Appendix G
Noise Study

141st and Normandie Townhome Project

Noise Impact Study

City of Gardena, CA

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1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate the potential noise impacts for the project study area and to recommend noise mitigation measures, if necessary, to minimize the potential noise impacts. The assessment was conducted and compared to the noise standards set-forth by the Federal, State and Local agencies. Consistent with the City's Noise Guidelines, the project must demonstrate compliance to the applicable noise criterion as outlined within the City's Noise Element and Municipal Code.

The following is provided in this report:

- A description of the study area and the proposed project
- Information regarding the fundamentals of noise
- A description of the local noise guidelines and standards
- An analysis of traffic noise impacts to the project site
- An analysis of construction noise impacts

1.2 Site Location and Study Area

The 141st and Normandie Townhomes Project (Project) site is located in the City of Gardena within the County of Los Angeles; refer to Exhibit A. Specifically, the Project site is located within the northeastern portion of the City at 1335, 1337, 1341, and 1343 W. 141st Street. It is approximately 2.02 acres in size

The Project site is a relatively flat square-shaped property at an elevation of approximately 53 feet above mean sea level, with a general topographic gradient to the southwest.[1] There is currently a landscape nursery (Lloyd's Nursery) in operation on the project site. In addition to the nursery (with rows of containers containing a variety of plants and trees) and associated glasshouse and greenhouse structures, there are two single-family residential structures located on the site. One of the residential structures serves as an office for the nursery operations and the other serves as the residence for the nursery's groundskeeper.

The project site is primarily accessed from W. 141st Street. Two driveways provide access to the nursery portion of the site. An unpaved/dirt driveway extends north from W. 141st Street within the project site and then extends west along the northern portion of the project site to S. Normandie Avenue. The driveway is gated on S. Normandie Avenue and primarily serves the nursery portion of the site. The two on-site residential structures are accessed by separate driveways from W. 141st Street.

The northern portion of the site is separated from adjacent uses by a block wall, chain link fence, and landscaping. A chain link fence separates a portion of the project site's eastern boundary and the

[1] Stantec, *Phase I and II Environmental Site Assessment 1335, 1337, 1341, and 1343 West 141st Street, Gardena, California*, May 21, 2019.

adjacent residential property. The remainder of the eastern portion of the project site is open to the adjacent residential property. The project site's southern property line extends to the existing curb; there are no sidewalks along the frontage of the project site. A chain link fence and landscaping are located along the project site's western boundary. A sidewalk and parkway are located between the project site and S. Normandie Avenue.

Uses surrounding the Project site include:

- North: Two-story multiple-family residential buildings, vacant land and light industrial land uses border the site to the north. Properties north of the site are zoned R3 and R1.

- East: Single-family residences border the site to the east. These properties are zoned R1.

- South: 140th Street borders the site to the south. Land uses south of 140th Street are commercial and residential.. These properties are zoned C3 and R1.

- West: S. Normandie Avenue borders the project site to the west. Land uses west of S. Normandie Avenue are commercial/manufacturing. These properties are zoned M-1

1.3 Proposed Project Description

The proposed project includes the demolition of all buildings onsite and the construction of a multiple-family townhome development. The project proposes 6 buildings with a central courtyard area, and 50 high density residential (townhomes units) on approximately 2.02 acres. The proposed site plan is presented on Exhibit B.

Exhibit A

Location Map

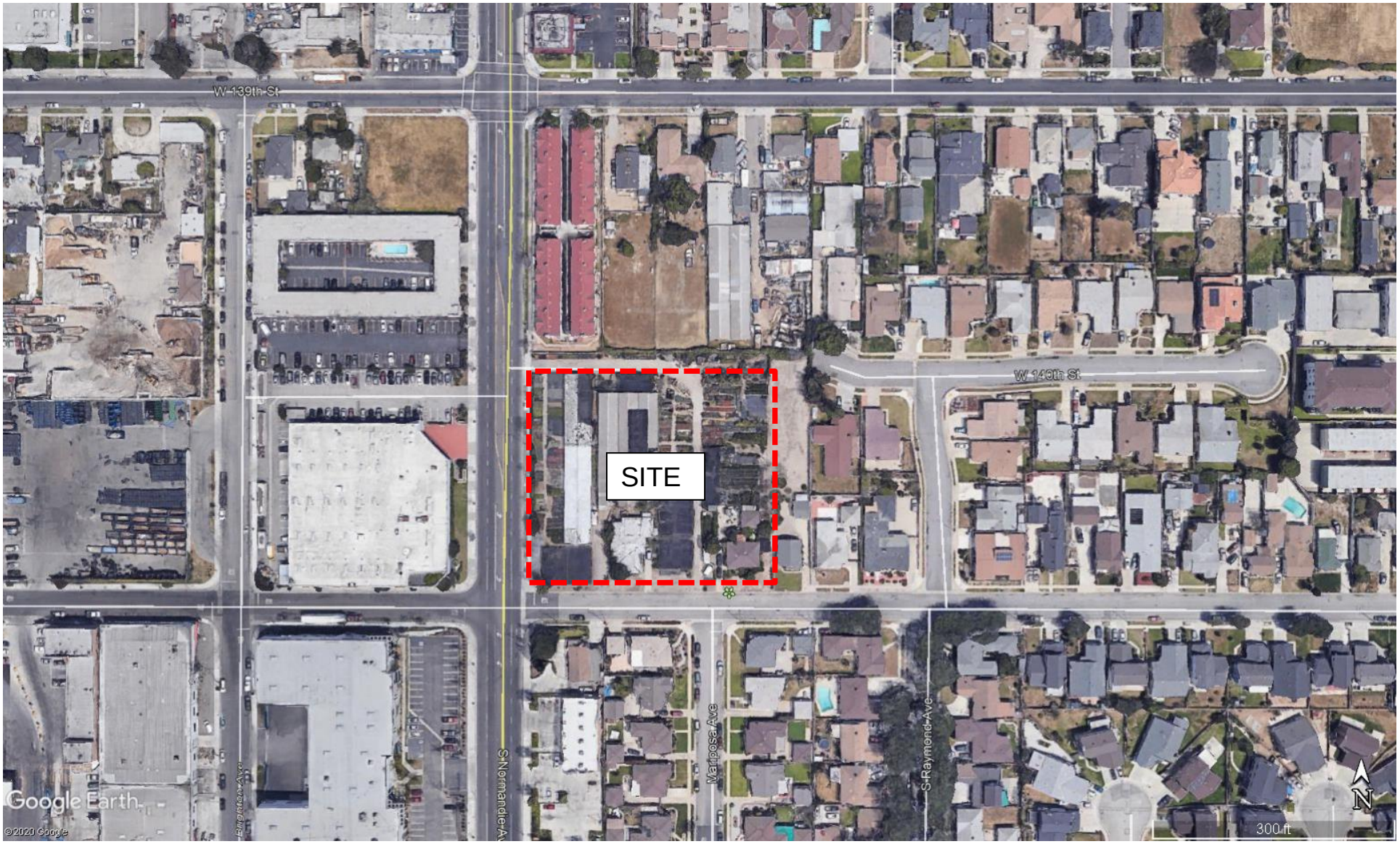
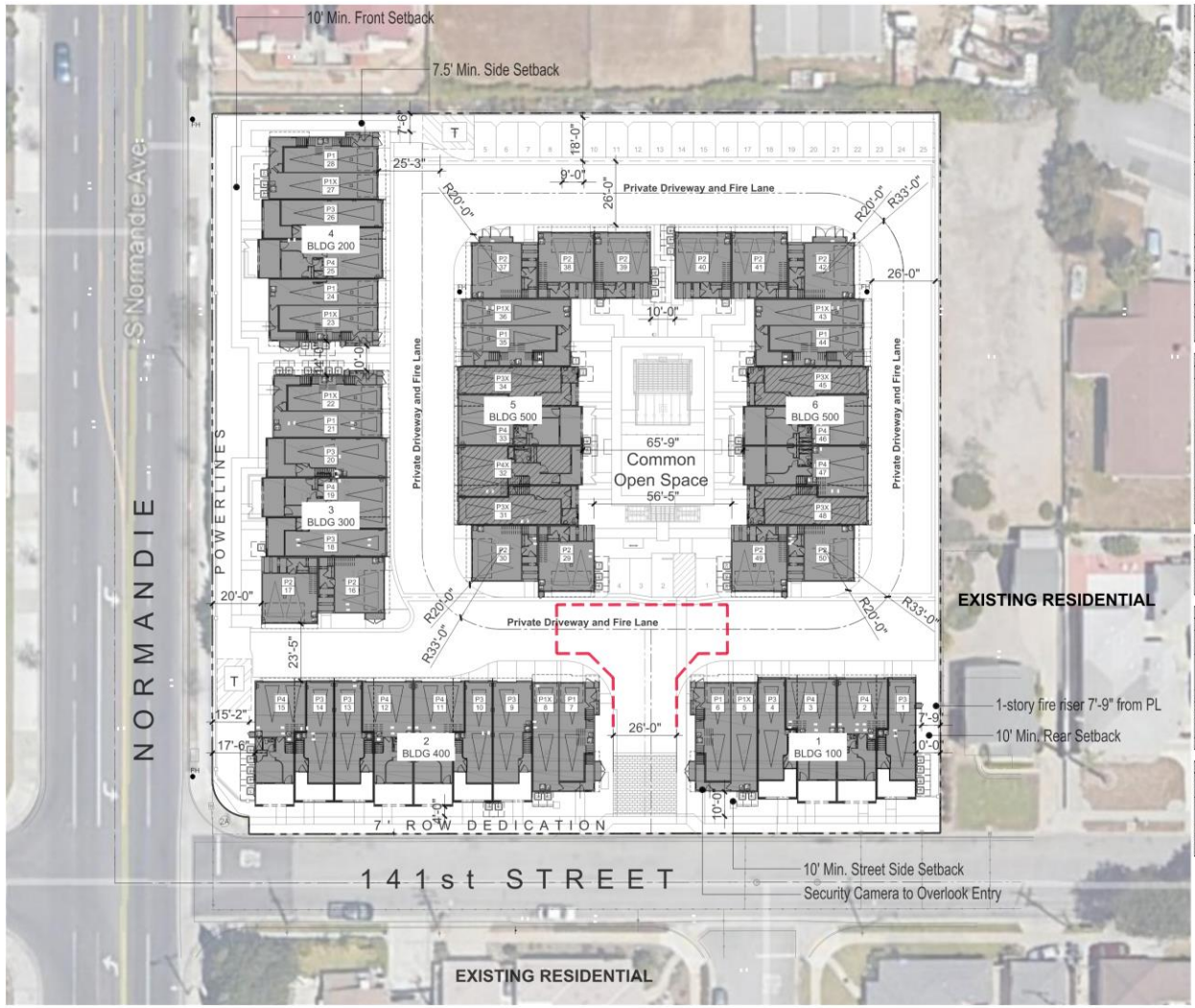


Exhibit B

Site Plan



Property Address	Legal Description
1335, 1337,1341, & 1343 West 141st Street Gardena, CA 90247	Pin No. Assessors No :6115-013-007,-008,-009, -010, & -011 TTM No. 82945

Building Code Summary	
Occupancy	R-2
Construction Type	Type V-B (non rated)
Fire Sprinkler	NFPA 13
Building Type	On-Grade
Number of Stories	3
Zoning	
Current Zoning	R-1 & R-3
Proposed Zoning	R-4

