APPENDIX F

Noise and Vibration Assessment

Little Portugal Gateway Mixed-Use Project Initial Study/MND

LITTLE PORTUGAL GATEWAY MIXED-USE DEVELOPMENT NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The Little Portugal Gateway project would demolish the existing buildings occupying the site and construct 123 multifamily units, 13,897 square-feet (sf) of commercial space and two underground parking levels. This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses noise and land use compatibility utilizing policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of piledriving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most

at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

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

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California, Santa Clara County, and the City of San José have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, California Building Code, Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan, and the City of San José General Plan are used to assess the potential significance of impacts. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) 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;

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(c) 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.

Pursuant to recent court decisions, the impacts of site constraints, such as exposure of the proposed project to excessive levels of noise and vibration, are not included in the Impacts and Mitigation Section of this report. These items are discussed in a separate section addressing the project's consistency with the policies set forth in the City's General Plan.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels in multi-family residential units attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA DNL/CNEL in any habitable room.

2016 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings, as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2016 revisions. Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. The sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA DNL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan adopted by the Santa Clara County Airport Land Use Commission contains standards for projects within the vicinity of San José International Airport, which are relevant to this project:

<u>4.3.2.1 Noise Compatibility Policies</u>

Policy N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (2022 Aircraft Noise Contours).

Policy N-4 No residential or transient lodging construction shall be permitted within the 65 dB CNEL contour boundary unless it can be demonstrated that the resulting interior sound levels will be less than 45 dB CNEL and there are no outdoor patios or outdoor activity areas associated with the residential portion of a mixed use residential project or a multi-unit residential project. (Sound wall noise mitigation measures are not effective in reducing noise generated by aircraft flying overhead.)

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies in the City of San José. The following policies are applicable to the proposed project:

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state, and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:

Interior Noise Levels

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

    - For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable;" or

- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

Regulatory Background – Vibration

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

EC-2.3 Require new development to minimize continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

Existing Noise Environment

The project site is comprised of three contiguous parcels located at 1661, 1663, and 1665 Alum Rock Avenue in the City of San José. The site is located on the north side of Alum Rock Avenue, between North 34th Street and North King Road. Alum Rock Avenue is the primary noise source in the project vicinity. Residential land uses bound the site to the southwest and northwest, while a parking lot exists to the northeast.

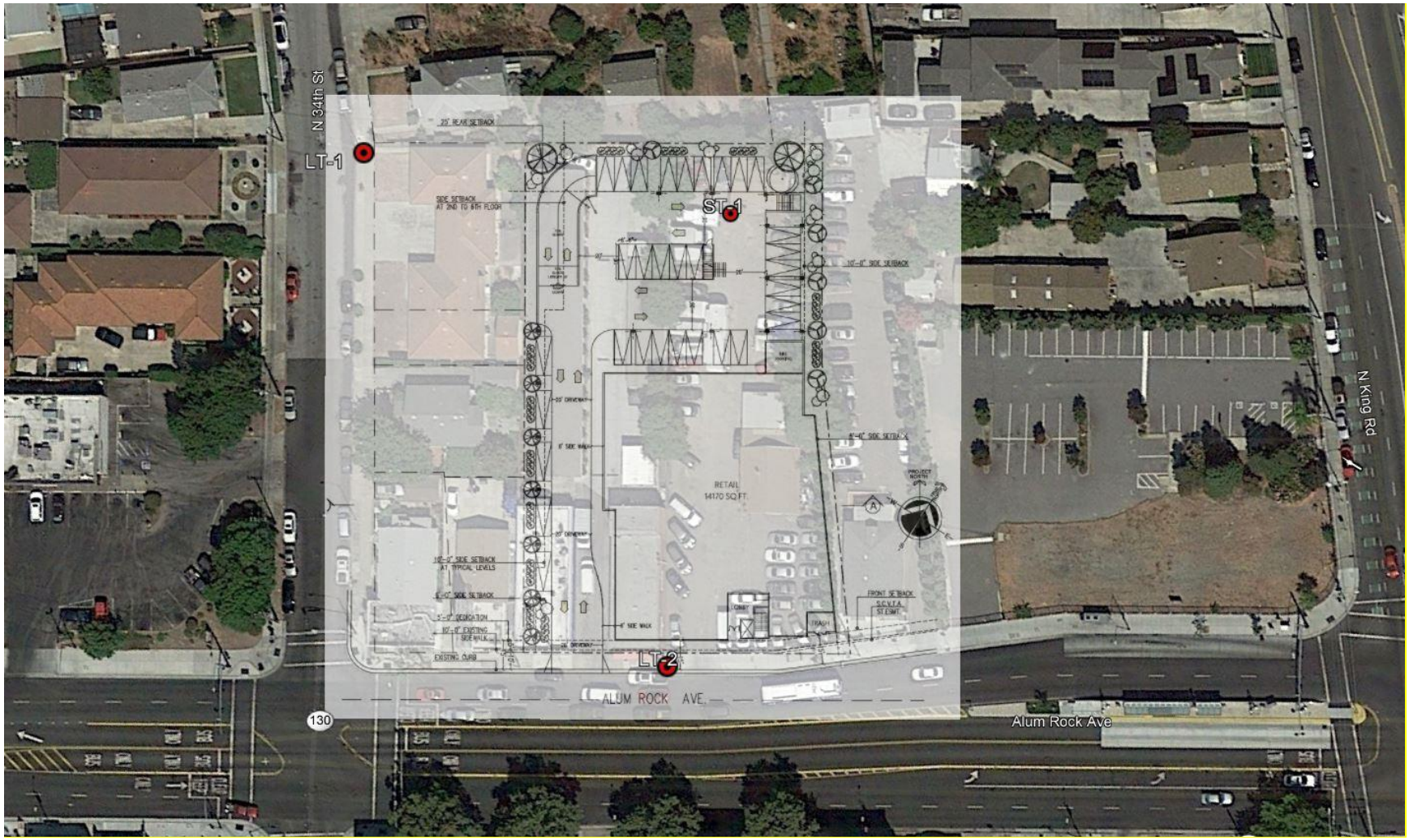
A noise monitoring survey was made by Illingworth & Rodkin, Inc. between Tuesday, September 17, 2019 and Friday, September 20, 2019. The monitoring survey included two long-term (LT-1 and LT-2) noise measurements and one short-term (ST-1) noise measurement. The measurement locations are shown in Figure 1. The existing noise environment at the project site results primarily from vehicular traffic on Alum Rock Avenue and other nearby roadways. Aircraft associated with Mineta San José International Airport are also intermittently audible.

Long-term noise measurement LT-1 was made approximately 22 feet from the centerline of North 34th Street, just west of the project site to represent the ambient noise environment at residential land uses bordering the site. Vehicular traffic on North 34th Street and Alum Rock Avenue was the primary source of noise affecting ambient noise levels, which typically ranged from 57 to 65 dBA L_{eq} during the day and from 48 to 61 dBA L_{eq} at night. The day-night average noise level on Wednesday, September 18, 2019 was 64 dBA DNL and 63 dBA DNL on Thursday, September 19, 2019. The daily trends in noise levels at LT-1 are shown in Figures 2 through 5.

Long-term noise measurement LT-2 was made approximately 44 feet from the centerline of Alum Rock Avenue to represent ambient noise levels at the front of the project site. Hourly average noise levels typically ranged from 65 to 72 dBA L_{eq} during the day and from 58 to 69 dBA L_{eq} at night. The day-night average noise level was 72 dBA DNL on both Wednesday, September 18, 2019 and Thursday, September 19, 2019. The daily trends in noise levels at LT-2 are shown in Figures 6 through 9.

A short-term noise measurement (ST-1) was made at the rear of the site in order to complete the noise survey. ST-1 was made over a ten-minute period between 2:10 p.m. and 2:20 p.m. on Friday, September 20, 2019. Local traffic was the predominant source of noise at the short-term noise measurement site ST-1. During the measurement, three jet aircraft resulted in noise levels ranging from 54 to 63 dBA. Table 4 summarizes the data collected at the short-term measurement site.

FIGURE 1 Noise Measurement Locations



Source: Google Earth 2019.

