impact does not preclude the finding of less-than-significant impacts for subsequent projects analyzed at the project level.

Impact 5.12-3

With implementation of Mitigation Measures N-2, N-3, and N-4, coupled with adherence to associated performance standards, Impact 5.12-3 would be reduced to less-than-significant levels. Specifically, Mitigation Measure N-2 would reduce potential vibration impacts during construction below the pertinent thresholds, and Mitigation Measures N-3 and N-4 (operations-related vibration) would reduce potential vibration impacts from commercial/industrial uses and proposed uses near existing railroads and facilities to less-than-significant levels. No significant and unavoidable vibration impacts would remain.

5.12.8 References

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