Site Summary	Site Area	
Gross Site Area	88,038 SF	2.02 AC
Net Site Area	85,813 SF	1.97 AC
Dwelling Units*	50 DU	
Gross Density	24.7 DU/AC	
Net Density	25.4 DU/AC	
Lot Coverage		
Permitted Lot Coverage	N/A	
Provided Lot Coverage	38.85 % Provided	
Density		
Permitted Density (30 DU/AC)	60.6 DU	
Provided Density	50.0 DU	
Building Height		
Allowed	35'-0" or 40'-0" with projections, max. 3-stories	
Proposed	36'-7"	

Townhomes Plan Summary	#	GFA	Beds	%	Total GFA	FA + Garage
P1	7	1,260	2	14.0%	8,820	11,886
P1X	7	1,293	2	14.0%	9,051	12,362
P2	12	1,310	2	24.0%	15,720	21,396
P3	13	1,415	3	26.0%	18,395	24,362
P4	11	1,659	3	22.0%	18,249	22,308
Total	50			100.0%	70,235	92,314

Type	#	%
2 bedroom Units	26	52.0%
3 bedroom Units	24	48.0%
Total	**50**	**100%**

Bedroom Count		
Type	#	%
2 bedroom total	52	41.9%
3 bedroom total	72	58.1%
Total	**124**	**100%**

Parking Summary	Spaces/ Unit	Req.
Required		
Resident	2.0	100
Guest	0.5	25
Total Required Parking	**2.5**	**125**

Parking Provided	Spaces/ Unit	ces Provided
Garage Spaces	2.0	100
Guest Spaces	0.46	23
Accessible Space	0.04	2
Total Provided Parking	**2.50**	**125**

Open Space			
Common Open Space	±	24,543 SF	74 %
Private Open Space	±	8,693 SF	26 %
Total Gross Open Space	±	33,236 SF	664.7 SF/UNIT
Building Coverage	±	34,199 SF	38.85 %
Pavement Coverage	±	29,296 SF	33.28 %
Gross Landscape Coverage	±	24,543 SF	27.88 %

Legend

Accessible Units (5)

FH Fire Hydrant

Total Square Footage Per Building

Building #	SF
1	12,081
2	18,272
3	13,863
4	11,642
5	22,115
6	22,115

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GARDENA - 141st & NORMANDIE
GARDENA, CA # 2019-0355

Plot Date: 07.16.2020

CONCEPTUAL SITE PLAN

SCALE: 1"=20'-0"
0 10 20 40

A1.0

2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

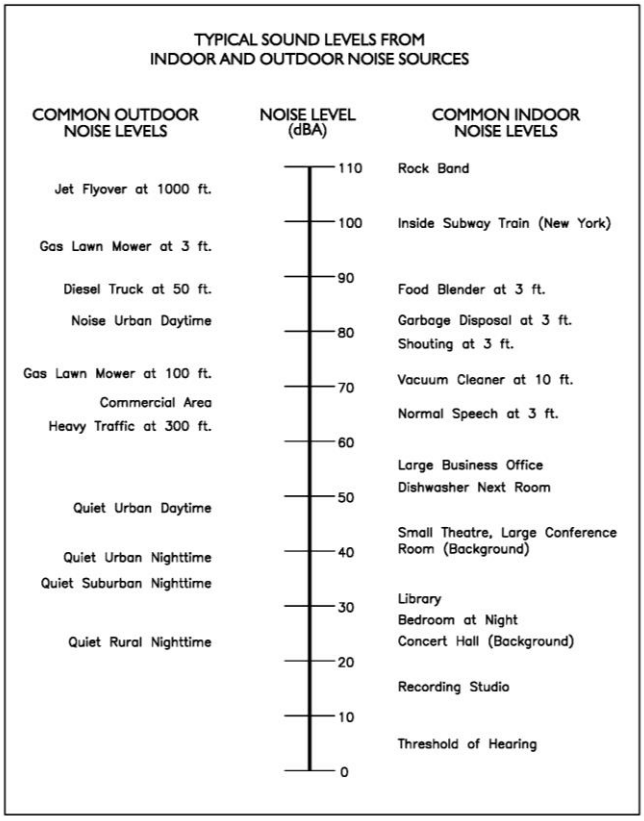
2.1 Sound, Noise and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic, or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.

2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding) and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting out at 20 Hz all the way to the high pitch of 20,000 Hz.

Exhibit C: Typical A-Weighted Noise Levels



2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines it loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measure in units of micro-Newton per square inch meter (N/m2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels abbreviated dB. Exhibit C illustrates references sound levels for different noise sources.

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3 dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, (A-weighted scale) and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive the change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g. doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

2.6 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted 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 response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a 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, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly, L50, L90 and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc. associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

2.7 Traffic Noise Prediction

Noise levels associated with traffic depends on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2–3 axle) and heavy truck percentage (4 axle and greater), and sound propagation. The greater the volume of traffic, higher speeds and truck percentages equate to a louder

volume in noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.8 Sound Propagation

As sound propagates from a source it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity and turbulence can further impact have far sound can travel.

3.0 Ground-Bourne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV) which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be

effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.

4.0 Regulatory Setting

The proposed project is located in the City of Gardena and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible to regulate noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible to regulate noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdiction use their land use regulatory authority to arrange new development in such a way that “noise sensitive” uses are either prohibited from being constructed adjacent to a highway or, or alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the City is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix.” The matrix allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24 and the Uniform Building Code (UBC) which in some cases requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan.

The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable. The City of Gardena has adopted their own version of the State's Land Use Compatibility Guidelines. These are presented on Exhibit D.

4.3 City of Gardena Noise Regulations

The City of Gardena outlines their noise regulations and standards within the Noise Element of the City's General Plan and the Noise Ordinance located in the City's Municipal Code.

City of Gardena General Plan

Applicable policies and standards governing environmental noise in the City are set forth in the General Plan Noise Element. The City's noise and land use compatibility guidelines for land use planning are presented in Exhibit D. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable.

Exhibit D: Land Use Compatibility Guidelines

Land Use Category	CNEL, dB						
	55	60	65	70	75	80	
Residential - Single family, multifamily, duplex	A	A	B	C	C		
Residential - Mobile homes	A	A	B	C	C		
Transient Lodging - Motels, hotels	A	A	B	B	C	C	
Schools, Libraries, Churches, Hospitals, Nursing Homes	A	A	B	C	C		
Auditoriums, Concert Halls, Amphitheaters, Meeting Halls	B	B	C	C			
Sports Arenas, Outdoor Spectator Sports, Amusement Parks	A	A	A	B	B		
Playgrounds, Neighborhood Parks	A	A	A	B	C		
Golf Courses, Riding Stables, Cemeteries	A	A	A	A	B	C	C
Office and Professional Buildings	A	A	A	B	B	C	
Commercial Retail, Banks, Restaurants, Theaters	A	A	A	A	B	B	C
Industrial, Manufacturing, Utilities, Wholesale, Service Stations	A	A	A	A	B	B	B
Agriculture	A	A	A	A	A	A	A

Legend

A — NORMALLY ACCEPTABLE
Specified land use is satisfactory based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

B — CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

C — NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If it does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

Source: Taken in part from "Aircraft Noise Impact Planning Guidelines for Local Agencies," U.S. Dept. of Housing and Urban Development, TE/NA-472, November 1972.

In addition to the noise standards, the City has outlined goals, policies and implementation measures to reduce potential noise impacts and are presented below:

Goals, Policies, and Implementation Measures

Policies, goals and implementation program measures from the Noise Element that are applicable to the proposed project are presented below.

Goal N 1.0: Use noise control measures to reduce the impact from transportation noise sources.

Policy N 1.1: Minimize noise conflicts between land uses and the circulation network, and mitigate sound levels where necessary or feasible to ensure the peace and quiet of the community.

Goal N 2.0: Incorporate noise considerations into land use planning decisions.

Policy N 2.2: Require noise/land use compatibility standards to guide future planning and development.

Policy N 2.9: Encourage the creative use of site and building design techniques as a means to minimize noise impacts.

Goal 3.0: Develop measures to control non-transportation noise impacts.

Policy N 3.3: Require compliance with construction hours to minimize the impacts of construction noise on adjacent land.

City of Gardena Municipal Code

Sections 8.36.040 and 8.36.050 of the City's Noise Ordinance establish exterior and interior noise standards that limit how loud project operation noise can be. The allowable exterior noise levels presented in Table 1, limit project operational noise at nearby land uses; and the allowable interior noise levels presented in Table 2, limit how loud project operational noise can be inside nearby residential and mixed use structures. Subsection 8.36.040(C), states that in the event the ambient noise level exceeds the noise standard, the ambient noise level shall become the noise standard.

<Table 1, next page>

Table 1: Allowable Exterior Noise Level (dBA, Leq)

Type of Land Use	15-Minute Average Noise (dBA, Leq)		Maximum Noise Level (dBA, Lmax)	
	7 AM-10 PM	10 PM to 7 AM	7 AM-10 PM	10 PM to 7 AM
Residential	55	50	75	70
Residential portions of mixed use	60	50	80	70
Commercial	65	60	85	80
Industrial or manufacturing	70	70	90	90

Source: City of Gardena Municipal Code Section 8.36.040.

A. The exterior noise standards, unless otherwise specifically indicated, shall apply to all property within the City. The Land Use category refers to the affected receiver property. In the event the alleged offensive noise contains a pure tone such as a whine, screech, or hum, or contains repetitive, impulsive or impact noise such as hammering or riveting, or contains music or speech conveying informational content, each of the above noise standards shall be reduced by 5 dB.

B. No person shall operate or cause to be operated, any source of sound at any location within the incorporated City or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured from any other property, either incorporated or unincorporated, to exceed the noise standards presented in the above table.

C. In the event the ambient noise level exceeds the noise standard, the ambient noise level shall become the noise standard.

Table 2: Allowable Interior Noise Level (dBA, Leq)

Type of Land Use	15-Minute Average Noise (dBA, Leq)		Maximum Noise Level (dBA, Lmax)	
	7 AM-10 PM	10 PM to 7 AM	7 AM-10 PM	10 PM to 7 AM
Residential	45	40	65	60
Residential portions of mixed use	45	40	70	60

Source: City of Gardena Municipal Code Section 8.36.050.70
Notes:

A. The interior noise standards presented above, unless otherwise specifically indicated, shall apply to all residential dwellings with windows in their normal seasonal configuration, where such dwelling is the receiver of intrusive noise:
In the event the alleged offensive noise contains a pure tone such as a whine, screech, or hum, or contains repetitive, impulsive or impact noise such as hammering or riveting, or contains music or speech conveying informational content, each of the above noise standards shall be reduced by 5 dB.

B. No person shall operate or cause to be operated, any source of sound at any location within the incorporated City or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured within any residential dwelling, either incorporated or unincorporated, to exceed the noise standards of paragraph (A).

C. In the event the ambient noise level exceeds the noise standard, the ambient noise level shall become the noise standard.

Construction Noise Regulations

Per Section 8.36.080 of the City's Noise Ordinance, project construction activities are explicitly exempt from the exterior and interior noise standards presented in Sections 8.36.040 and 8.36.050. Specifically, the ordinance states that "noise associated with construction, repair, remodeling, grading or demolition of any real property are exempt from the provisions in Chapter 8.36 (City of Gardena Noise Ordinance), provided said activities do not take place between the hours of 6:00 PM and 7:00 AM on weekdays between the hours of 6:00 PM and 9:00 AM on Saturday or any time on Sunday or a Federal holiday".

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance to the City of Gardena and the Caltrans TeNS manual. All measurements equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). MD noise measurement procedures are presented below:

- Microphones for sound level meters were placed 5-feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of equipment, a wind screen was placed over the microphone
- Frequency weighting was set on “A” and slow response
- Results of the noise measurements were recorded on field data sheets
- During any short-term noise measurements any noise contaminations such as barking dogs, local traffic, lawn mowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Locations

Noise monitoring locations were selected to obtain a baseline of the existing noise environment. Three short-term noise measurements were conducted at nearby noise-sensitive land uses. Appendix A includes photos, field sheet, and measured noise data. Exhibit E illustrates the location of the measurements.