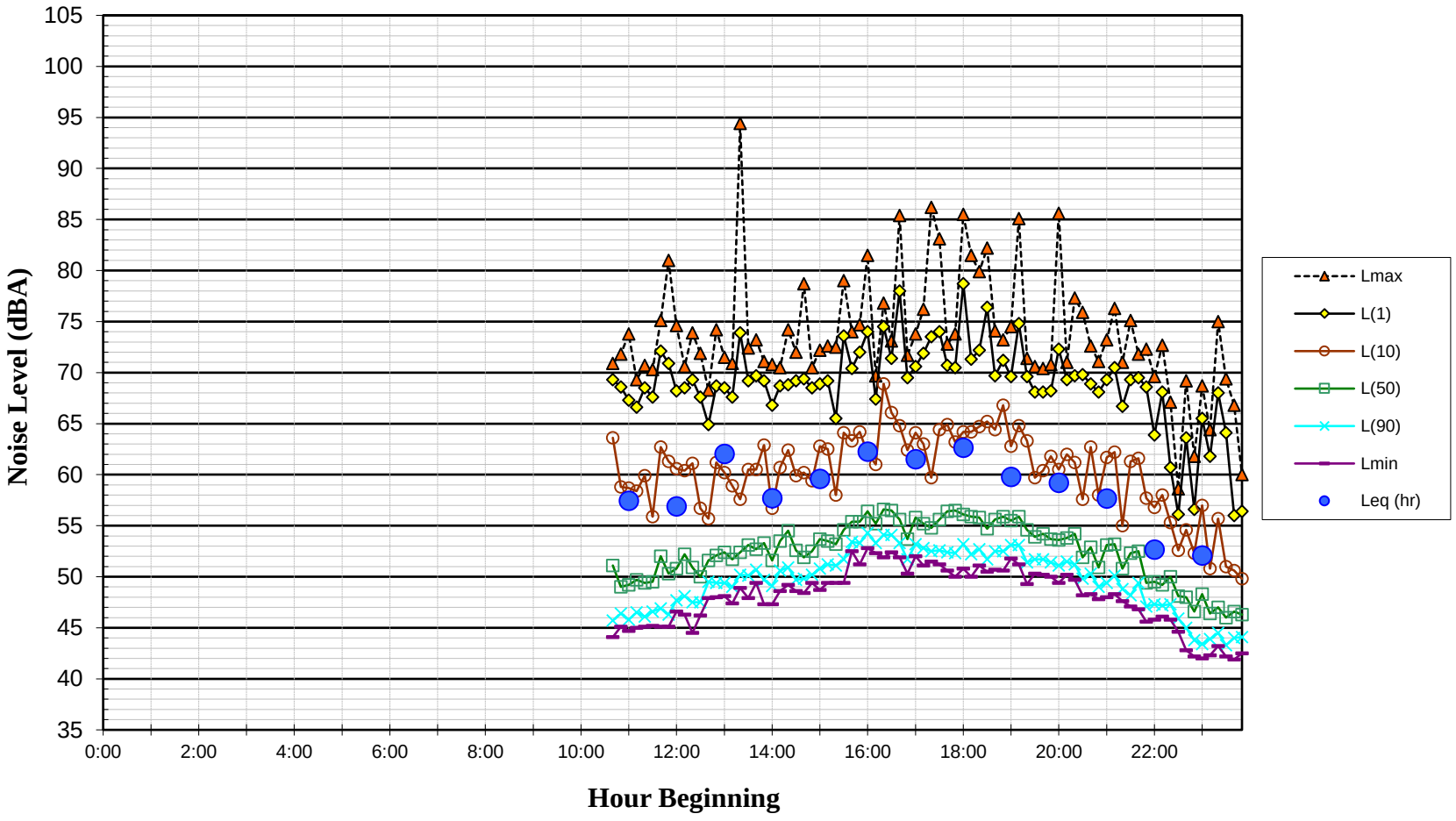
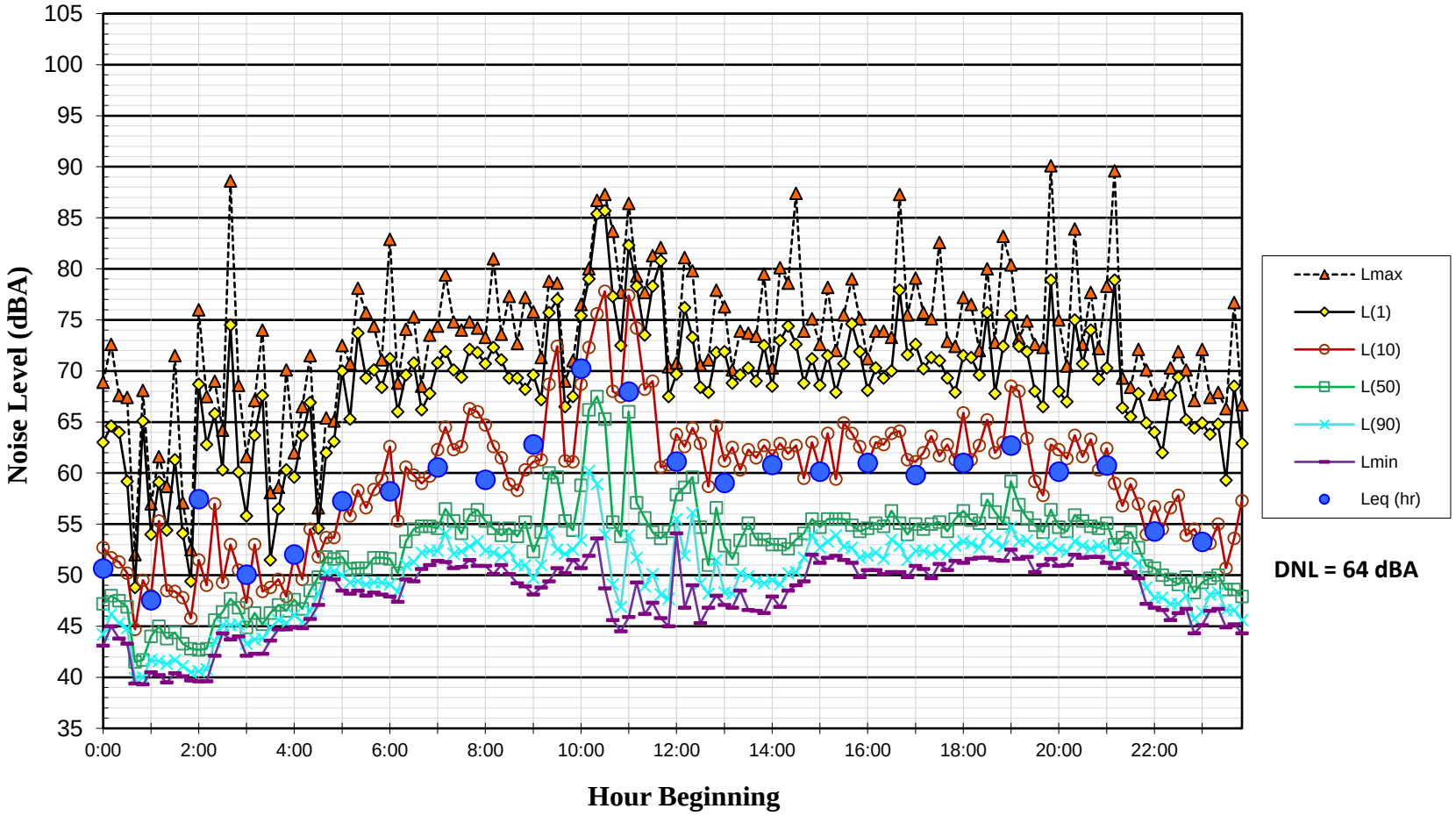

Noise Levels at Noise Measurement Site LT-1
22 North 34th Street, 22' from Centerline
Tuesday, September 17, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 2

