Heatherglen Planned Development, TTM 17604, CUP 15-006

Initial Study – Mitigated Negative Declaration

Appendix K – Noise Study

Noise Study
Heatherglen Residential Project
City of Highland

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1.0 INTRODUCTION

This noise analysis has been prepared to support the environmental review process for the proposed residential development project and provide information regarding potential impacts related to noise that could be generated. This noise study describes the existing land uses and ambient noise environment, identifies applicable rules and regulations, evaluates potential noise impacts of the proposed project.

1.1 Project Location and Site Description

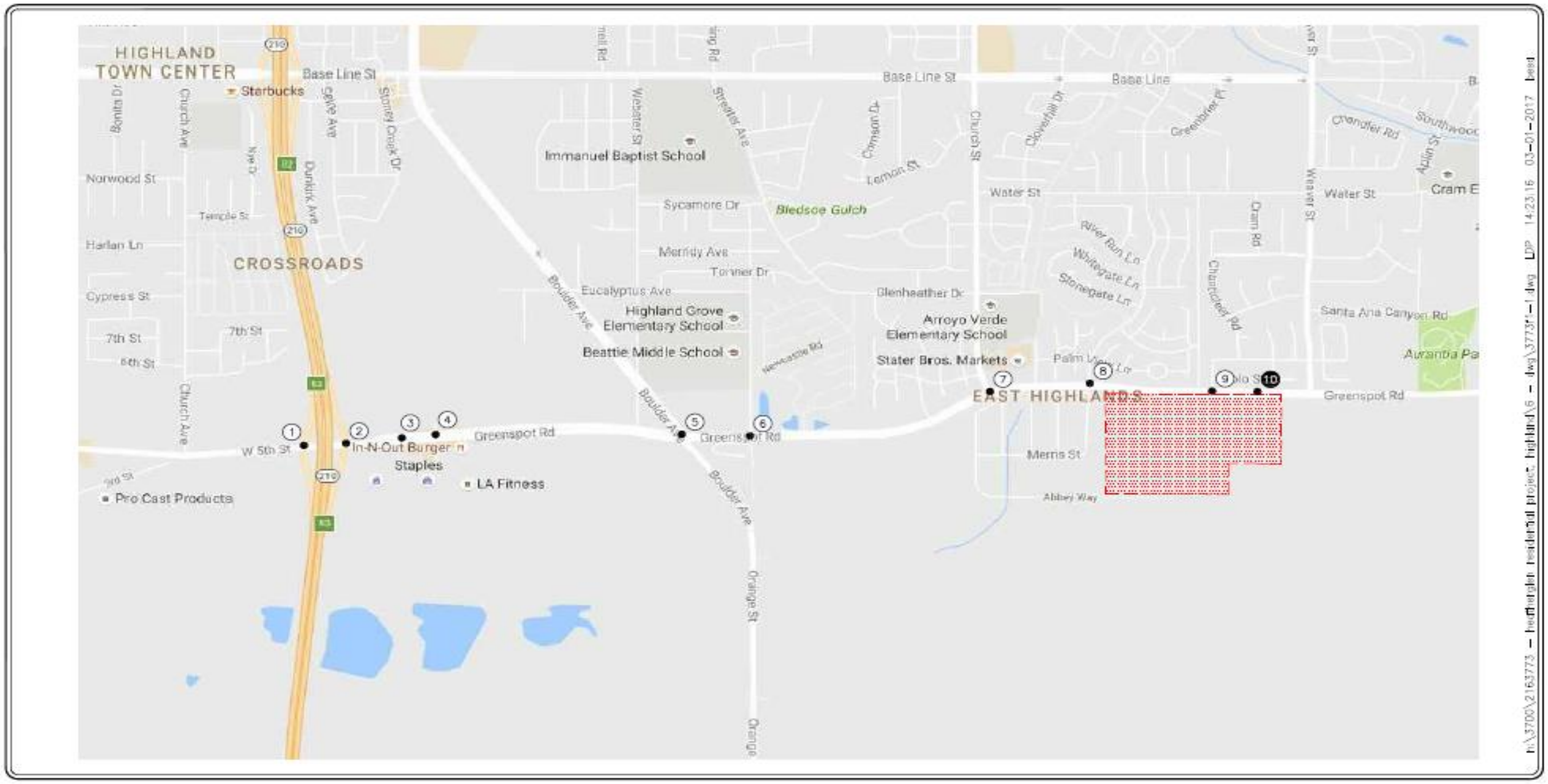
The 59.03- acre project site is located in the City of Highland, on the south side of Greenspot Road, east of Merris Street, and west of the Creek Flood Control Channel, as shown in **Figure 1** and **Figure 2**. The State Route (SR) 210 provides regional access to the project site. The principal local network of streets providing access to the site includes: Greenspot Road, Boulder Avenue, and Church Street.