5.3 SoundPLAN Noise Model

SoundPLAN acoustical modeling software was utilized to model worst-case buildout traffic noise levels at the project site and stationary noise associated with the proposed project.

Buildout Traffic Noise Levels on the Project Site

SoundPLAN acoustical modeling software was utilized to model worst-case buildout traffic noise levels associated with S. Normandie Avenue at the proposed project site. The SoundPLAN software utilizes algorithms (based on the inverse square law) to calculate noise level projections. The software allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations. The SoundPLAN software also calculates noise level increases due to the reflection of noise from hard surfaces. Roadway parameters utilized in the noise model include location, traffic volume, speed and vehicle mix (autos, medium trucks, and heavy trucks).

The proposed project will be exposed to traffic noise associated with S. Normandie Avenue. W. 141st Street is not an acoustically significant roadway. S. Normandie Avenue, is designated as a 4-lane divided with an 80-foot right-of-way. It is also designated as a truck route. The 4-lane collector is designed to handle 15,000 to 25,000 ADTs (City of Gardena General Plan, 2006b). Per the traffic study prepared for the 2005 City of Gardena General Plan, S. Normandie Avenue is expected to handle 25,900 ADTs in the year 2025 (City of Gardena 2006b). It is important to evaluate potential impacts of the noisiest possible future conditions which is when the maximum amount of vehicles pass at the greatest speed. This scenario usually corresponds to Level of Service C (LOS C) Conditions, or about 75% of buildout capacity. Therefore, future noise levels associated with S. Normandie Avenue in the vicinity of the proposed project were modeled utilizing an average daily trip volume of 19,425. Speed was modeled as posted and day/night/evening mixes typical of southern California were utilized for modeling purposes. SoundPLAN traffic noise modeling input and output is provided in Appendix B.

Stationary Noise Modeling

SoundPLAN acoustical modeling software was also utilized to model project operational noise. Future worst-case noise level projections were modeled using referenced sound level data for the various stationary on-site sources (air conditioner units). The SP model assumes a total of 50 air conditioning units are operating simultaneously (worst-case scenario), when in actuality the noise will be intermittent and lower in noise level. MD utilized a reference noise level of 68 dBA at 3-feet away within the model. This noise level was utilized as it was an average noise level from a sample set of HVAC unit data. Typical HVAC noise level ranges between 62 to 77 dBA at 3 to 5 feet away from said unit. HVAC units were modeled as shown on the site plan.

5.4 FHWA Traffic Noise Prediction Model

The FHWA Traffic Noise Prediction Model (FHWA-RD-77-108) was utilized to model existing and existing plus project traffic noise volumes along roadways affected by project generated vehicle traffic. The FHWA model arrives at the predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). Existing volumes were calculated using data provided by the City of Gardena Public Works Department (2015). A growth rate of 2% was utilized to estimate 2020 existing volumes. Project trip generation was provided in the traffic impact study prepared by Kittelson & Associates (2020). The referenced traffic data was applied to the model and is in Appendix B. The following outlines the key adjustments made to the REMEL for the roadway inputs:

- Roadway classification – (e.g. freeway, major arterial, arterial, secondary, collector, etc.),
- Roadway Active Width – (distance between the center of the outer most travel lanes on each side of the roadway)
- Average Daily Traffic Volumes (ADT), Travel Speeds, Percentages of automobiles, medium trucks and heavy trucks
- Roadway grade and angle of view
- Site Conditions (e.g. soft vs. hard)
- Percentage of total ADT which flows each hour through-out a 24-hour period

Table 3 indicates the roadway parameters and vehicle distribution utilized for this study.

Table 3: Roadway Parameters and Vehicle Distribution

Roadway	Type	Existing ADT[1]	Existing + Project ADT[2]	Speed (MPH)	Site Conditions
Normandie Avenue	4-Lane Collector	19,432	19,704	35	Soft
Normandie Ave Vehicle Distribution and Mix[3]					
Motor-Vehicle Type		**Daytime % (7AM to 7 PM)**	**Evening % (7 PM to 10 PM)**	**Night % (10 PM to 7 AM)**	**Total % of Traffic Flow**
Automobiles		77.5	12.9	9.6	97.42
Medium Trucks		84.8	4.9	10.3	1.54
Heavy Trucks		86.5	2.7	10.8	0.74

Notes:
[1] Existing ADT volumes for Normandie Ave were calculated using 2015 ADTs provided by the City of Gardena Public Works Dept. with a 2% growth rate.
[2] Project trip generation provided in the traffic study prepared for the project (Kittleson & Assoc. 2020).
[3] Vehicle distribution data is based on typical Southern California roadway vehicle percentages. Normandie Ave is a designated truck route.

To determine the project's noise impact to the surrounding land uses, MD generated noise contours for existing ADT, and existing + project conditions. Noise contours are used to provide a characterization of sound levels experienced at a set distance from the centerline of a subject roadway. They are intended to represent a worst-case scenario and do not take into account structures, sound walls, topography, and/or other sound attenuating features which may further reduce the actual noise level. Noise contours are developed for comparative purposes and are used to demonstrate potential increases/decreases along subject roadways as a result of a project. The traffic noise calculation worksheet outputs are located in Appendix B.

5.5 Interior Noise Modeling

The interior noise level is the difference between the projected exterior noise level at the structure's facade and the noise reduction provided by the structure itself. Typical building construction will provide a conservative 12 dBA noise level reduction with a "windows open" condition and a very conservative 20 dBA noise level reduction with "windows closed". MD estimated the interior noise level by subtracting the building shell design from the predicted exterior noise level. A "windows closed" condition requires mechanical fresh air ventilation (e.g. air conditioning) be provided in habitable dwelling units.

5.6 Construction Noise Modeling

Construction noise associated with the proposed project was calculated utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Construction activities are anticipated to include four phases site preparation, grading, building construction, and architectural coating.

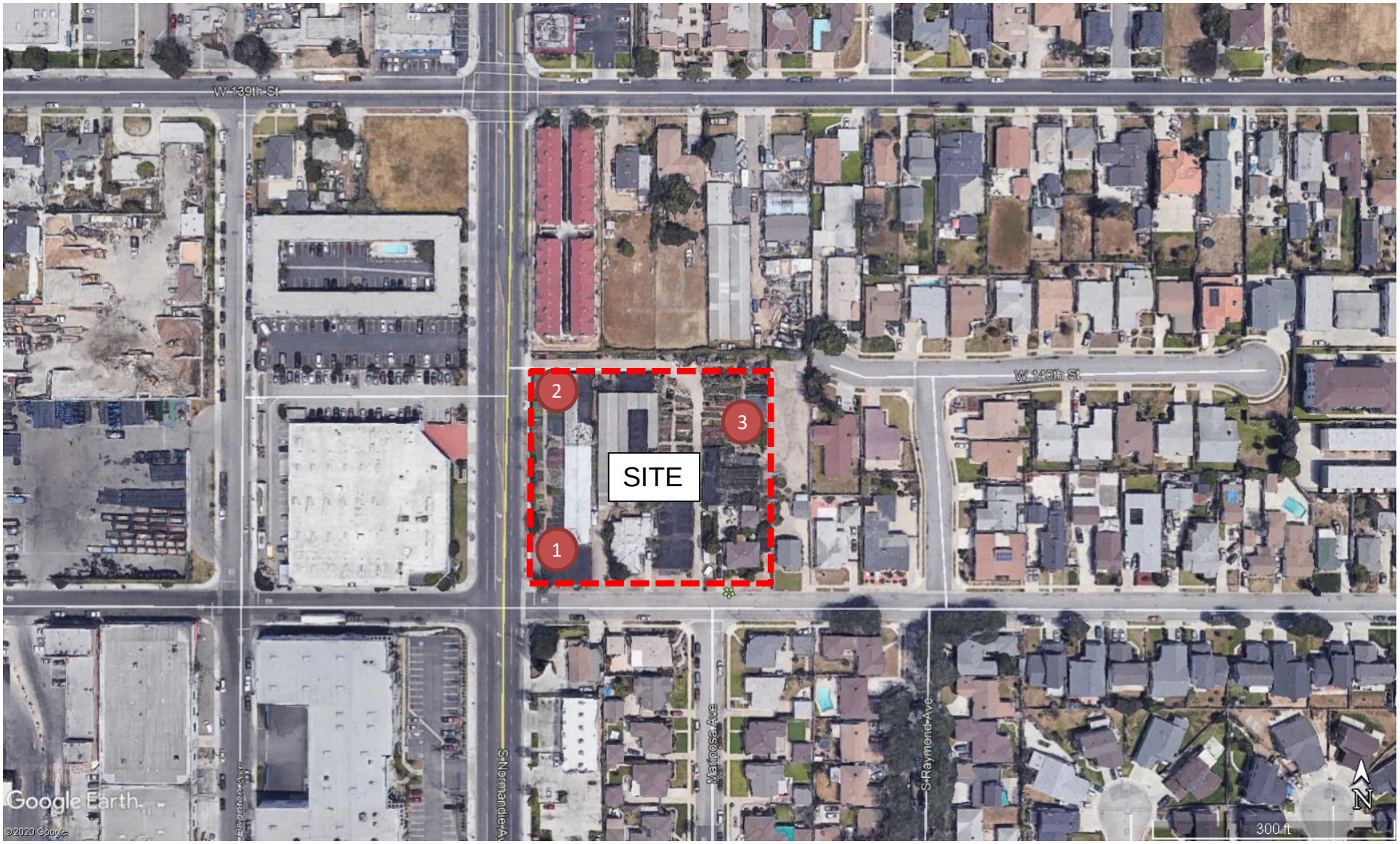
Construction noise levels were calculated for each phase based on CalEEMod Air Quality Model assumptions provided by the project proponent. All equipment was assumed to be situated at the center of the project site. Construction equipment typically moves back and forth across the site; and it is an industry standard to use the acoustical center of the site to model average construction noise levels. construction worksheets are provided in Appendix C.

X = Measurement location

= boundary

Exhibit E

Measurement Locations



6.0 Existing Noise Environment

Noise measurements were conducted in the vicinity of the project site in order to document the existing noise environment. The measurements measured the 1-hour Leq, Lmin, Lmax and other statistical data (e.g. L2, L8). The noise measurements were taken to determine the existing baseline noise conditions.

6.1 Short-Term Noise Measurement Results

Three (3) short-term ambient noise level measurements were performed. The results of the short-term noise data are presented in Table 4.

Table 4: Short-Term Noise Measurement Data (dBA)[1]

Location	Date	Start Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)
Site 1	4/24/2020	8:16 AM to 9:16 AM	67.1	83.5	47.9	75.3	71.5	67.8	63.2
Site 2	4/24/2020	8:19 AM to 9:22 AM	65.2	80.4	45.3	73.6	70.1	65.7	60.3
Site 3	4/24/2020	8:28 AM to 9:28 AM	49.5	75.8	42.6	58.2	52.2	47.2	45.6

Notes:
1. Measurement locations are indicated in Exhibit E.

The data indicates the ambient noise levels at nearby land uses range between 49.5 and 67.1 dBA Leq. The measured noise levels and field notes indicate that traffic noise is the main source of noise impacting the project site.

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts to the project and compares the results to the City's Noise Standards. The analysis details the estimated exterior noise levels associated with traffic from adjacent roadway sources.