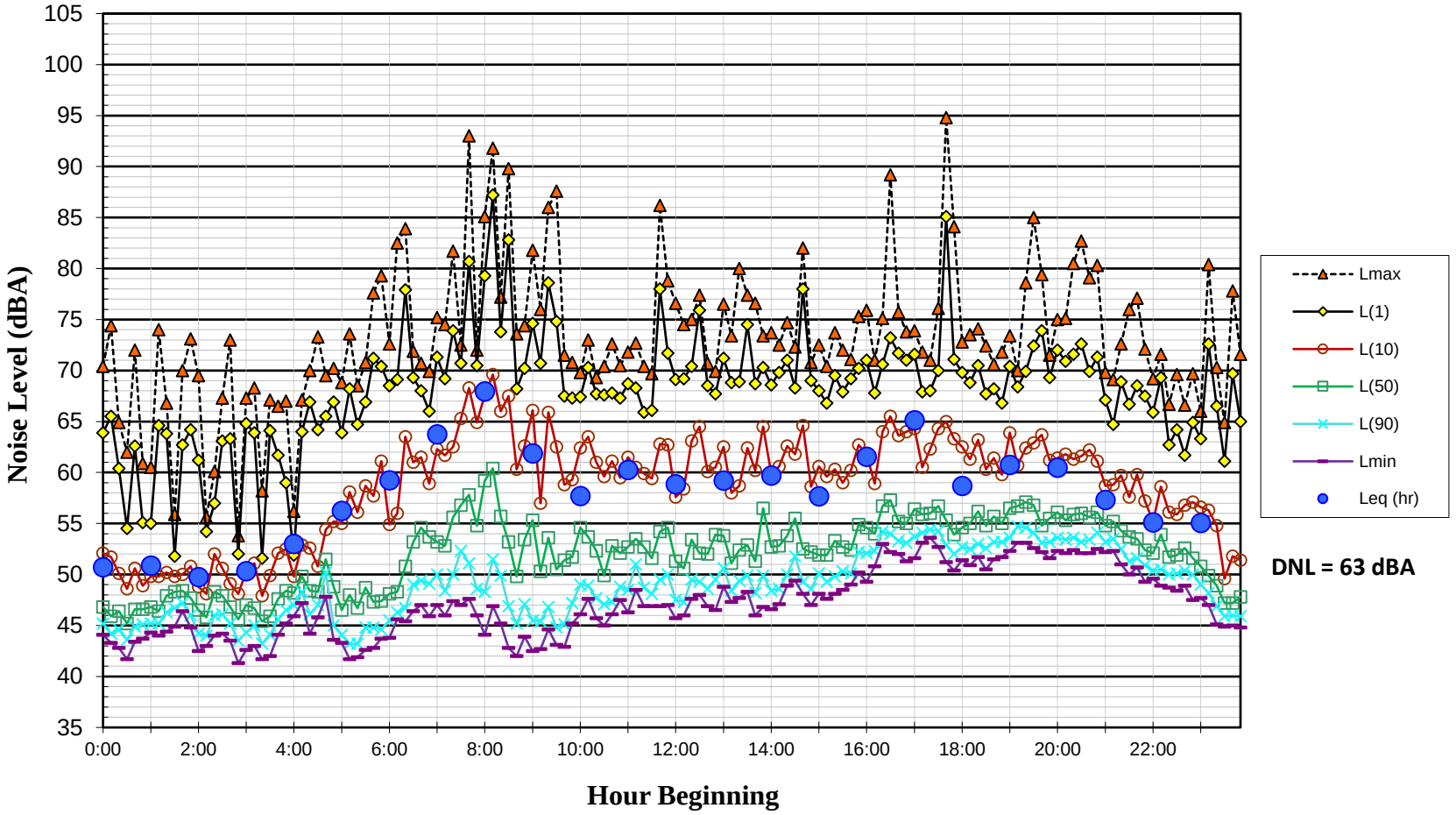
Noise Levels at Noise Measurement Site LT-1
22 North 34th Street, 22' from Centerline
Wednesday, September 18, 2019



DNL = 64 dBA

Figure 3

Noise Levels at Noise Measurement Site LT-1
22 North 34th Street, 22' from Centerline
Thursday, September 19, 2019



DNL = 63 dBA

Figure 4

Noise Levels at Noise Measurement Site LT-1
22 North 34th Street, 22' from Centerline
Friday, September 20, 2019