The project site is currently vacant and undeveloped and has an existing General Plan Land Use and zoning designation of Agricultural/Equestrian Residential (AG/EQ). As described in the City of Highland General Plan Land Use Element, areas designated as Agricultural/Equestrian are appropriate for rural and equestrian-oriented residential development, and the current designations allow a maximum intensity of 2 dwelling units per l acre.

1.2 Project Description

The proposed residential project would develop up to 215 single-family dwelling units, a community park and areas designated for conservation and a retention basin l, as shown in **Figure 3**. The proposed project includes a General Plan Land Use amendment and a zoning designation change from AG/EQ to Planned Development (PD).

The proposed project is expected to be developed by Year 2019. As described by the Traffic Impact Analysis (TIA) prepared for the proposed project (LLG 2017), operation of the 215 single-family dwelling units is anticipated to generate 2,047 weekday daily vehicular trips (one-half arriving, one-half departing), with 161 trips (40 inbound, 121 outbound) in the weekday a.m. peak hour and 215 trips (135 inbound, 80 outbound) in the weekday p.m. peak hour.



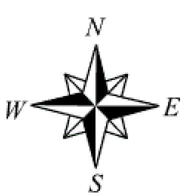


Figure 1. Regional Map of Project Location

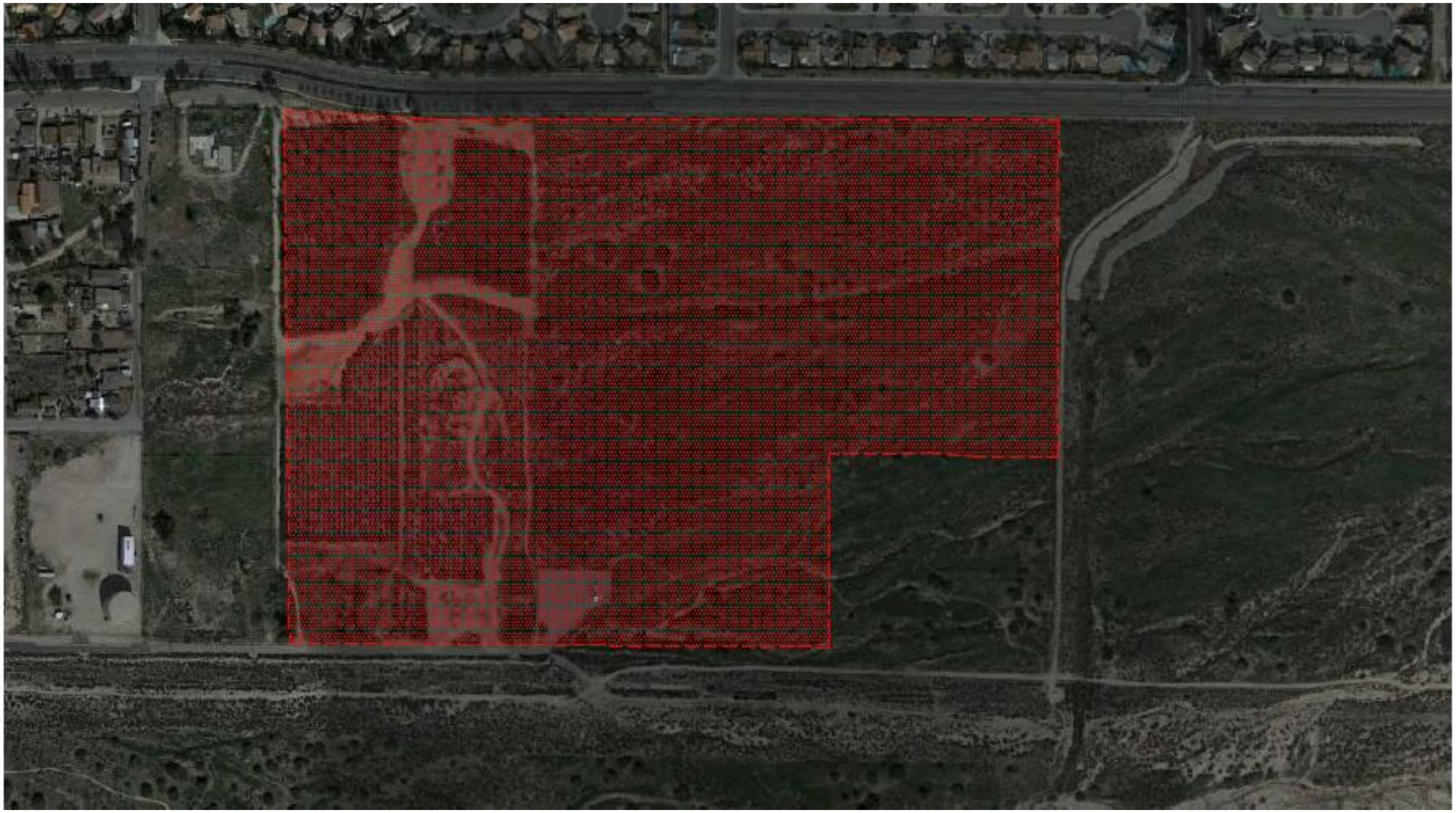


Figure 2. Project Vicinity Map Location

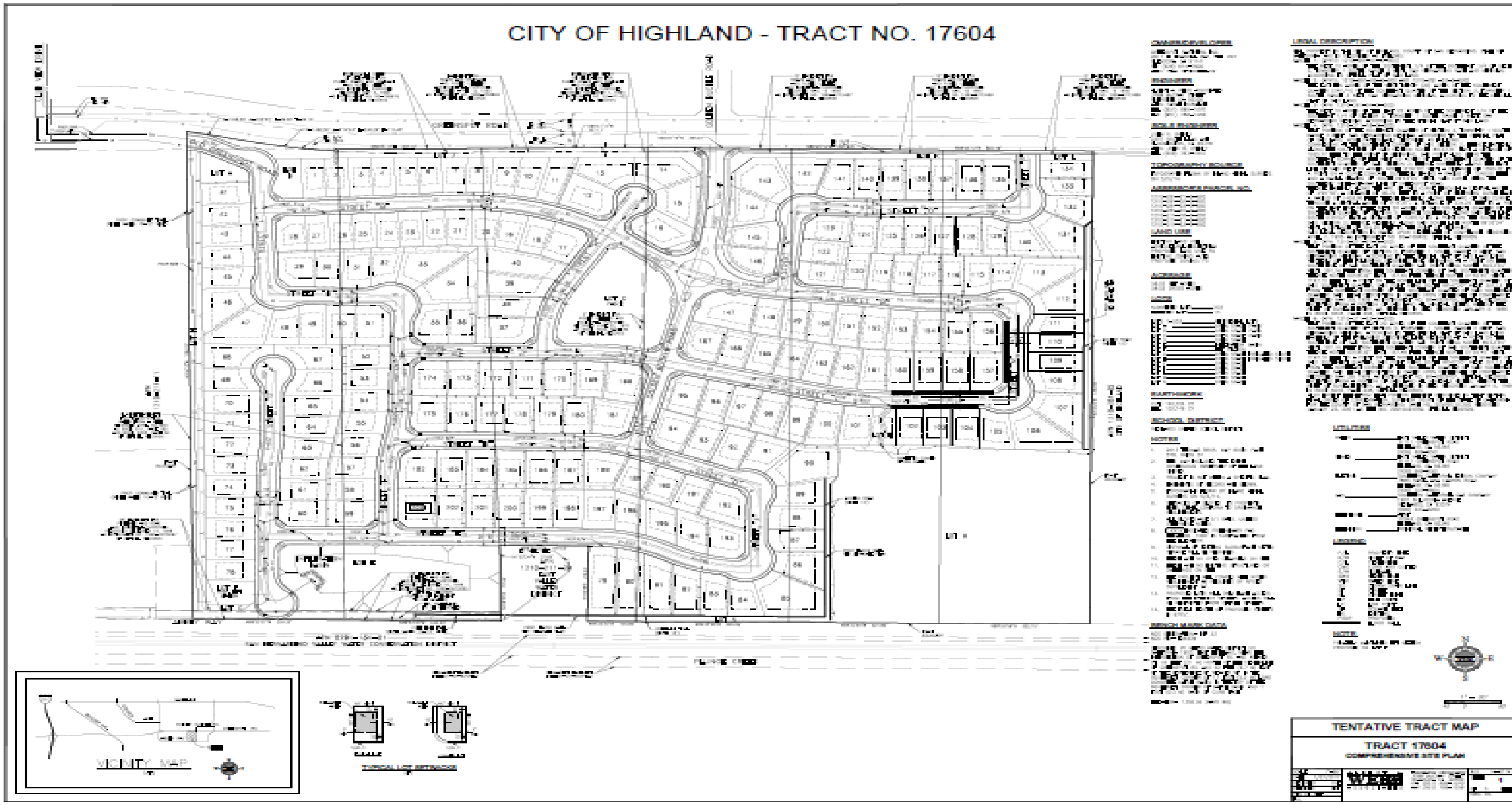


Figure 3. Proposed Project Site Plan

1.3 Fundamentals of Sound

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally defined as unwanted or excessive sound, which can vary in intensity by over one million times within the range of human hearing; therefore, a logarithmic scale, known as the decibel scale (dB), is used to quantify sound intensity. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. As such, background noise level changes throughout a typical day, corresponding with the addition and subtraction of distant noise sources such as traffic, and single-event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