7.1 Future Exterior Noise

7.1.1 Offsite Traffic Noise Impact

The potential off-site noise impacts caused by the increase in vehicular traffic as a result of the project were calculated at a distance of 50 feet. The distance to the 55, 60, 65, and 70 dBA CNEL noise contours are also provided for reference. The noise level at 50 feet is representative of approximate distances to existing homes along the subject roadway. The noise contours were calculated for the following scenarios and conditions:

- Existing Condition: This scenario refers to the existing year traffic noise condition and is demonstrated in Table 5.

- Existing + Project Condition: This scenario refers to the existing year plus project traffic noise condition and is demonstrated in Table 5.

Existing/Existing + Project Scenario Comparison

Table 5 provides the Existing and Existing + Project noise conditions and shows the change in noise level as a result of the proposed project. As shown in Table 5, the increase in traffic noise for the Existing and Existing + Project scenario would result in an increase of 0.3 dBA at 50 feet from the centerline of the subject roadway.

<Table 5, next page>

Table 5: Noise Levels Along Roadways (dBA CNEL)

Existing Noise Levels

Roadway	Segment	CNEL at 50 Ft (dBA)	Distance to Contour (Ft)			
			70 dBA CNEL	65 dBA CNEL	60 dBA CNEL	55 dBA CNEL
Normandie Avenue	135th St to Rosecrans Ave	69.5	47	101	217	467

Existing + Project Exterior Noise Levels

Roadway	Segment	CNEL at 50 Ft (dBA)	Distance to Contour (Ft)			
			70 dBA CNEL	65 dBA CNEL	60 dBA CNEL	55 dBA CNEL
Normandie Avenue	135th St to Rosecrans Ave	69.8	48	104	224	482

Noise Level Increase as a Result of the Proposed Project

Roadway[1]	Segment	CNEL at 50 Feet dBA[2]			
		Existing Without Project	Existing With Project	Change in Noise Level	Potential Significant Impact
Normandie Avenue	135th St to Rosecrans Ave	69.5	69.8	0.3	No

Notes:
[1] Exterior noise levels calculated at 5 feet above ground level.
[2] Noise levels calculated from centerline of subject roadway.

7.1.2 On-Site Traffic Noise Impact

Traffic noise from the local roadway network was evaluated and compared to the City's Exterior Noise Standard. Per the City's Exterior Noise Standard (Exhibit D), multi-family residential noise limit is 65 dBA CNEL. As shown in Exhibit F, future traffic noise levels associated with S. Normandie Avenue are expected to range between 29.6 and 37.2 at the proposed outdoor use areas which are shielded by the proposed buildings. Noise levels at proposed outdoor use areas will fall within normally acceptable noise levels as presented in Exhibit D.

Noise levels at buildings proposed along S. Normandie Avenue are expected to reach up to 72.6 dBA CNEL. This noise level exceeds the City's conditionally acceptable noise level as presented in Exhibit D. Impacts related to interior noise levels are discussed in Section 7.2 of this report and a condition of approval to ensure that interior noise levels do not exceed 45 dBA CNEL inside the proposed buildings is provided in Section 7.3 of this report.

7.1.3 Noise Impacts to Off-Site Receptors Due to Stationary Noise Sources

Sensitive receptors that may be affected by project operational noise include adjacent land uses to the North, east and south. The worst-case stationary noise was modeled using SoundPlan acoustical modeling software. The model utilizes a reference level of 68 dBA at 3-feet from the air conditioning unit.

As conditional of approval, the project will need to demonstrate compliance to the City's noise ordinance as it relates to HVAC noise. This can be achieved by implementing an HVAC system with a noise level range between 62 to 77 dBA.

A total of four (4) receptors were modeled using the SoundPLAN noise model to evaluate the proposed project's operational impact. A receptor is denoted by a yellow dot. All yellow dots represent either an existing building, a property line, or a sensitive receptor such as an outdoor sensitive area (courtyard, patio, backyard, etc.).

Project Operational Noise Levels

Exhibits G show the "project only" operational noise levels and noise level contours sensitive receptors and Exhibit H shows how the noise will propagate from the project site. Operational noise levels at the adjacent uses are anticipated to range between 37.3 dBA and 45.7 dBA Leq (depending on the location).

The "project only" noise projections to the adjacent uses are below the City's 55 dBA residential limit, as outlined within the City's noise ordinance (see Table 1).

Project Plus Ambient Operational Noise Levels

As shown in Table 6, existing plus project noise level projections are anticipated to range between 49.8 and 67.1 dBA Leq at receptors (R1 – R4).

Table 6: Worst-case Predicted Operational Leq Noise Level

Receptor[1]	Floor	Existing Ambient Noise Level (dBA, Leq)[2]	Project Noise Level (dBA, Leq)[3]	Total Combined Noise Level (dBA, Leq)	Daytime (7AM - 10PM) Stationary Noise Limit (dBA, Leq)	Change in Noise Level as Result of Project
1	1	67.1	38.3	67.1	**55.0**	0.0
2	2	65.2	45.7	65.2		0.0
3	1	49.5	37.3	49.8		0.3
4	1	49.5	37.4	49.8		0.3

Notes:
[1.] Receptors 1-4 represent residential uses
[2.] Existing measured ambient condition
[3.] See Exhibit G for the operational noise level projections at said receptors.

As shown in Table 6, the project will increase the worst-case noise level by 0.3 dBA Leq at receptors 1-4. As discussed in Section 2.5 of this report, an increase in 1 dB is not perceptible; an increase of 3 dB is just perceptible, and an increase of 5 dB is clearly perceptible to the human ear. The project's contribution to existing noise levels would fall into the "not perceptible" acoustic characteristic.

As a conservative measure MD has compared the worst-case project daytime noise levels with the measured ambient levels. In the case of Receptors 1 and 2, existing noise levels already exceed the stationary noise standard by at least 10 dB and project generated operational noise would not result in

a noticeable increase at these locations. At Receptors 3 and 4, the project would result in a slight increase (0.3 dBA Leq) in ambient noise levels, which would not be perceptible. Further, existing plus project noise levels at Receptors 3 and 4 would not exceed the noise standard of 55 dBA Leq. Therefore, the project complies with local noise regulations.

7.2 Interior Noise Levels

The future interior noise level was calculated for the sensitive receptor locations using a typical "windows open" and "windows closed" condition. A "windows open" condition assumes 12 dBA of noise attenuation from the exterior noise level. A "windows closed" condition" assumes 20 dBA of noise attenuation from the exterior noise level. Table 7 indicates the first and second floor interior noise levels for the project site.

Table 7: Future Interior Noise Levels (dBA CNEL)

Location	Roadway Noise Source	Exterior Façade Study Location	Modeled Noise Level at Building Facade[1]	Interior Noise Reduction Required to Meet Interior Noise Standard of 45 dBA CNEL	Interior Noise Level w/ Typical Residential Windows (STC≥ 2)		STC Rating for Windows Facing Subject Roadway[4]
					Window Open[2]	Windows Closed[3]	
1st Row Units Along Western Property Line	S. Normandie Avenue	1st Floor	72.0	27.0	60.0	52.0	30
		2nd Floor	72.6	26.7	60.6	52.6	31
		3rd Floor	72.1	27.1	60.1	52.1	30

Notes:
1. Noise level from SoundPLAN Traffic Modeling provided in Appendix B.
2. A minimum of 12 dBA noise reduction is assumed with a "windows open" condition.
3. A minimum of 20 dBA noise reduction is assumed with a "windows closed" condition.
4. Indicates the required STC rating to meet the interior noise standard.

As shown in Table 7, the interior noise level will range between 60.0 and 60.6 dBA CNEL with the windows open and between 52.0 and 52.6 dBA CNEL with the windows closed. To achieve an interior noise level of 45 dBA CNEL a "windows closed" condition is required. The windows and sliding glass doors directly facing S. Normandie Avenue will require minimum STC ratings of 30 at the first and third floors and 31 at 2nd floor. A "windows closed" condition simply means that in order to achieve a 45 dBA CNEL interior noise level, the windows must be closed and does not mean the windows must be fixed.

7.3 Condition of Approval

The following condition of approval has been provided to assure that the project will meet all local noise ordinances.

1. To meet the City's interior 45 dBA CNEL, a "windows closed" condition is required. The windows and sliding glass doors directly facing S. Normandie Avenue will require a minimum STC ratings of 30 at the first floor and 32 at the 2nd and 3rd floors. A "windows closed" condition simply

means that in order to achieve a 45 dBA CNEL interior noise level, the windows must be closed and does not mean the windows must be fixed.