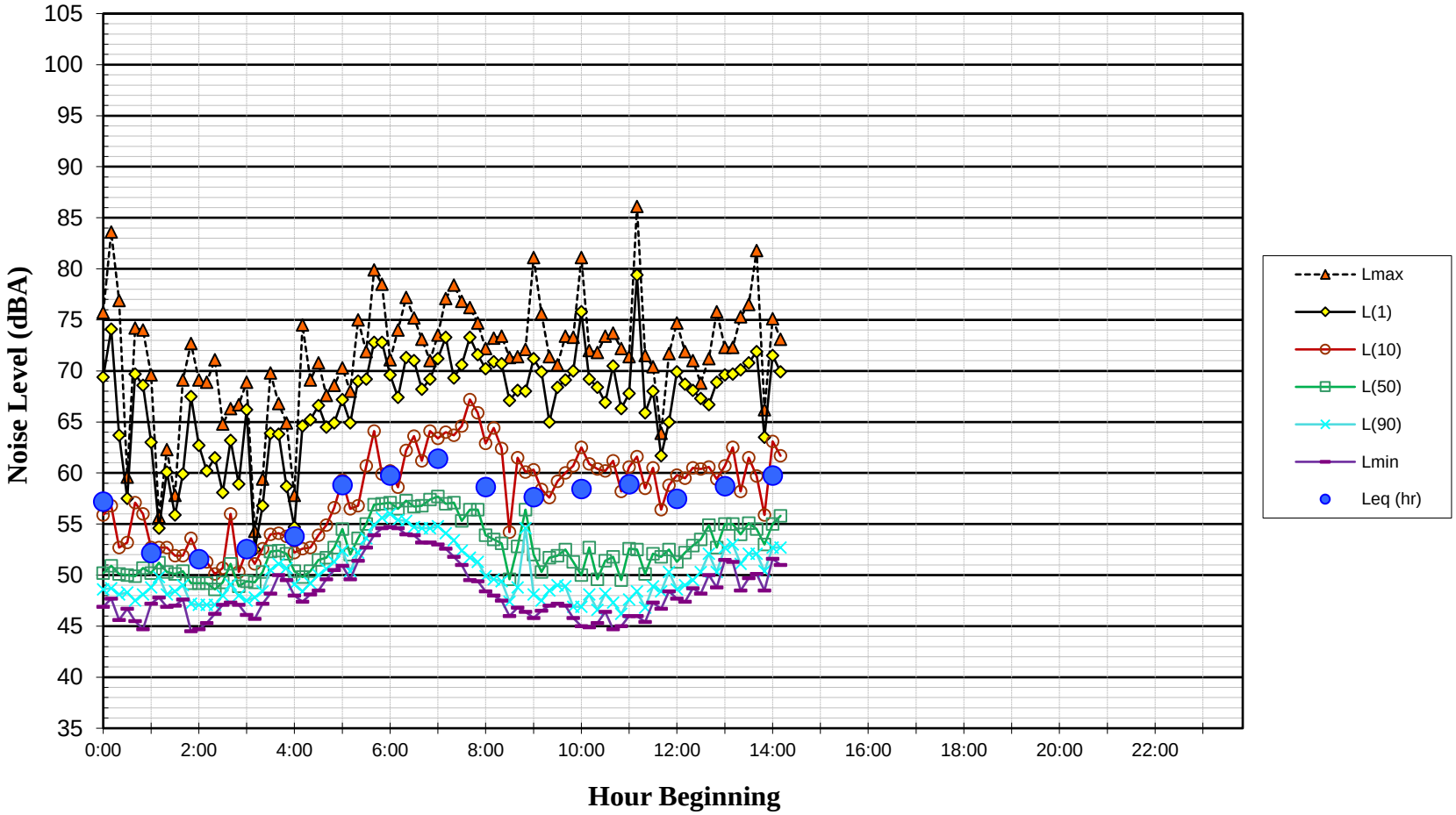


Figure 5

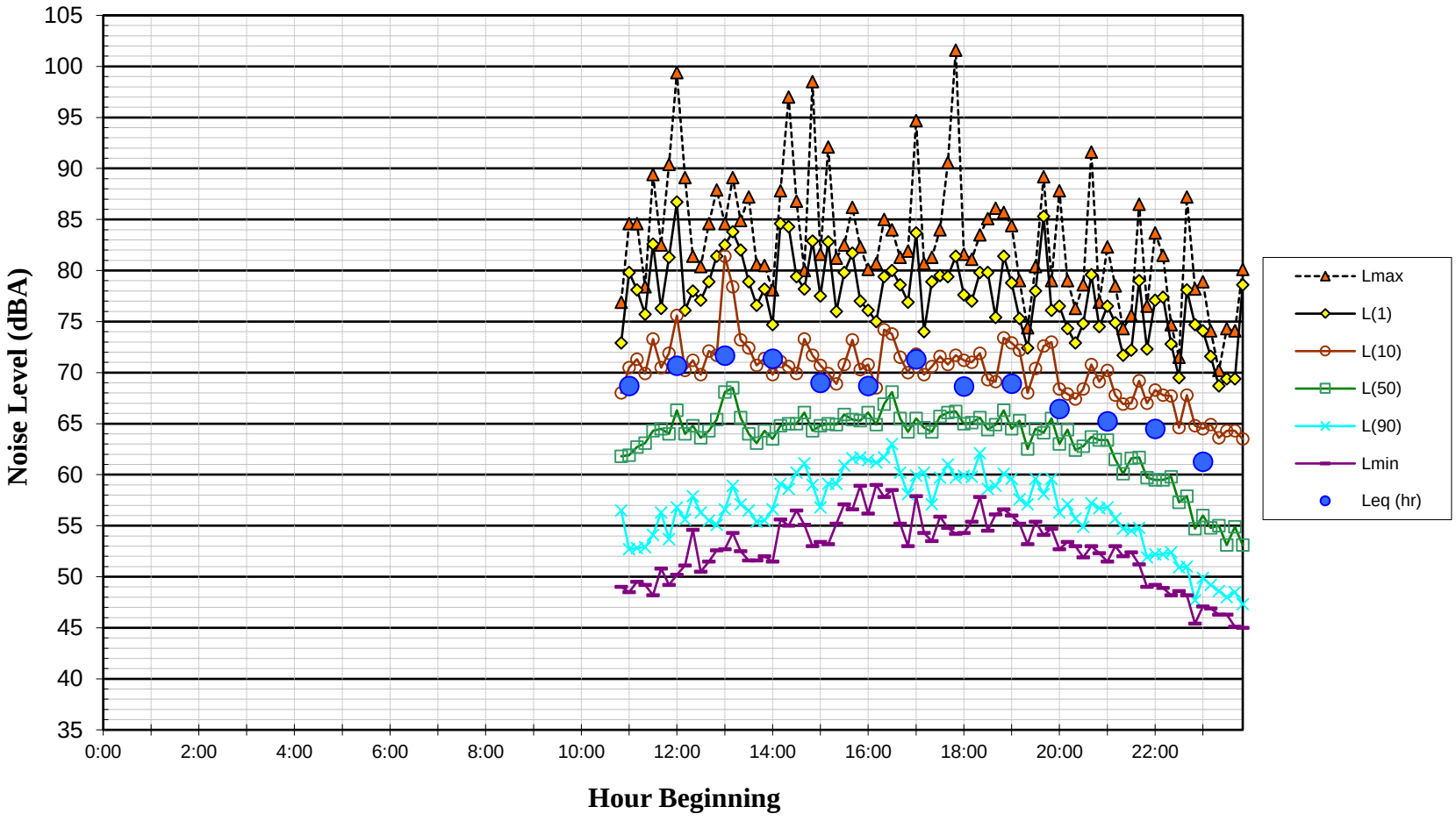
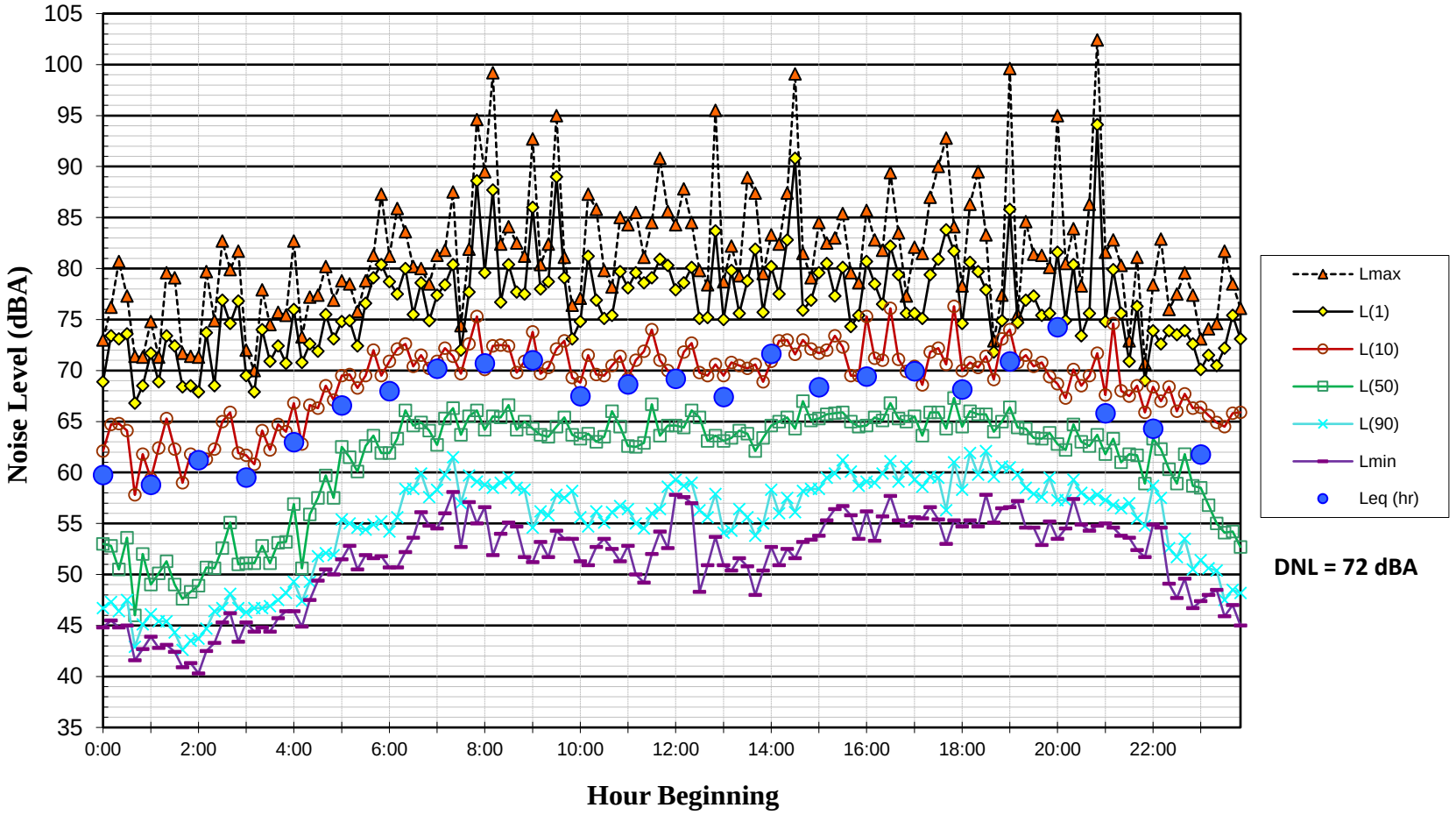

Noise Levels at Noise Measurement Site LT-2
1663 Alum Rock Avenue, 44' from Centerline
Tuesday, September 17, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 6

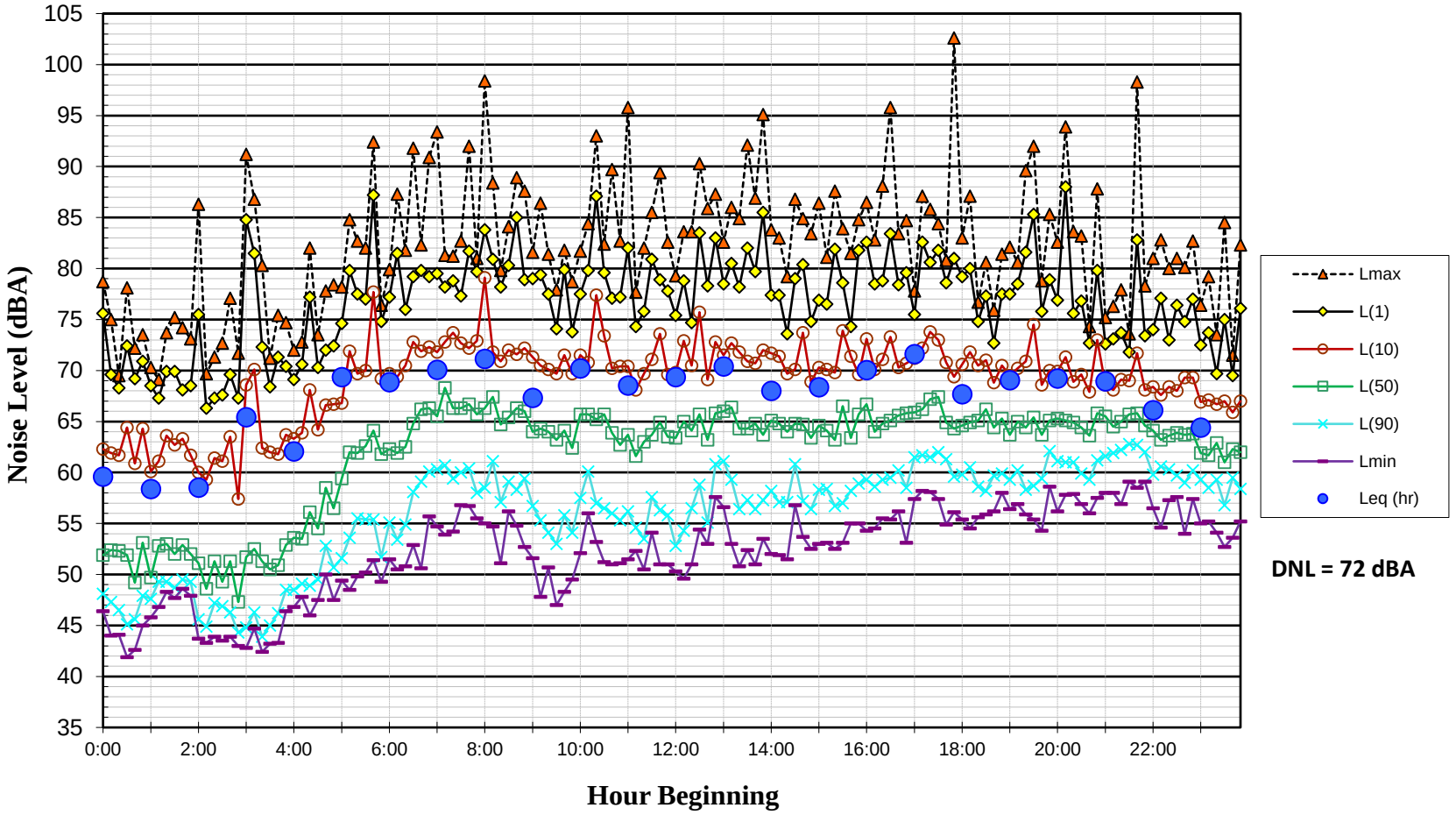
Noise Levels at Noise Measurement Site LT-2
1663 Alum Rock Avenue, 44' from Centerline
Wednesday, September 18, 2019