Because the noise environment is continually changing, average noise over a period of time is generally used to describe the community noise environment, which requires the measurement of noise over a period of time to accurately characterize a community noise environment. This time-varying characteristic of environmental noise is described using various noise descriptors, which are defined below:

L_{eq}: The L_{eq}, or equivalent sound level, is used to describe noise over a specified period of time in terms of a single numerical value; the L_{eq} of a time-varying signal and that of a steady signal are the same if they deliver the same acoustic energy over a given time. The L_{eq} may also be referred to as the average sound level.

Lmax: The maximum, instantaneous noise level experienced during a given period of time.

Lmin: The minimum, instantaneous noise level experienced during a given period of time.

Lx: The noise level exceeded a percentage of a specified time period. The "x" represents the percentage of time a noise level is exceeded. For instance, L50 and L90 represents the noise levels that are exceeded 50 percent and 90 percent of the time, respectively.

Ldn: Also termed the day-night average noise level (DNL), the Ldn is the average A-weighted noise level during a 24-hour day, obtained after an addition of 10 dBA to measured noise levels between the hours of 10:00 pm to 7:00 am to account nighttime noise sensitivity.

CNEL: CNEL, or Community Noise Equivalent Level, is the average A-weighted noise level during a 24-hour day that is obtained after an addition of 5 dBA to measured noise levels between the hours of 7:00 pm to 10:00 pm and after an addition of 10 dBA to noise levels between the hours of 10:00 pm to 7:00 am to account for noise sensitivity in the evening and nighttime, respectively.

In addition, sound is characterized by both its amplitude and frequency (or pitch). The human ear does not hear all frequencies equally. In particular, the ear deemphasizes low and very high frequencies. To approximate the sensitivity of human hearing, the A-weighted decibel scale (dBA) is used. On this scale, the human range of hearing extends from approximately 3 dBA to around 140 dBA. **Table 1** includes examples of A-weighted noise levels from common indoor and outdoor activities.

Table 1. Typical A-Weighted Noise Levels

Common Outdoor Noise	Noise Level (dBA)	Common Indoor Noise
	— 110 —	Rock band (noise to some, music to others)
Jet fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	— 70 —	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher in neighboring room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing
SOURCE: Caltrans 1998.		

Using the decibel scale, sound levels from two or more sources cannot be directly added together to determine the overall sound level. Rather, the combination of two sounds at the same level yields an increase of 3 dBA. The smallest recognizable change in sound levels is approximately 1 dBA. A 3-dBA increase is generally considered perceptible, whereas a

5-dBA increase is readily perceptible. A 10-dBA increase is judged by most people as an approximate doubling of the sound loudness.

Two of the primary factors that reduce levels of environmental sounds are increasing the distance between the sound source to the receiver and having intervening obstacles such as walls, buildings, or terrain features between the sound source and the receiver. Factors that act to increase the loudness of environmental sounds include moving the sound source closer to the receiver, sound enhancements caused by reflections, and focusing caused by various meteorological conditions.

1.4 Effects of Noise on People

Noise is generally loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity that is a nuisance or disruptive. The effects of noise on people can be placed into four general categories:

- Subjective effects (e.g., dissatisfaction, annoyance)
- Interference effects (e.g., communication, sleep, and learning interference)
- Physiological effects (e.g., startle response)
- Physical effects (e.g., hearing loss)

Although exposure to high noise levels has been demonstrated to cause physical and physiological effects, the principal human responses to typical environmental noise exposure are related to subjective effects and interference with activities. Interference effects refer to interruption of daily activities and include interference with human communication activities, such as normal conversations, watching television, telephone conversations, and interference with sleep. Sleep interference effects can include both awakening and arousal to a lesser state of sleep. With regard to the subjective effects, the responses of individuals to similar noise events are diverse and are influenced by many factors, including the type of noise, the perceived importance of the noise, the appropriateness of the noise to the setting, the duration of the noise, the time of day and the type of activity during which the noise occurs, and individual noise sensitivity.