Exhibit F

Future Traffic Noise Levels

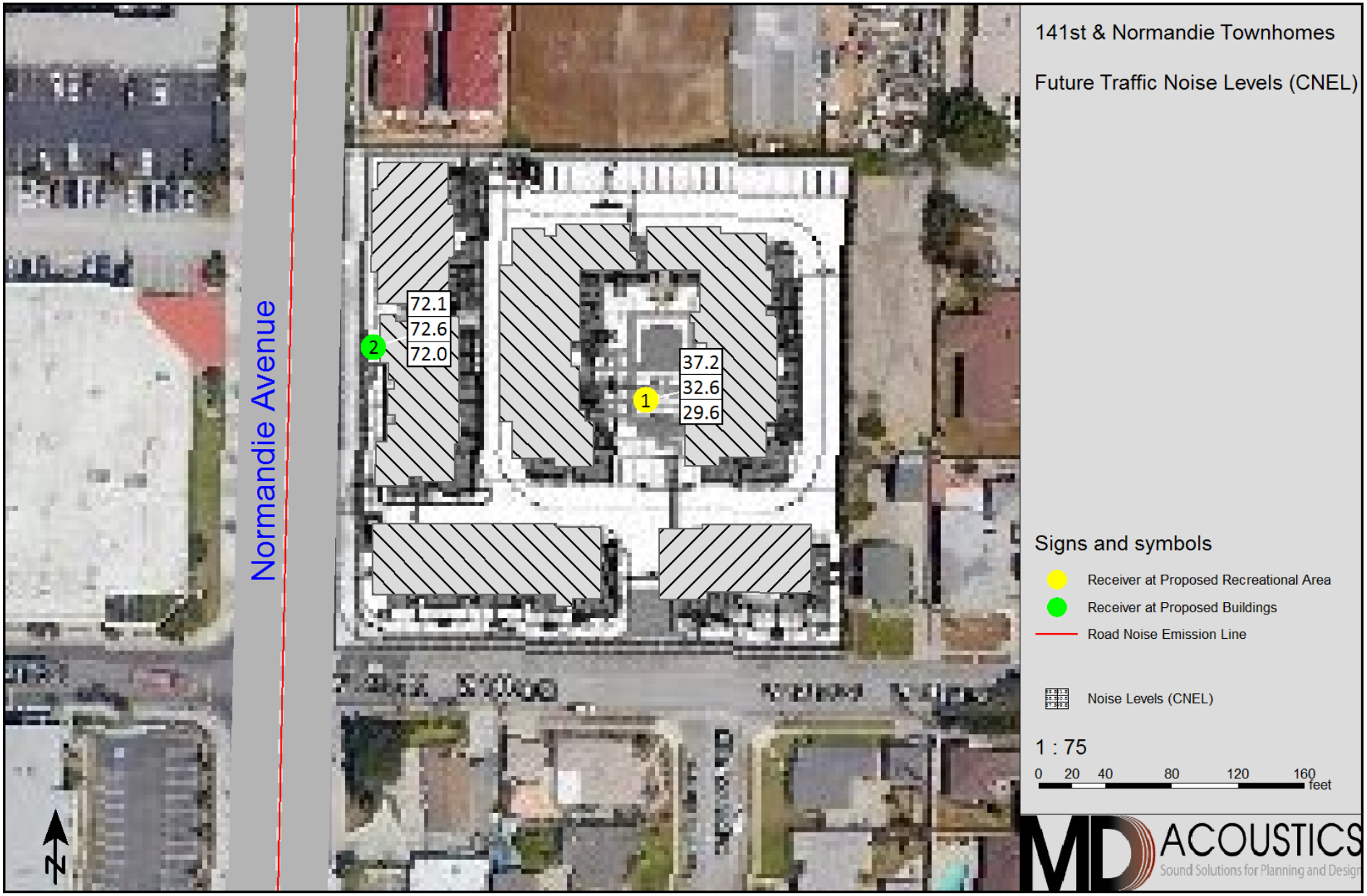


Exhibit G

Worst-Case Operational Noise Levels

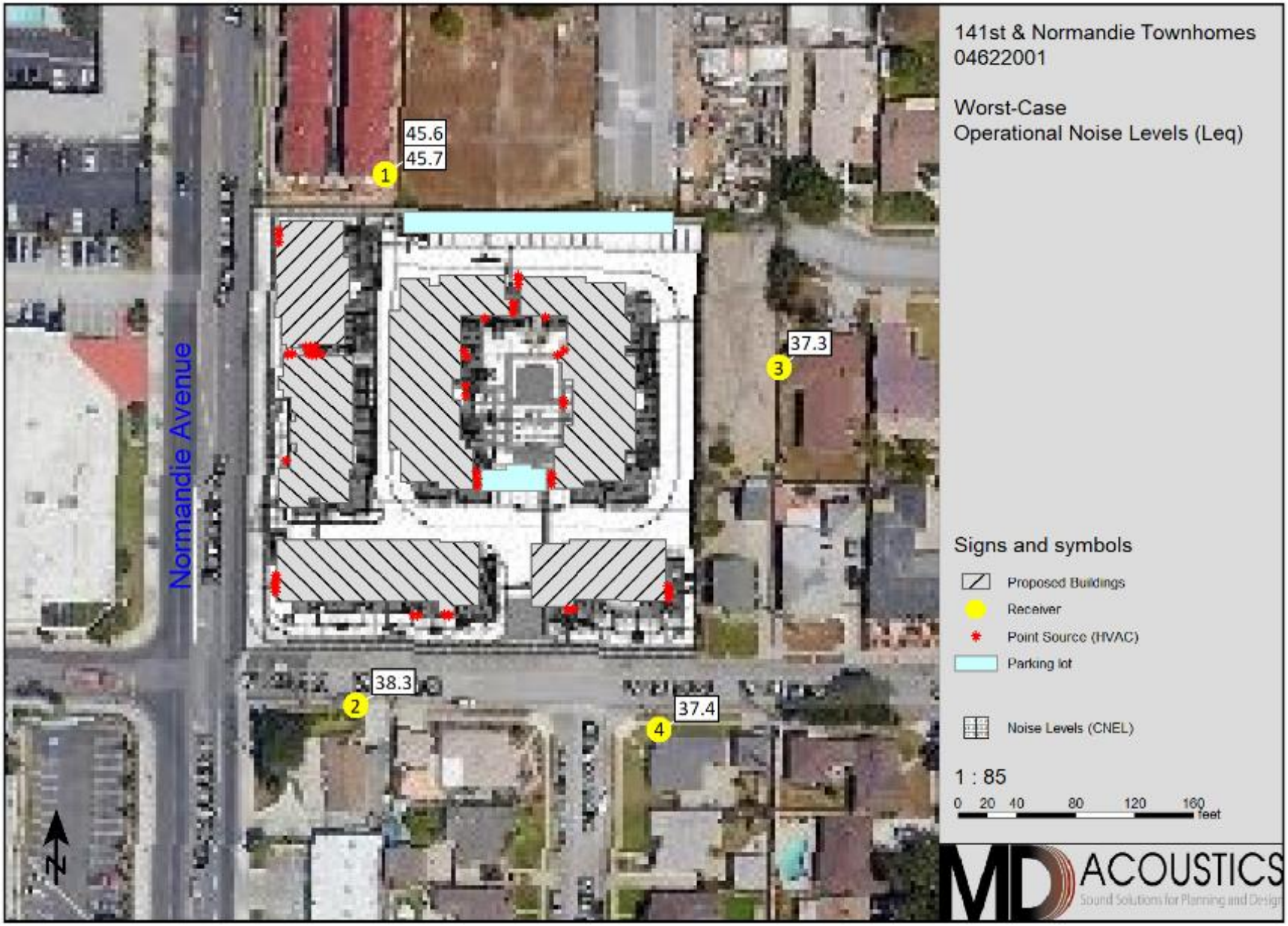


Exhibit H

Worst-Case Operational Noise Level Contours

8.0 Construction Noise and Vibration Impacts

The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. Project construction will occur in four phases, site preparation, grading, building construction and architectural coating. This section summarizes discusses noise and groundborne vibration modeling efforts, impact analysis, and mitigation, if necessary.

8.1 Construction Noise

Typical construction equipment noise levels are presented in Table 8.

Table 8: Typical Construction Equipment Noise Levels[1]

EQUIPMENT POWERED BY INTERNAL COMBUSTION ENGINES

Type	Noise Levels (dBA) at 50 Feet
Earth Moving	
Compactors (Rollers)	73 - 76
Front Loaders	73 - 84
Backhoes	73 - 92
Tractors	75 - 95
Scrapers, Graders	78 - 92
Pavers	85 - 87
Trucks	81 - 94
Materials Handling	
Concrete Mixers	72 - 87
Concrete Pumps	81 - 83
Cranes (Movable)	72 - 86
Cranes (Derrick)	85 - 87
Stationary	
Pumps	68 - 71
Generators	71 - 83
Compressors	75 – 86

IMPACT EQUIPMENT

Type	Noise Levels (dBA) at 50 Feet
Saws	71 - 82
Vibrators	68 - 82

Notes:
[1] Referenced Noise Levels from the Environmental Protection Agency (EPA)

Construction noise associated with each phase of the project was calculated at nearby sensitive receptors utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise

and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Construction equipment typically moves back and forth across the site; and it is an industry standard to use the acoustical center of the site to model average construction noise levels.

Construction activities are anticipated to include four phases site preparation, grading, building construction, and architectural coating. Worst-case noise levels at each receptor are shown in Table 9. The construction noise calculation output worksheet is located in Appendix C.

Table 9: Construction Noise Level by Phase (dBA, Leq)

Activity	Receptor to the North		Receptor to the East and South		Receptor to the Northwest	
	Leq at 160 FT	Lmax at 160 FT	Leq at 200 FT	Lmax at 200 FT	Leq at 300 FT	Lmax at 300 FT
Site Preparation	70	74	72	76	62	66
Grading	73	76	71	73	63	64
Building Construction	66	67	60	61	60	62
Architectural Coating	69	73	63	67	57	61

Note:
1. Construction Modeling Data is provided in Appendix C.
2. All construction equipment was modeled from the center of the project site.

As shown in Table 9, project construction noise will range between 57 and 73 dBA Leq and 61 and 76 dBA Lmax at nearby sensitive receptors. Existing ambient noise levels at nearby land uses range between 49.5 and 67.1 dBA Leq and 75.8 and 83.5 Lmax. Although project construction may result in short-term increases in ambient noise levels, Section 8.36.080 of the City's Noise Ordinance, exempts project construction activities from Sections 8.36.040 and 8.36.050 of the City's Noise Ordinance provided that they do not take place between the hours of 6:00 PM and 7:00 AM on weekdays between the hours of 6:00 PM and 9:00 AM on Saturday or any time on Sunday or a Federal holiday. Construction is anticipated to occur during the permissible hours. Measures to minimize construction noise at adjacent land uses are presented in section 8.3.

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. The primary vibration source during construction may be from a bull dozer. A large bull dozer has a vibration impact of 0.089 inches per second peak particle velocity (PPV) at 25 feet which is perceptible but below any risk to architectural damage.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref} (100/D_{rec})^{n}$$

Where: PPV_{ref} = reference PPV at 100ft.
D_{rec} = distance from equipment to receiver in ft.
n = 1.1 (the value related to the attenuation rate through ground)

The thresholds from the Caltrans Transportation and Construction Induced Vibration Guidance Manual in Table 10 (below) provides general thresholds and guidelines as to the vibration damage potential from vibratory impacts.

Table 10: Guideline Vibration Damage Potential Threshold Criteria

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

Source: Table 19, Transportation and Construction Vibration Guidance Manual, Caltrans, Sept. 2013.
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 11 gives approximate vibration levels for particular construction activities. This data provides a reasonable estimate for a wide range of soil conditions.

Table 11: Vibration Source Levels for Construction Equipment

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Pile driver (impact)	1.518 (upper range)	112
	0.644 (typical)	104
Pile driver (sonic)	0.734 upper range	105
	0.170 typical	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill	0.008 in soil	66
(slurry wall)	0.017 in rock	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

The closest existing off-site structures are approximately 10 feet to the north and east of the project site. A large bulldozer would yield a worst-case 0.244 PPV (in/sec) which is perceptible but below any risk of damage (0.5 in/sec PPV is the threshold of residential structures). The impact is less than significant, and no mitigation is required.

8.3 Construction Noise Reduction Measures

Construction operations must follow the City's General Plan and the Noise Ordinance, which states that construction, repair or excavation work performed must occur within the permissible hours. To further ensure that construction activities do not disrupt the adjacent land uses, the following measures should be taken:

1. Construction should occur during the permissible hours as defined in City of Gardena Municipal Code Section 8.36.080.

2. During construction, the contactor shall ensure all construction equipment is equipped with appropriate noise attenuating devices.

3. The contractor should locate equipment staging areas that will create the greatest distance between construction-related noise/vibration sources and sensitive receptors nearest the project site during all project construction.

4. Idling equipment should be turned off when not in use.

5. Equipment shall be maintained so that vehicles and their loads are secured from rattling and banging.

9.0 References

City of Gardena

2006a General Plan

2006b Final Environmental Impact Report for the General Plan.

Municipal Code

California Department of Transportation (Caltrans)

2013 Transportation and Construction Induced Vibration Guidance Manual.

Federal Transit Administration (FTA)

2018 Transit Noise and Vibration Impact Assessment Manual

Governor's Office of Planning and Research

State of California General Plan Guidelines, 1998

Kittleson & Associates

141st and Normandie Townhomes, Local Transportation Assessment. July 24, 2020

Appendix A:

Field Measurement Data

MD ACOUSTICS
Sound Solutions for Planning and Design
www.mdacoustics.com

AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

1-Hour Continuous Noise Measurement Datasheet

Project:	Olson Company Residential Townhome	**Site Observations:**	Clear skys, Sunny temps in the 70's. no wind. Light pedestrian traffic.
Site Address/Location:	West 141st Street and Normandie Ave, Gardenia, CA		
Date:	4/24/2020		
Field Tech/Engineer:	Jason Schuyler		

General Location:

Sound Meter:	NTi Audio	**SN:** A2A-05967-E0	
Settings:	A-weighted, slow, 1-sec, 10-minute interval		
Meteorological Con.:	70 degrees F, no wind		
Site ID:	ST-1 thru ST-3		

Site Topo: Flat green houses open are
Ground Type: Soft site crush gavel and dirt

Noise Source(s) w/ Distance:

ST1- 10' from S. P/l and 5' from W. P/l

ST2- is 5' from N. P/L and 15' roughly from the P/L to the W.