DNL = 72 dBA

Figure 7

Noise Levels at Noise Measurement Site LT-2
1663 Alum Rock Avenue, 44' from Centerline
Thursday, September 19, 2019



DNL = 72 dBA

Figure 8

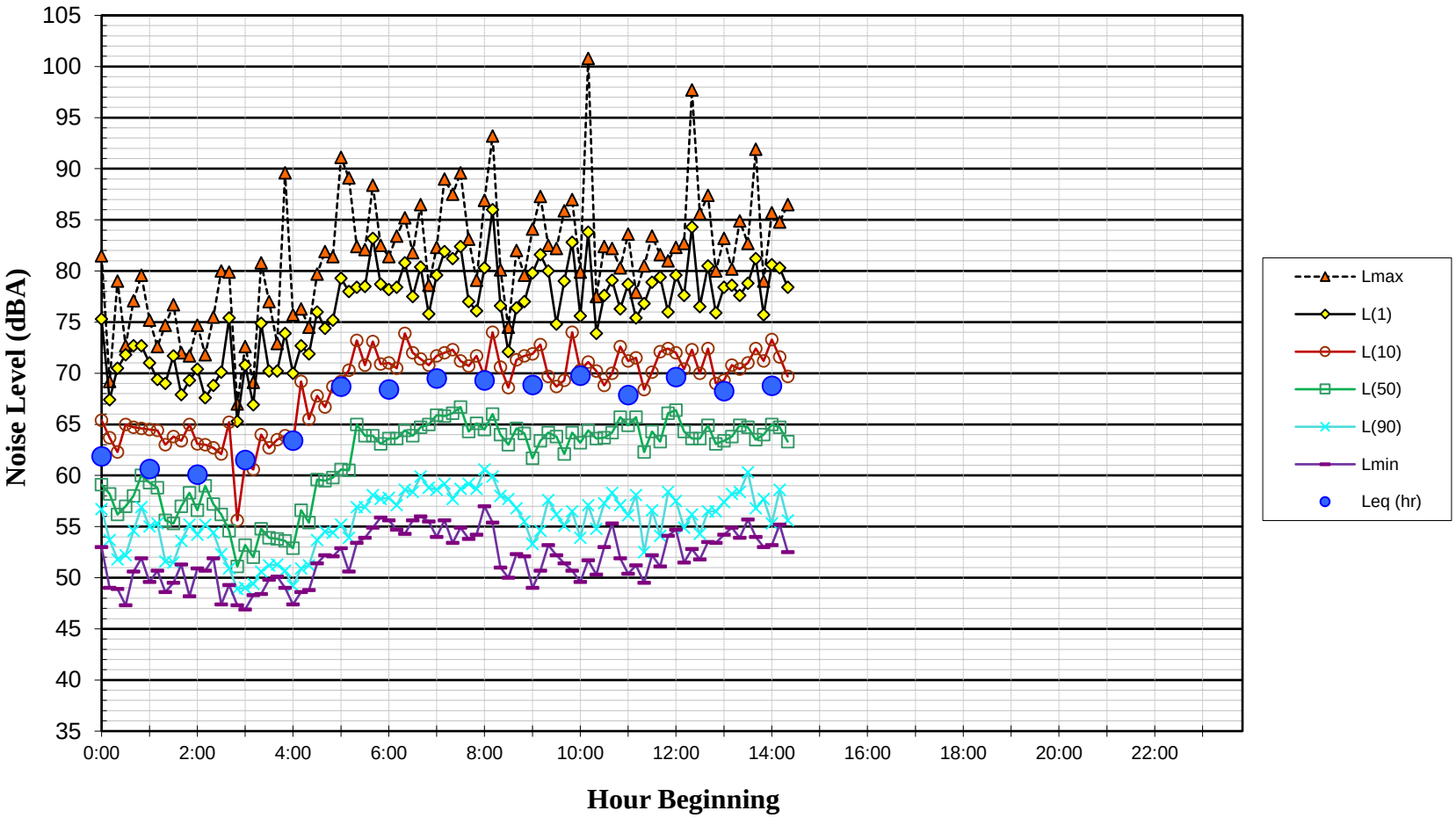

Noise Levels at Noise Measurement Site LT-2
1663 Alum Rock Avenue, 44' from Centerline
Friday, September 20, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 9

TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: At Rear of Project Site (9/20/2019, 2:10-2:20 p.m.)	63	61	57	53	49	54

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The exterior noise threshold for the residential component of mixed-use developments is 60 dBA DNL at usable outdoor activity areas, excluding balconies and porches. The City requires that interior noise levels be maintained at 45 dBA DNL or less within residential units, and the Cal Green Code applies to the interior of the non-residential component of the project.

The future noise environment at the project site would continue to result primarily from vehicular traffic along Alum Rock Avenue. Cumulative Plus Project traffic conditions are expected to result in traffic noise level increases of 1 dBA DNL or less at the project site resulting in a future noise level of 72 dBA DNL at ground level at a distance of 57 feet from the centerline of Alum Rock Avenue.

Future Exterior Noise Environment

Communal open space for the residents would be provided on the second floor podium, sixth floor balcony area, and roof garden. The podium level would contain lounge, group dining, and bistro areas, totaling approximately 4,887 square feet on the western side of the building. The roof level of the building would contain an approximately 4,082 square feet communal lounge and dining area, also on the east central part of the building. The sixth floor of the building would also have a common open space balcony area, totaling approximately 1,435 square feet on the west side of the building.

The common open space areas would be effectively shielded from traffic by the building itself. When accounting for distance from the noise sources and acoustical shielding, exterior noise levels due to local traffic are calculated to be less than 55 dBA DNL.

The future exterior noise levels at residential common use areas would be 60 dBA DNL or less and compatible with the City's General Plan threshold for exterior noise levels at multi-family residential land uses.

Future Interior Noise Environment

The State of California and the City of San José require that interior noise levels be maintained at 45 dBA DNL or less for residential land uses and that all non-residential land uses follow the requirements of the Cal Green Code. Commercial retail uses are planned for the first floor and residential uses are planned for floors two to six. The three residential suites would be located on the sixth floor.

Residential Land Uses

The proposed residential units having direct line-of-sight to Alum Rock Avenue would be exposed to future exterior noise levels up to 72 dBA DNL. The western and eastern façades of the building would be exposed to future exterior noise levels ranging from 60 to 69 dBA DNL. The southern façade of the building would be exposed to future exterior noise levels ranging from 70 to 72 dBA DNL. Exterior noise levels at the northernmost façade of the building would be 55 dBA DNL or less.

Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA DNL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA DNL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

Assuming windows to be partially open for ventilation, the interior noise levels for the proposed project would be up to 54 dBA DNL at the units along the western, and eastern façades of proposed building nearest to Alum Rock Avenue, and up to 57 dBA DNL at the southern façade, facing Alum Rock Avenue. This would exceed the 45 dBA DNL threshold for interior noise.

Commercial Retail Uses

The Cal Green Code performance method requires that interior noise levels within non-residential land uses be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation. The proposed commercial uses would be located on the first floor of the proposed building and exposed to future exterior noise levels reaching 72 dBA $L_{eq(1\text{-}hr)}$ during daytime hours. Interior noise levels for the proposed commercial uses would range from 41 to 44 dBA $L_{eq(1\text{-}hr)}$ assuming standard construction methods, which would be less than the 50 dBA $L_{eq(1\text{-}hr)}$ Cal Green Code performance method standard.