ST3- is 5' from road in back of property

Figure 1: Monitoring Locations

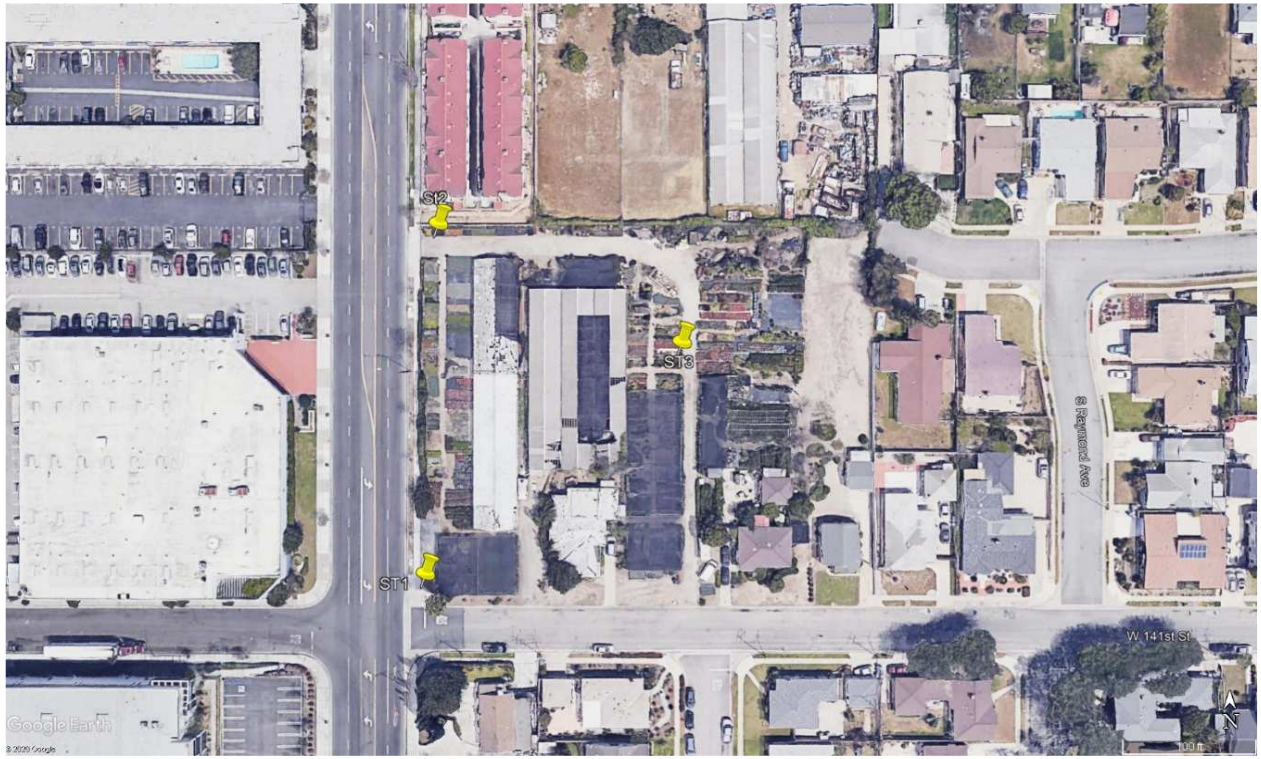


Figure 2: ST-1 Photo

Figure 3: ST-2 Photo

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www.mdacoustics.com

AZ Office
4960 S. Gilbert Rd, Ste 1-461
Chandler, AZ 85249

CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

1-Hour Noise Measurement Datasheet - Cont.

Project: Olson Company Residential Townhome
Site Address/Location: West 141st Street and Normandie Ave, Gardenia, CA
Site ID: ST-1 thru ST-3

Figure 4: ST-3 Photo

Figure 5: ST-3 Photo

Table 1: Baseline Noise Measurement Summary

Location	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
1	8:16 AM	9:16 AM	67.1	83.5	47.9	75.3	71.5	67.8	63.2	52.2
2	8:19 AM	9:19 AM	65.2	80.4	45.3	73.6	70.1	65.7	60.3	49.4
3	8:28 AM	9:28 AM	49.5	75.8	42.6	58.2	52.2	47.2	45.6	44.1

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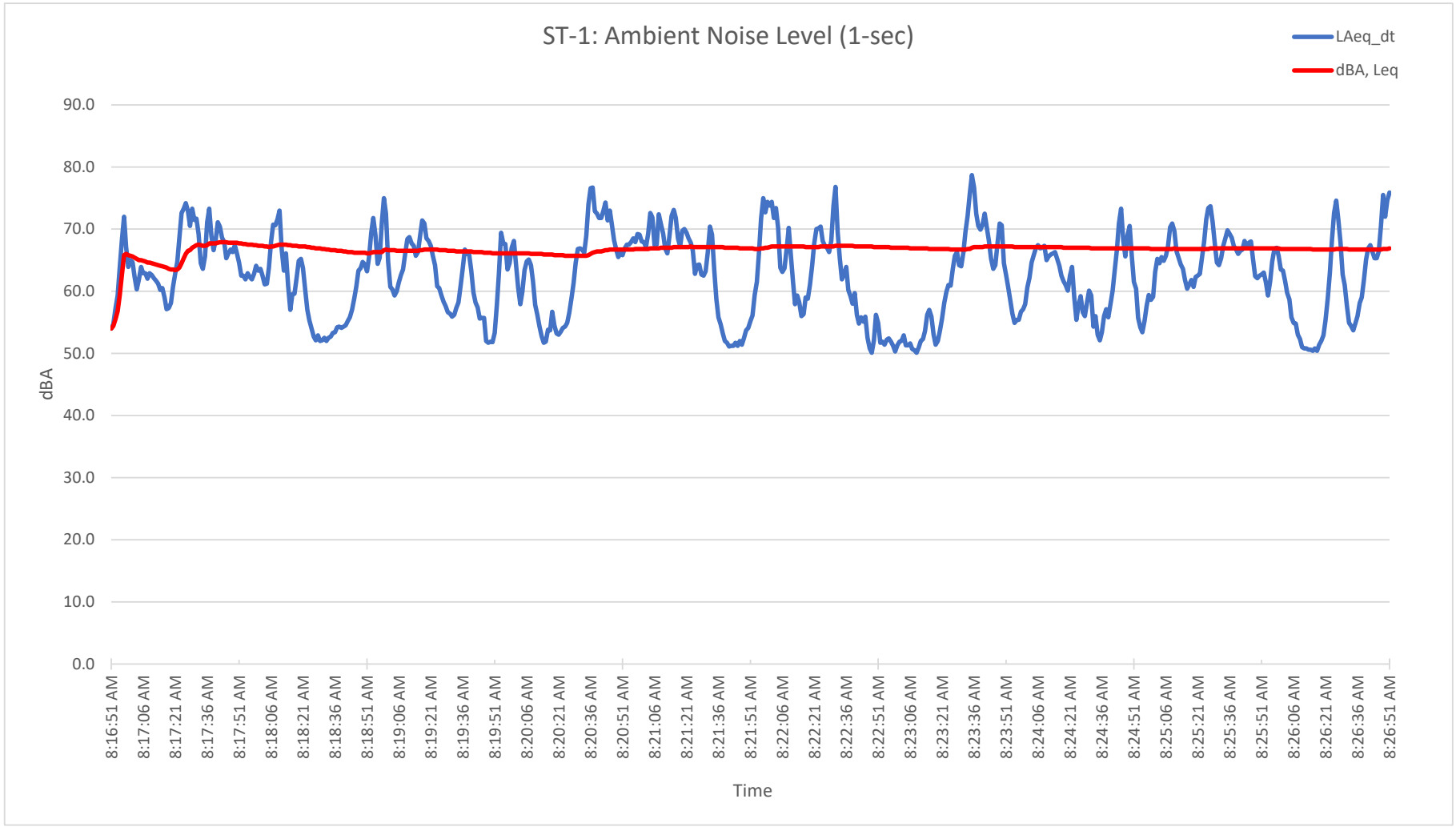
CA Office
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

1-Hour Noise Measurement Datasheet - Cont.

Project: Olson Company Residential Townhome
Site Address/Location: West 141st Street and Normandie Ave, Gardenia, CA
Site ID: ST-1



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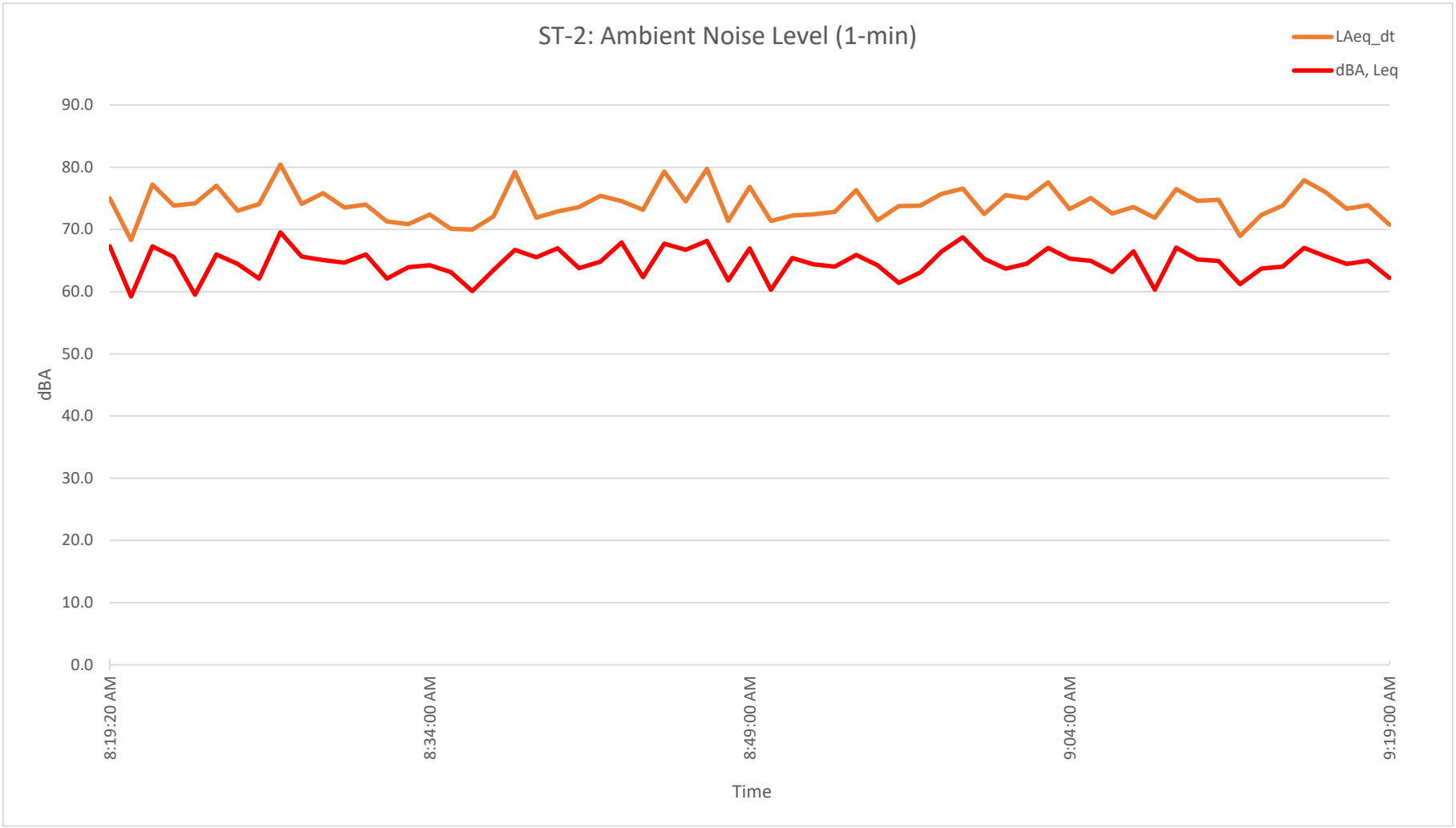
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

1-Hour Noise Measurement Datasheet - Cont.

Project: Olson Company Residential Townhome
Site Address/Location: West 141st Street and Normandie Ave, Gardenia, CA
Site ID: ST-2



MD ACOUSTICS
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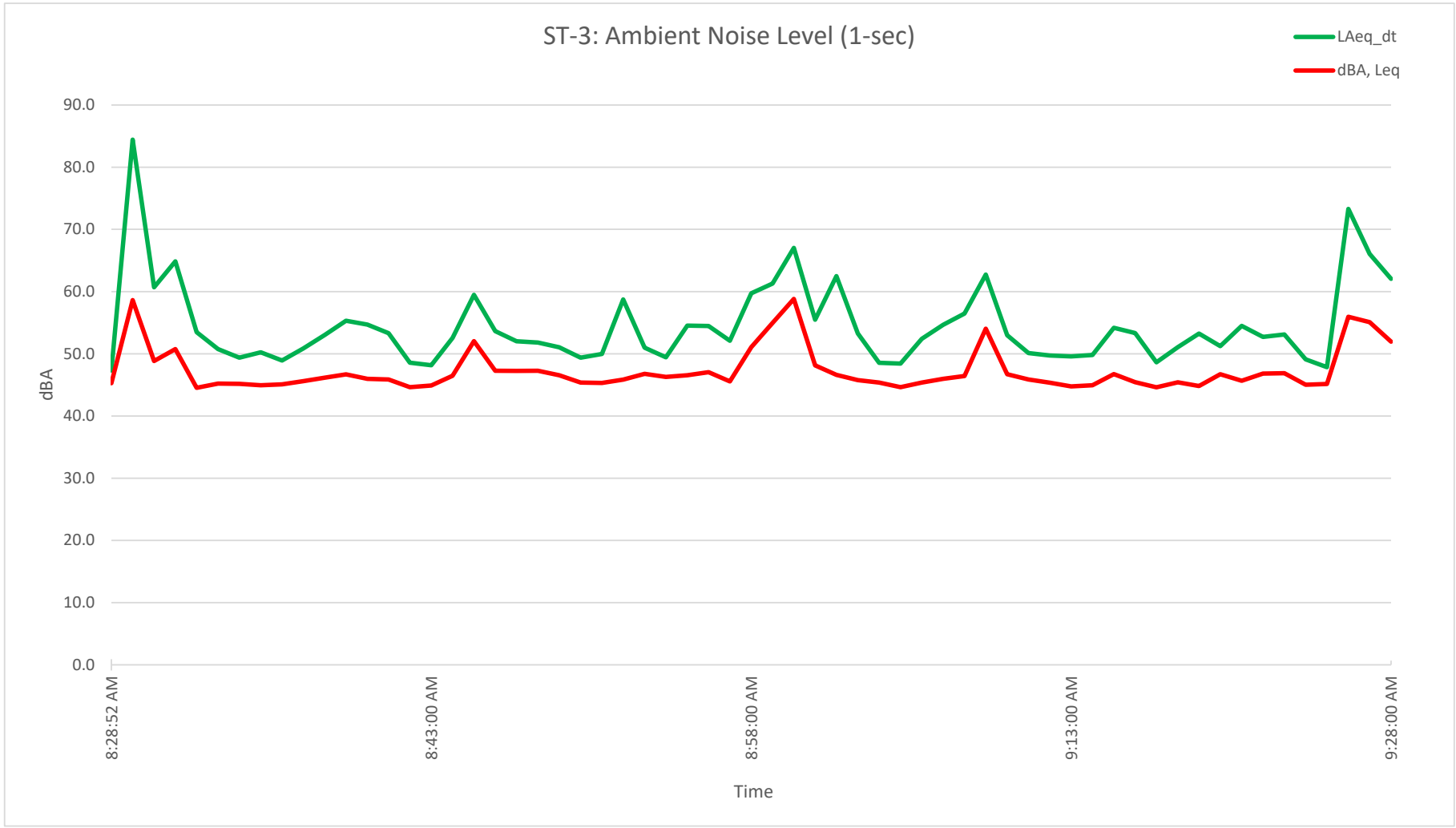
1197 E Los Angeles Ave, C-256
Simi Valley, CA 93065

1-Hour Noise Measurement Datasheet - Cont.

Project: Olson Company Residential Townhome
Site Address/Location: West 141st Street and Normandie Ave, Gardenia, CA
Site ID: ST-3



Appendix B:

SoundPLAN Noise Modeling Data

Noise emissions of road traffic

Station km	ADT Veh/24	Vehicles type	Vehicle name	Traffic values day Veh/h	evening Veh/h	night Veh/h	Speed km/h	Contr devic	Cons Spee km/h	Affe veh. %	Road surface	Gradie Min / M %
Normandie Avenue							Traffic direction: In entry direction					
0+000	19978	Total	-	1187	846	294	-	none	-	-	Average (of DGAC	-0.2
		Automobiles	-	1125	835	207	56					
		Medium trucks	-	23	4	32	56					
		Heavy trucks	-	39	7	54	56					
		Buses	-	-	-	-	-					
		Motorcycles	-	-	-	-	-					
		Auxiliary vehicle	-	-	-	-	-					

Receiver list

No.	Receiver name	Building side	Floor	Limit Lden dB(A)	Level w/o NP Lden dB(A)	Level w NP Lden dB(A)	Difference Lden dB	Conflict Lden dB
1	Outdoor Recreation	-	GF	-	29.6	0.0	-29.6	-
			1.Fl	-	32.6	0.0	-32.6	-
			2.Fl	-	37.2	0.0	-37.2	-
2	Proposed Building	West	GF	-	72.0	0.0	-72.0	-
			1.Fl	-	72.6	0.0	-72.6	-
			2.Fl	-	72.1	0.0	-72.1	-

Noise emissions of industry sources

Source name	Reference	Level Day dB(A)	Frequency spectrum [dB(A)] 63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	Corrections Cwall dB	CI dB	CT dB
HVAC1	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC2	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC3	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC4	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC5	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC6	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC7	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC8	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC9	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC10	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC11	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC12	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC13	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC14	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC15	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC16	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC17	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC18	Lw/unit	-	-28.8	2.4	33.2	48.5	56.9	64.6	62.2	53.2	36.8	-	-	-
HVAC19	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC20	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC21	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC22	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC23	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC24	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC25	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC26	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC27	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC28	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC29	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC30	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC31	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC32	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC33	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC34	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC35	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC36	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC37	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC38	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC39	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC40	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC41	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC42	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC43	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC44	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC45	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC46	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC47	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC48	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC49	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-
HVAC50	Lw/unit	-	-28.8	2.4	33.1	48.4	56.9	64.6	62.1	53.1	36.8	-	-	-

Noise emissions of parking lot traffic

Name	Parking lot type	Size	Movements per hour Day	Road surface	Separated method	Lw,ref dB(A)
1	Visitors and staff	21 Parking bays	0.900	Asphaltic driving lanes	no	78.9
2	Visitors and staff	4 Parking bays	0.900	Asphaltic driving lanes	no	69.0

Receiver list

No.	Receiver name	Building side	Floor	Limit Day dB(A)	Level w/o NP Day dB(A)	Level w NP Day dB(A)	Difference Day dB	Conflict Day dB
1	Outdoor Recreation2	-	GF	-	45.7	0.0	-45.7	-
			1.Fl	-	45.6	0.0	-45.6	-
2		-	GF	-	38.3	0.0	-38.3	-
3	Outdoor Recreation3	-	GF	-	37.3	0.0	-37.3	-
4	Outdoor Recreation4	-	GF	-	37.4	0.0	-37.4	-

Appendix C:

Construction Noise Modeling Output

Construction Noise Levels at Senstiive Receptors by Phase

Activity	Leq at 160 Feet (North)	Lmax at 160 FT (North)	Leq at 200 FT (East and South)	Lmax at 200 FT (East and South)	Leq at 300 FT (Northwest)	Lmax at 300 FT (Northwest)
Site Preparation	70	74	72	76	62	66
Grading	73	76	71	73	63	64
Building Construction	66	67	60	61	60	62
Architectural Coating	69	73	63	67	57	61

Equipment Summary	Reference (dBA) 50 ft Lmax
Rock Drills	96
Jack Hammers	82
Pneumatic Tools	85
Pavers	80
Dozers	85
Scrapers	87
Haul Trucks	88
Cranes	82
Portable Generators	80
Rollers	80
Tractors	80
Front-End Loaders	86
Hydraulic Excavators	86
Graders	86
Air Compressors	86
Trucks	86

Site Preparation

		Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements								
No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Dozer	85	1	40	160	0.5	0	72.4	68.4	6905339.66
2	Tractor/Backhoe	80	1	40	160	0.5	0	67.4	63.4	2183660.13
3	Grader	86								
4	Scraper	87								
							Lmax*	74	Leq	70
							Lw	104	Lw	101

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55
60	18.3	0.5	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53
70	21.3	0.5	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51
80	24.4	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
90	27.4	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
100	30.5	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
110	33.5	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
120	36.6	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
130	39.6	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
140	42.7	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
150	45.7	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
160	48.8	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
170	51.8	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
180	54.9	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
190	57.9	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
200	61.0	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
210	64.0	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
220	67.1	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
230	70.1	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
240	73.1	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
250	76.2	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
260	79.2	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
270	82.3	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
280	85.3	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
290	88.4	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
300	91.4	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
310	94.5	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
320	97.5	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
330	100.6	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
340	103.6	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
350	106.7	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
360	109.7	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
370	112.8	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33

Grading

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Grader	86	1	40	160	0.5	0	73.4	69.4	8693307.58
2	Dozer	85	1	40	160	0.5	0	72.4	68.4	6905339.66
3	Tractor/Backhoe	80	2	40	160	0.5	0	70.4	66.4	4367320.27
							Lmax*	**76**	**Leq**	**73**
							Lw	**105**	**Lw**	**105**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58
60	18.3	0.5	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56
70	21.3	0.5	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54
80	24.4	0.5	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53
90	27.4	0.5	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52
100	30.5	0.5	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50
110	33.5	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
120	36.6	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
130	39.6	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
140	42.7	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
150	45.7	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
160	48.8	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
170	51.8	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
180	54.9	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
190	57.9	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
200	61.0	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
210	64.0	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
220	67.1	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
230	70.1	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
240	73.1	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
250	76.2	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
260	79.2	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
270	82.3	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
280	85.3	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
290	88.4	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
300	91.4	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
310	94.5	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
320	97.5	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
330	100.6	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
340	103.6	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
350	106.7	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
360	109.7	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
370	112.8	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36

Building Construction

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Forklift/Tractor	80	1	40	160	0.5	0	67.4	63.4	2183660.13
2	Tractor/Backhoe	80	1	40	160	0.5	0	67.4	63.4	2183660.13

	Lmax*	**67**	**Leq**	**66**
	Lw	**#REF!**	**Lw**	**98**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**66**	**65**	**64**	**63**	**62**	**61**	**60**	**59**	**58**	**57**	**56**	**55**	**54**	**53**	**52**	**51**
60	18.3	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
70	21.3	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
80	24.4	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
90	27.4	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
100	30.5	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
110	33.5	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	**44**	43
120	36.6	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
130	39.6	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
140	42.7	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
150	45.7	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
160	48.8	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
170	51.8	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
180	54.9	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
190	57.9	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
200	61.0	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
210	64.0	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
220	67.1	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
230	70.1	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
240	73.1	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
250	76.2	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
260	79.2	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
270	82.3	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
280	85.3	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
290	88.4	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
300	91.4	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
310	94.5	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
320	97.5	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
330	100.6	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
340	103.6	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
350	106.7	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
360	109.7	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
370	112.8	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30