Recommended Conditions of Approval

The following Conditions of Approval are recommended to reduce interior noise levels within residences to 45 dBA DNL or less and interior noise levels within commercial uses to 50 dBA L_{eq} or less:

- Provide all commercial and residential units with a suitable form of forced-air mechanical ventilation (as determined by the local building official) so that windows can be kept closed at the occupant's discretion to control interior noise levels and achieve the interior noise level standards.

- A qualified acoustical specialist shall prepare a detailed analysis of interior residential noise levels resulting from all exterior sources during the design phase pf the project pursuant to requirements set forth in the State Building Code and submit a description of the necessary noise control treatments to the City prior to issuance of a building permit. The study will review the final site plan, building elevations, and floor plans and recommend building treatments to reduce residential interior noise levels to 45 dBA DNL or less and commercial interior noise levels to 50 dBA L_{eq} or less. Treatments would likely include, but are not limited to, sound-rated windows and doors, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. Preliminary acoustical glazing recommendations for the project indicate that commercial uses would require windows and doors rated at STC 28 or greater to achieve the 50 dBA L_{eq} threshold and residential uses would require standard windows and doors rated from STC 28 to STC 33 to achieve the 45 dBA DNL threshold.

The implementation of these conditions of approval would reduce interior noise levels to acceptable levels.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.

    - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.

    - A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.

- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. This is a **potentially significant** temporary noise impact.

The potential for temporary noise impacts due to project construction activities would depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use. Further, the City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

Construction activities generate considerable amounts of noise, especially during earth-moving activities and during the construction of the building's foundation when heavy equipment is used. The highest noise levels would be generated during grading, excavation, and foundation construction. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well.

Construction is estimated to begin in July 2020 and would take approximately 19 months. Construction activities for individual projects are typically carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 5 and 6. Table 5 shows the maximum noise levels produced by various construction equipment, and Table 6 shows the average noise level range by construction phase. Most demolition and construction noise falls with the range of 80 to 90 dBA L_{max} at a distance of 50 feet from the source. Average noise levels produced by the construction of domestic housing projects generally fall within the range of 65 to 88 dBA L_{eq} at the nearest receptors located approximately 50 feet from the construction work area. Such noise levels would be expected at the nearest receptors to the site. Construction-generated noise levels drop off at a rate of about 6 dBA

per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

TABLE 5 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 6 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

Table 7 summarizes the construction noise levels calculated with the Federal Highway Administration's Roadway Construction Noise Model (RCNM v1.1) based on construction equipment assumptions provided by the project applicant. The maximum instantaneous noise level (L_{max}) and average noise level (L_{eq}) is shown for each type of equipment. The average noise level for the construction phase was conservatively calculated assuming the operation of all construction equipment simultaneously.

TABLE 7 Construction Noise Levels Calculated with RCNM at 50 Feet (dBA)

Construction Phase	Equipment Type	Equipment L_{max}	Equipment L_{eq}	Construction Phase L_{eq}
Demolition	Concrete/Industrial Saws	90	83	86
	Excavators	80	77	
	Rubber-Tired Dozers	82	78	
	Tractors/Loaders/Backhoes	84	80	
Site Preparation	Graders	85	81	85
	Rubber Tired Dozers	82	78	
	Tractors/Loaders/Backhoes	84	80	
Grading / Excavation	Scrapers	84	80	86
	Excavators	81	77	
	Graders	85	81	
	Rubber Tired Dozers	82	78	
	Tractors/Loaders/Backhoes	84	80	
Trenching	Tractor/Loader/Backhoe	84	80	82
	Excavators	81	77	
Building Exterior	Cranes	81	73	83
	Forklifts	75	68	

Construction Phase	Equipment Type	Equipment L_{max}	Equipment L_{eq}	Construction Phase L_{eq}
	Generator Sets	81	78	
	Tractors/Loaders/Backhoes	84	80	
	Welders	74	70	
Building Interior	Air Compressors	78	74	75
	Aerial Lift	75	68	
Paving	Cement and Mortar Mixers	80	77	86
	Pavers	77	74	
	Paving Equipment	90	83	
	Rollers	80	73	
	Tractors/Loaders/Backhoes	84	80	

Source: Illingworth & Rodkin, Inc., September 2019.

Adjacent commercial land uses are exposed to ambient daytime noise levels typically ranging from 65 to 72 dBA L_{eq} due to traffic along Alum Rock Avenue. Existing residential land uses bordering the site are exposed to lower ambient noise levels because they are located further from Alum Rock Avenue and shielded by intervening buildings. Typical daytime noise levels at nearby residences range from 57 to 68 dBA L_{eq}. During busy construction periods, noise levels would generally fall within the range of 75 to 86 dBA L_{eq} at the nearest receptors located approximately 50 feet from the construction work area. Noise levels due to construction activities would substantially exceed ambient conditions for a period exceeding one year. This is a **potentially significant** impact.

Mitigation Measure 1a:

The potential short-term noise impacts associated with construction of the project would be mitigated by the implementation of General Plan Policy EC-1.7. This policy states:

> Construction operations within the City will be required to use available noise suppression devices and techniques and continue to limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:
>
> - Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.
>
> For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

A typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;

- Prohibit all unnecessary idling of internal combustion engines;

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

The potential short-term noise impacts associated with project construction activities would be mitigated by the reasonable noise reduction measures identified above, incorporated into the construction plan and implemented during all phases of construction activity. Construction noise would be minimized to the extent feasible, reducing the noise exposure of neighboring properties to a less-than-significant level.

Impact 1b: **Permanent Noise Level Increase.** The proposed project is not expected to cause a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

According to Policy EC-1.2 of the City's General Plan, a significant permanent noise increase would occur if the project would increase noise levels at noise-sensitive receptors by 3 dBA DNL or more where ambient noise levels exceed the "normally acceptable" noise level standard. Where ambient noise levels are at or below the "normally acceptable" noise level standard, noise level increases of 5 dBA DNL or more would be considered significant. The City's General Plan defines the "normally acceptable" outdoor noise level standard for the residential land uses to be 60 dBA DNL. Existing ambient levels, based on the measurements made in the project vicinity, exceed 60 dBA DNL near Alum Rock Avenue, and are about 54 dBA DNL away from Alum Rock Avenue. Therefore, a significant impact would occur if traffic due to the proposed project would

permanently increase ambient levels by 3 dBA DNL. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

The project's traffic study included peak hour turning movements for the existing traffic volumes at six intersections: King Road/Alum Rock Avenue, 34th Street/Alum Rock Avenue, 33rd Street/Alum Rock Avenue, US 101 Northbound Ramps/Alum Rock Avenue, US 101 Southbound Ramps/Alum Rock Avenue, and Project Access/Alum Rock Avenue. Additionally, the traffic study calculated trip generation information, which are 46 net additional trips during the peak AM hour and 79 net additional trips during the peak PM hour. The project's contribution to permanent noise level increases along roadways serving the site was calculated to be 1 dBA DNL or less. The proposed project would not result in a permanent noise increase of 3 dBA DNL or more and the impact is less-than-significant impact. Similarly, cumulative traffic noise levels would not be substantially increased, and the project would not cause a "cumulatively considerable" contribution to increased traffic noise levels in the project vicinity.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project could generate noise in excess of standards established in the City's General Plan at the nearby sensitive receptors. This is a **potentially significant** impact.

Under the City's Noise Element, noise levels produced by the operation of mechanical equipment shall not exceed a noise level of 55 dBA DNL at receiving noise-sensitive land uses.

The project design is not far enough along at this point that mechanical equipment that will service the building have been selected. Generally, however, one HVAC unit would be provided per unit at the rooftop level of the building which will cause most of the noise to be projected upward and away from neighboring properties.

Noise levels produced by a typical residential heat pump are approximately 56 dBA at 3 feet during operation. Noise levels produced by a typical residential air conditioning condenser are approximately 66 dBA at 3 feet during operation. Due to the limited ground space surrounding the building, it is assumed for the purpose of this study that the HVAC units would be located on the rooftop level of the building.

No equipment is anticipated for a project of this scale that would make meeting the applicable noise limits with standard noise control measures difficult. However, during final design of the mechanical systems, the noise levels from the various pieces of equipment on the rooftop should be calculated to ensure compliance with the City's 55 dBA DNL threshold. This is a potentially significant impact.

Parking Lot Noise

A surface parking lot with seven parking spaces is proposed for the north side of the building. This portion of the site is already currently being used as a parking lot. Noise levels at this location (ST-1) were measured at 54 dBA L_{eq} during the noise study. The noise levels at the residences just to

the north of the proposed parking lot will be further reduced by up to 5 dBA by a proposed six-foot stucco wall. The major noise sources attributed to parking lot activities is the sound of vehicles as they drive by, noise generated when vehicles start their engines, door slams, and the occasional sound of car alarms. Sounds of voices generally produce less noise. Based on data contained in *Illingworth & Rodkin, Inc.'s* files, typical parking lot activities generate maximum noise levels of 50 to 60 dBA L_{max} when measured at 50 feet from the source. Car alarms generate maximum noise levels of 63 to 70 dBA L_{max} at 50 feet. The hourly average noise level resulting from all these noise-generating activities in a small parking lot would reach 40 dBA L_{eq} at a distance of 50 feet from the parking area. Parking lot activities could result in intermittent, loud noises at adjoining residential land uses, but these sounds would not be expected to exceed existing noise levels due to parking lot activities in the area or result in noise levels exceeding the 55 dBA DNL noise limit established in the General Plan.

Mitigation Measure 1c: None required.

Mitigation Measure 1c:

Prior to the issuance of building permits, mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's 55 dBA DNL requirement. A qualified acoustical consultant shall be retained by the project applicant to review mechanical noise as the equipment systems are selected in order to determine specific noise reduction measures necessary to reduce noise to comply with the City's noise limit at the shared property lines. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and/ or installation of noise barriers such as mechanical equipment screens or enclosures.

The noise exposure of neighboring properties would be reduced to meet the General Plan thresholds resulting in a less-than-significant impact.

Impact 2: **Generation of Excessive Groundborne Vibration.** Construction-related vibration levels would exceed 0.2 in/sec PPV at adjacent buildings of normal conventional construction. **This is a potentially significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools are used. Construction activities would include the demolition of existing structures, site preparation work, excavation of the below-grade parking levels, foundation work, and new building framing and finishing. Pile driving is not anticipated as a foundation construction technique.

Policy EC-2.3 of the City of San José General Plan establishes a vibration limit of 0.08 in/sec PPV to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.2 in/sec PPV to minimize damage at buildings of normal conventional construction. The vibration limits contained in this policy are conservative and designed to provide the ultimate level of protection for existing buildings in San José. As discussed in detail below, vibration levels exceeding these thresholds would be capable of cosmetically damaging adjacent buildings. Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage is defined as hairline cracking in masonry or the loosening of plaster. Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls.

Table 8 presents typical vibration levels from construction equipment at 25 feet. Jackhammers typically generate vibration levels of 0.035 in/sec PPV and drilling typically generates vibration levels of 0.09 in/sec PPV at 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 8 also presents construction vibration levels at various distances from the construction equipment. Calculations were made to estimate vibration levels at distances of 5 feet from project construction areas, as well as distances of 15, 35, and 45 feet from the site to represent other nearby buildings surrounding the site. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

TABLE 8 Vibration Levels for Construction Equipment at Various Distances

Equipment		PPV at 5 ft. (in/sec)	PPV at 15 ft. (in/sec)	PPV at 25 ft. (in/sec)	PPV at 35 ft. (in/sec)	PPV at 45 ft. (in/sec)
Clam shovel drop		**1.186**	**0.354**	**0.202**	0.140	0.106
Hydromill (slurry wall)	in soil	0.047	0.014	0.008	0.006	0.004
	in rock	0.100	0.030	0.017	0.012	0.009
Vibratory Roller		**1.233**	**0.368**	**0.210**	0.145	0.110
Hoe Ram		**0.523**	0.156	0.089	0.061	0.047
Large bulldozer		**0.523**	0.156	0.089	0.061	0.047
Caisson drilling		**0.523**	0.156	0.089	0.061	0.047
Loaded trucks		**0.446**	0.133	0.076	0.052	0.040
Jackhammer		**0.206**	0.061	0.035	0.024	0.018
Small bulldozer		0.018	0.005	0.003	0.002	0.002

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., September 2019.

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.2 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction. A review of the City of San José Historic Resource Inventory[1] identified the building located at 1805 Alum Rock Avenue, approximately 1,000 feet from the project site, as the only historic resource in the site vicinity. Groundborne vibration levels due to project construction activities would not exceed 0.08 in/sec PPV at distances greater than 60 feet, therefore, the impact to historic structures in the site vicinity is less-than-significant. A significant impact would result at nearby buildings of normal conventional construction if groundborne vibration levels attributable to project construction would exceed 0.2 in/sec PPV.

Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity of historic properties adjoining the site. Some activities would occur at distances of about 5 feet, and at this distance, vibration levels due to construction are conservatively calculated to reach up to 1.2 in/sec PPV, which would exceed 0.2 in/sec PPV threshold for buildings of normal conventional construction.

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507[2], and these findings have been applied to vibrations emanating from construction equipment on buildings[3]. As shown on Figure 10, these studies indicate an approximate 20% probability of "threshold damage" (referred to as cosmetic damage elsewhere in this report) at

[1] City of San José Historic Resources Inventory, https://www.sanjoseca.gov/DocumentCenter/View/35475 and https://www.arcgis.com/apps/webappviewer/index.html?id=b2d7cc355a86493c8da904b8c2fc3e3e&extent=-13591970.1207%2C4462771.7617%2C-13533877.9792%2C4499308.6613%2C102100

[2] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

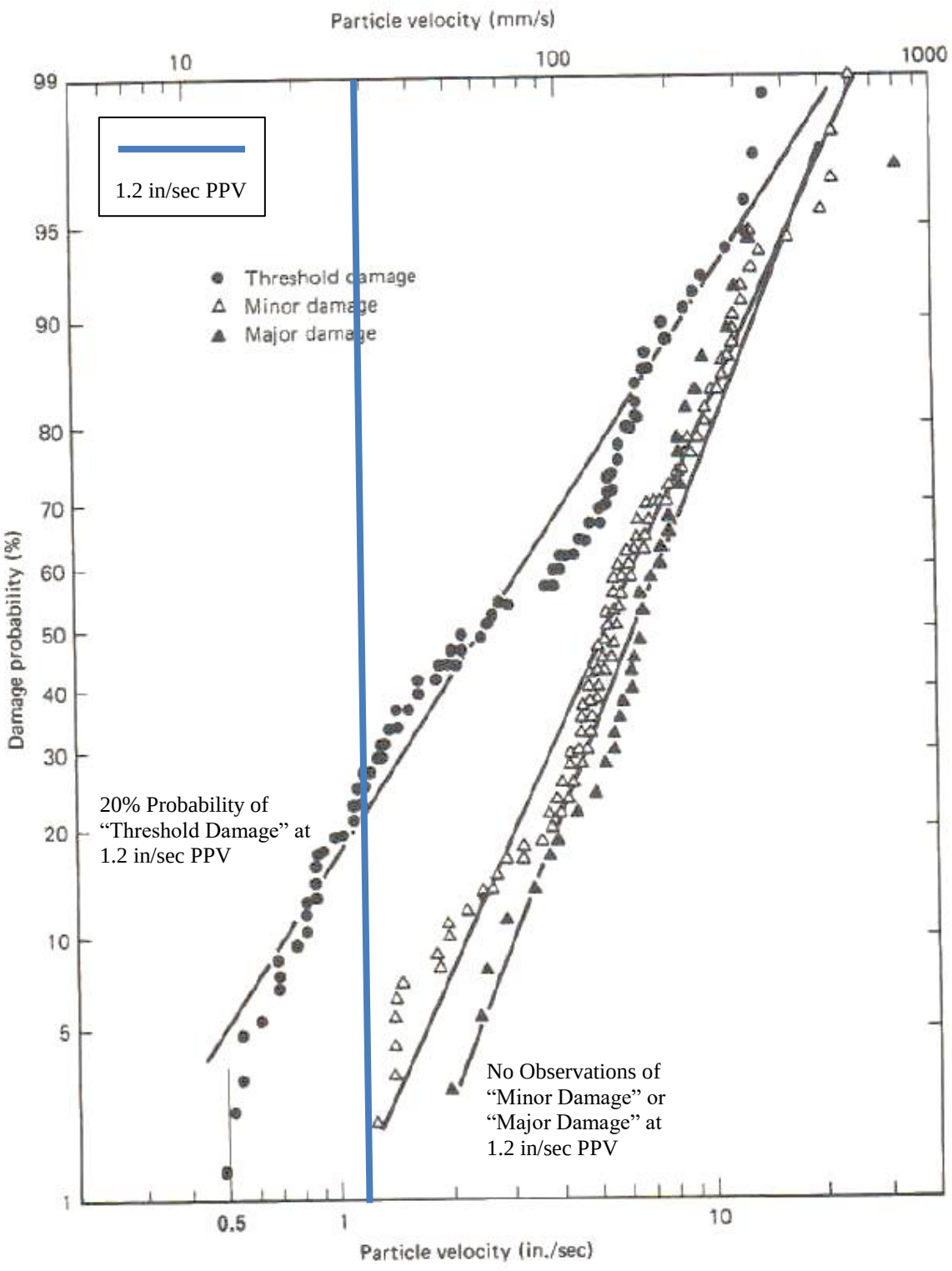
[3] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

vibration levels of 1.2 in/sec PPV or less and no observations of “minor damage” or “major damage” at vibration levels of 1.2 in/sec PPV or less. Figure 10 presents the damage probability as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 1.2 in/sec PPV. Based on these data, cosmetic or threshold damage would be manifested in the form of hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. However, minor damage (e.g., hairline cracking in masonry or the loosening of plaster) or major structural damage (e.g., wide cracking or shifting of foundation or bearing walls) would not occur assuming a maximum vibration level of 1.2 in/sec PPV. Project-generated vibration levels would fall below the General Plan threshold of 0.2 in/sec PPV at other surrounding conventional buildings located 30 feet or more from the project site. Neither cosmetic, minor, or major damage would occur at conventional buildings located 30 feet or more from the project site.