Architectural Coating

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Air Compressor	86	1	40	160	0.5	0	73.4	69.4	8693307.58
2										
3										
							Lmax*	**73**	**Leq**	**69**
							Lw	**105**	**Lw**	**101**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**69**	**68**	**67**	**66**	**65**	**64**	**63**	**62**	**61**	**60**	**59**	**58**	**57**	**56**	**55**	**54**
60	18.3	0.5	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52
70	21.3	0.5	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51
80	24.4	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
90	27.4	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
100	30.5	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
110	33.5	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	**47**	46
120	36.6	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
130	39.6	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
140	42.7	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
150	45.7	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
160	48.8	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
170	51.8	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
180	54.9	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
190	57.9	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
200	61.0	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
210	64.0	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
220	67.1	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
230	70.1	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
240	73.1	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
250	76.2	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
260	79.2	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
270	82.3	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
280	85.3	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
290	88.4	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
300	91.4	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
310	94.5	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
320	97.5	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
330	100.6	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
340	103.6	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
350	106.7	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
360	109.7	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
370	112.8	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33

Site Preparation

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA)		Energy
								Lmax	Leq	
1	Dozer	85	3	40	200	0.5	0	74.7	70.7	11858541.2
2	Tractor/Backhoe	80	4	40	200	0.5	0	71.0	67.0	5000000
3	Grader	86								
4	Scraper	87								
							Lmax*	**76**	**Leq**	**72**
							Lw	**106**	**Lw**	**104**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57
60	18.3	0.5	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55
70	21.3	0.5	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54
80	24.4	0.5	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52
90	27.4	0.5	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51
100	30.5	0.5	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50
110	33.5	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
120	36.6	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
130	39.6	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
140	42.7	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
150	45.7	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
160	48.8	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
170	51.8	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
180	54.9	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
190	57.9	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
200	61.0	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
210	64.0	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
220	67.1	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
230	70.1	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
240	73.1	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
250	76.2	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
260	79.2	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
270	82.3	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
280	85.3	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
290	88.4	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
300	91.4	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
310	94.5	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
320	97.5	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
330	100.6	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
340	103.6	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
350	106.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
360	109.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
370	112.8	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36

Grading

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Grader	86	1	40	200	0.5	0	70.9	67.0	4976339.63
2	Dozer	85	1	40	200	0.5	0	69.9	66.0	3952847.08
3	Tractor/Backhoe	80	2	40	200	0.5	0	68.0	64.0	2500000
							Lmax*	**73**	**Leq**	**71**
							Lw	**103**	**Lw**	**102**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56
60	18.3	0.5	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54
70	21.3	0.5	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52
80	24.4	0.5	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50
90	27.4	0.5	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
100	30.5	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
110	33.5	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
120	36.6	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
130	39.6	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
140	42.7	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
150	45.7	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
160	48.8	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
170	51.8	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
180	54.9	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
190	57.9	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
200	61.0	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
210	64.0	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
220	67.1	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
230	70.1	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
240	73.1	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
250	76.2	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
260	79.2	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
270	82.3	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
280	85.3	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
290	88.4	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
300	91.4	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
310	94.5	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
320	97.5	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
330	100.6	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
340	103.6	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
350	106.7	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
360	109.7	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
370	112.8	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34

Building Construction

		Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements						Calculated (dBA)		
No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Lmax	Leq	Energy
2	Forklift/Tractor	80	1	40	290	0.5	0	60.9	56.9	493730.558
4	Tractor/Backhoe	80	1	40	290	0.5	0	60.9	56.9	493730.558
							Lmax*	61	Leq	60
							Lw	#REF!	Lw	92

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**60**	**59**	**58**	**57**	**56**	**55**	**54**	**53**	**52**	**51**	**50**	**49**	**48**	**47**	**46**	**45**
60	18.3	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
70	21.3	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
80	24.4	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
90	27.4	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
100	30.5	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
110	33.5	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	**37**	36
120	36.6	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
130	39.6	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
140	42.7	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
150	45.7	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
160	48.8	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
170	51.8	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
180	54.9	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
190	57.9	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
200	61.0	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
210	64.0	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
220	67.1	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
230	70.1	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
240	73.1	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
250	76.2	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
260	79.2	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
270	82.3	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
280	85.3	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
290	88.4	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
300	91.4	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
310	94.5	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
320	97.5	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
330	100.6	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
340	103.6	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
350	106.7	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
360	109.7	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
370	112.8	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23

Architectural Coating

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Air Compressor	86	1	40	290	0.5	0	66.9	62.9	1965576.75
2										
3										
							Lmax*	**67**	**Leq**	**63**
							Lw	**99**	**Lw**	**95**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**63**	**62**	**61**	**60**	**59**	**58**	**57**	**56**	**55**	**54**	**53**	**52**	**51**	**50**	**49**	**48**
60	18.3	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
70	21.3	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
80	24.4	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
90	27.4	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
100	30.5	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
110	33.5	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	**40**	39
120	36.6	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
130	39.6	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
140	42.7	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
150	45.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
160	48.8	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
170	51.8	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
180	54.9	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
190	57.9	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
200	61.0	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
210	64.0	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
220	67.1	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
230	70.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
240	73.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
250	76.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
260	79.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
270	82.3	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
280	85.3	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
290	88.4	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
300	91.4	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
310	94.5	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
320	97.5	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
330	100.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
340	103.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
350	106.7	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
360	109.7	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
370	112.8	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26

Site Preparation

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA)		Energy
								Lmax	Leq	
1	Dozer	85	3	40	495	0.5	0	64.9	60.9	1230532.98
2	Tractor/Backhoe	80	4	40	495	0.5	0	61.1	57.2	518838.262
3	Grader	86								
4	Scraper	87								
							Lmax*	**66**	**Leq**	**62**
							Lw	**97**	**Lw**	**94**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47
60	18.3	0.5	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45
70	21.3	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
80	24.4	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
90	27.4	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
100	30.5	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
110	33.5	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
120	36.6	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
130	39.6	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
140	42.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
150	45.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
160	48.8	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
170	51.8	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
180	54.9	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
190	57.9	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
200	61.0	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
210	64.0	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
220	67.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
230	70.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
240	73.1	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
250	76.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
260	79.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
270	82.3	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
280	85.3	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
290	88.4	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
300	91.4	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
310	94.5	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
320	97.5	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
330	100.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
340	103.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
350	106.7	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
360	109.7	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
370	112.8	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26

Grading

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Grader	86	1	40	495	0.5	0	61.1	57.1	516383.081
2	Dozer	85	1	40	495	0.5	0	60.1	56.1	410177.662
3	Excavator	86	1	40	495	0.5	0	61.1	57.1	516383.081
4	Tractor/Backhoe	80	3	40	495	0.5	0	59.9	55.9	389128.697
							Lmax*	**64**	**Leq**	**63**
							Lw	**93**	**Lw**	**94**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	15.2	0.5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
60	18.3	0.5	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46
70	21.3	0.5	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44
80	24.4	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
90	27.4	0.5	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
100	30.5	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
110	33.5	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
120	36.6	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
130	39.6	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
140	42.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
150	45.7	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
160	48.8	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
170	51.8	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
180	54.9	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
190	57.9	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
200	61.0	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
210	64.0	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
220	67.1	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
230	70.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
240	73.1	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
250	76.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
260	79.2	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
270	82.3	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
280	85.3	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
290	88.4	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
300	91.4	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
310	94.5	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
320	97.5	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
330	100.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
340	103.6	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
350	106.7	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
360	109.7	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
370	112.8	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26

Building Construction

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
1	Cranes	82	1	40	495	0.5	0	57.1	53.1	205575.807
2	Forklift/Tractor	80	3	40	495	0.5	0	59.9	55.9	389128.697
3	Generator	80	1	40	495	0.5	0	55.1	51.1	129709.566
4	Tractor/Backhoe	80	3	40	495	0.5	0	59.9	55.9	389128.697
							Lmax*	**62**	**Leq**	**60**
							Lw	**93**	**Lw**	**92**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**60**	**59**	**58**	**57**	**56**	**55**	**54**	**53**	**52**	**51**	**50**	**49**	**48**	**47**	**46**	**45**
60	18.3	0.5	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43
70	21.3	0.5	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
80	24.4	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
90	27.4	0.5	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39
100	30.5	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
110	33.5	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	**38**	37
120	36.6	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
130	39.6	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
140	42.7	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
150	45.7	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34
160	48.8	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
170	51.8	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
180	54.9	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
190	57.9	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
200	61.0	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
210	64.0	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
220	67.1	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
230	70.1	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
240	73.1	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
250	76.2	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
260	79.2	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
270	82.3	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
280	85.3	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
290	88.4	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
300	91.4	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
310	94.5	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
320	97.5	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
330	100.6	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
340	103.6	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
350	106.7	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
360	109.7	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
370	112.8	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24

Architectural Coating

Noise Level Calculation Prior to Implementation of Noise Attenuation Requirements

No.	Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage Factor[1]	Distance to Receptor (ft)	Ground Effect	Shielding (dBA)	Calculated (dBA)		Energy
								Lmax	Leq	
1	Air Compressor	86	1	40	495	0.5	0	61.1	57.1	516383.081
2										
3										
							Lmax*	**61**	**Leq**	**57**
							Lw	**93**	**Lw**	**89**

Source: MD Acoustics, May. 2019.
1- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

Feet	Meters	Ground Effect	No Shielding Leq dBA	1 dBA Shielding Leq dBA	2 dBA Shielding Leq dBA	3 dBA Shielding Leq dBA	4 dBA Shielding Leq dBA	5 dBA Shielding Leq dBA	6 dBA Shielding Leq dBA	7 dBA Shielding Leq dBA	8 dBA Shielding Leq dBA	9 dBA Shielding Leq dBA	10 dBA Shielding Leq dBA	11 dBA Shielding LeqdBA	12 dBA Shielding Leq dBA	13 dBA Shielding Leq dBA	14 dBA Shielding Leq dBA	15 dBA Shielding Leq dBA
50	**15.2**	**0.5**	**57**	**56**	**55**	**54**	**53**	**52**	**51**	**50**	**49**	**48**	**47**	**46**	**45**	**44**	**43**	**42**
60	18.3	0.5	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
70	21.3	0.5	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38
80	24.4	0.5	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
90	27.4	0.5	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
100	30.5	0.5	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35
110	33.5	0.5	49	48	47	46	45	44	43	42	41	40	39	38	37	36	**35**	34
120	36.6	0.5	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
130	39.6	0.5	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
140	42.7	0.5	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31
150	45.7	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
160	48.8	0.5	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
170	51.8	0.5	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
180	54.9	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
190	57.9	0.5	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
200	61.0	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
210	64.0	0.5	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
220	67.1	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
230	70.1	0.5	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26
240	73.1	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
250	76.2	0.5	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
260	79.2	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
270	82.3	0.5	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24
280	85.3	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
290	88.4	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
300	91.4	0.5	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23
310	94.5	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
320	97.5	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
330	100.6	0.5	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
340	103.6	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
350	106.7	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
360	109.7	0.5	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
370	112.8	0.5	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20

Appendix D:

Construction Vibration Modeling Output

VIBRATION LEVEL IMPACT

Project:	Gardena Olsen Townhomes	Date: 7/23/20
Source:	Large Bulldozer	
Scenario:	Unmitigated	
Location:	Project Site	
Address:		

PPV = PPVref(25/D)^n (in/sec)

DATA INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN BLUE
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	10.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.244**	IN/SEC	OUTPUT IN RED