At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

In summary, the construction of the project would not generate vibration levels exceeding the General Plan threshold of 0.08 in/sec PPV at the nearest historic property, but would produce vibration levels exceeding 0.2 in/sec PPV or more at buildings of normal conventional construction located within 30 feet of the project site. Such vibration levels would be capable of cosmetically damaging the adjacent buildings.

FIGURE 10 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996 as modified by Illingworth & Rodkin, Inc., September 2019.

Mitigation Measure 2:

- Prohibit impact or vibratory pile driving. Drilled piles or mat slab foundations cause lower vibration levels where geological conditions permit their use.

- A list of all heavy construction equipment to be used for this project known to produce high vibration levels (tracked vehicles, vibratory compaction, jackhammers, hoe rams, etc.) shall be submitted to the City by the contractor. This list shall be used to identify equipment and activities that would potentially generate substantial vibration and to define the level of effort required for continuous vibration monitoring.

- Place operating equipment on the construction site as far as possible from vibration-sensitive receptors.

- Use smaller equipment to minimize vibration levels below the limits.

- Avoid using vibratory rollers and tampers near sensitive areas.

- Select demolition methods not involving impact tools.

- Modify/design or identify alternative construction methods to reduce vibration levels below the limits.

- Avoid dropping heavy objects or materials.

- A construction vibration-monitoring plan shall be implemented to document conditions conventional properties within 30 feet of the project site prior to, during, and after vibration generating construction activities. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and be in accordance with industry accepted standard methods. The construction vibration monitoring plan should be implemented to include the following tasks:

    - Identification of sensitivity to ground-borne vibration of the property. A vibration survey (generally described below) would need to be performed.

    - Performance of a photo survey, elevation survey, and crack monitoring survey for the structures within 30 feet of the site. Surveys shall be performed prior to, in regular intervals during, and after completion of vibration generating construction activities and shall include internal and external crack monitoring in the structure, settlement, and distress and shall document the condition of the foundation, walls and other structural elements in the interior and exterior of said structure.

    - Development of a vibration monitoring and construction contingency plan to identify where monitoring would be conducted, set up a vibration monitoring schedule, define structure-specific vibration limits, and address the need to conduct photo, elevation, and crack surveys to document before and after construction.

Construction contingencies would be identified for when vibration levels approach the limits.

- If vibration levels approach limits, suspend construction and implement contingencies to either lower vibration levels or secure the affected structure.

- Conduct a post-survey on the structure where either monitoring has indicated high levels or complaints of damage. Make appropriate repairs where damage has occurred as a result of construction activities.

- The results of all vibration monitoring shall be summarized and submitted in a report shortly after substantial completion of each phase identified in the project schedule. The report will include a description of measurement methods, equipment used, calibration certificates, and graphics as required to clearly identify vibration-monitoring locations. An explanation of all events that exceeded vibration limits will be included together with proper documentation supporting any such claims.

- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

The implementation of these measures would reduce the impact to a less-than-significant level.

Impact 3: **Excessive Aircraft Noise.** The project site is located over 2 miles from a public airport or public use airport and would not expose people residing or working in the project area to excessive aircraft noise. **This is a less-than-significant impact.**

Reid-Hillview Airport and Mineta San José International Airport are public airports located approximately 2.2 and 3.1 miles from the project site, respectively. The project site lies outside both Reid-Hillview Airport's 2022 60 dBA CNEL noise contour[4] (see Figure 11) and Mineta San José International Airport's 2027 60 dBA CNEL noise contour[5] (see Figure 12). This means that future exterior noise levels due to aircraft from these airports are compatible with the proposed land use resulting in a less-than-significant impact.

Mitigation Measure 3: **None required.**

[4] Santa Clara County Airport Land Use Commission, "Comprehensive Land Use Plan, Santa Clara County, Reid-Hillview Airport", Amended November 16, 2016.
[5] City of San José, "Norman Y. Mineta San José International Airport Master Plan Update Project: Eighth Addendum to the Environmental Impact Report," City of San José Public Project File No. PP 10-024, February 10, 2010.

FIGURE 11 2022 CNEL Noise Contours for Reid-Hillview Airport

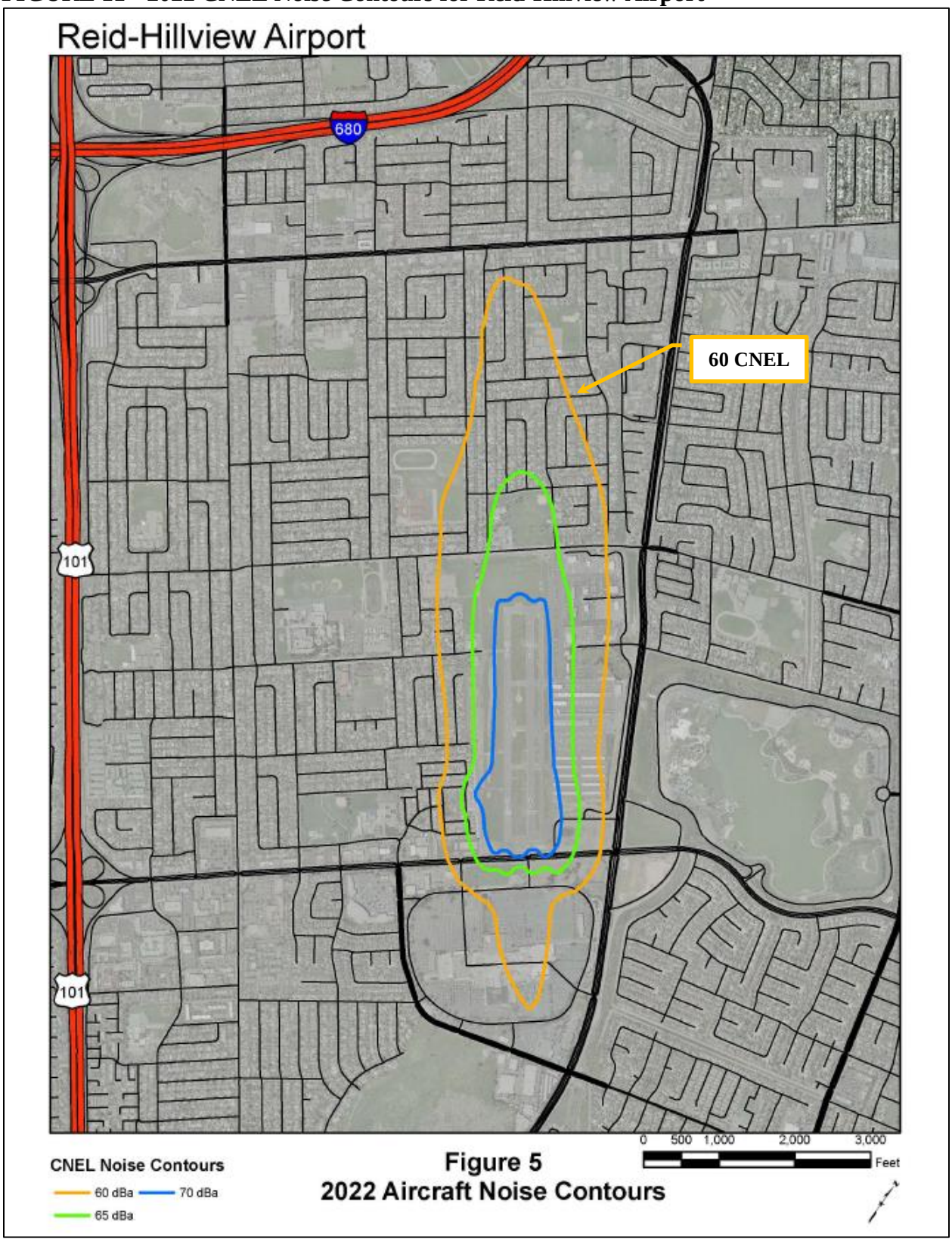


FIGURE 12 2027 CNEL Noise Contours for SJIA Relative to Project Site