Overall, a wide variation of tolerance to noise exists, based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted (i.e., comparison to the ambient noise environment). In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships generally occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived.
- Outside of the laboratory, a 3 dBA change in noise levels is considered to be a barely perceivable difference.
- A change in noise levels of 5 dBA is considered to be a readily perceivable difference.
- A change in noise levels of 10 dBA is subjectively heard as doubling of the perceived loudness.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion, hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

1.5 Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver, such as asphalt or concrete surfaces or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass, or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such as traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement (Caltrans 1998).

1.6 Fundamentals of Vibration

Vibration is energy transmitted in waves through the ground or man-made structures. These energy waves generally dissipate with distance from the vibration source. Common sources of groundborne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving, and operation of heavy earth-moving equipment. As described in the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment (FTA 2006), ground-borne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (VdB) is commonly used to measure RMS. The relationship of PPV to RMS velocity is expressed in terms of the "crest factor," defined as the ratio of the PPV amplitude to the RMS amplitude. Peak particle velocity is typically a factor of 1.7 to 6 times greater than RMS vibration velocity (FTA 2006). The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration sensitive equipment.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration levels exceed the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV (FTA 2006).

In residential areas, the background vibration velocity level is usually around 50 VdB (approximately 0.0013 in/sec PPV). This level is well below the vibration velocity level threshold of perception for humans, which is approximately 65 VdB. A vibration velocity level of 75 VdB is considered to be the approximate dividing line between barely perceptible and distinctly perceptible levels for many people (FTA 2006).

1.7 Existing Noise Environment

Sensitive Land Uses

Noise sensitive land uses are generally defined to include: places where people sleep, such as residences, hospitals, and hotels; institutional land uses where it is important to avoid interference with speech or reading, including schools, libraries, and churches; and outdoor areas where quiet is fundamental to its specific use (i.e. amphitheaters and National Parks).

The project site is vacant and undeveloped, but located adjacent to an urban and generally developed area. The closest residence is approximately 100 feet west of the project site, a mobile home and 100 feet from two-story residences located across Greenspot Road, bound by a 6-foot high cement block wall.

Noise Measurements

Sources of noise in the City of Highland are typical of those found in other urban developed areas include, but not limited to, traffic, construction work, commercial and residential operations, human activities, emergency vehicles, aircraft overflights, etc. One long-term and three short-term noise measurements of existing ambient noise levels were taken on and adjacent to the project site on April 5th and 6th, 2017 to characterize existing ambient noise levels. **Figure 4** shows the noise measurement locations.

Tables 3 lists the long-term ambient noise levels at the long-term measurement location. The highest hourly noise measurement over the 24-hour period was 65.4 dBA L_{eq} and the lowest noise was 50.6 dBA L_{eq}. The existing CNEL is 66 dBA L_{eq}. In addition, as shown in **Table 4**, the short-term noise measurements identified existing ambient noise at sensitive receiver's ranges between 46.4 dBA L_{eq} and 68.8 dBA L_{eq}.

Existing Vibration Levels

Aside from periodic construction work that may occur in the vicinity of the project area, other sources of groundborne vibration include heavy-duty vehicular travel (e.g., refuse trucks and delivery trucks) on the roadways that are adjacent to the project site. Trucks traveling at a distance of 50 feet typically generate groundborne vibration velocity levels of around 63 VdB (approximately 0.006 in/sec PPV), and these levels could reach 72 VdB (approximately 0.016 in/sec PPV) when trucks pass over bumps in the road (FTA 2006).

Figure 4. Noise Measurement and Sensitive Receiver Locations

Table 2. Summary of Long-Term Noise Measurement LT-1

Hour Beginning	dBA L_{eq}[h]
11:00 AM	61.5
12:00 PM	60.4
1:00 PM	62.5
2:00 PM	62.6
3:00 PM	64
4:00 PM	65.4
5:00 AM	63.2
6:00 AM	63.1
7:00 AM	63.2
8:00 PM	61
9:00 PM	59.5
10:00 PM	58.1
11:00 PM	54.3
12:00 AM	51.5
1:00 AM	50.8
2:00 AM	50.6
3:00 AM	52.7
4:00 AM	59.1
5:00 AM	63.4
6:00 AM	63.1
7:00 AM	61.9
8:00 AM	60.4
9:00 AM	59.6
10:00 AM	60.2

Table 3. Summary of Short-Term Noise Measurements

Location	dBA L_{eq}
ST-1	58.6
ST-2	46.4
ST-3	68.8

2.0 REGULATORY FRAMEWORK

The governing regulatory framework in the City of Highland includes federal, state, and local agencies that enforce noise and vibration standards.

2.1 Federal Regulations and Standards

There are no federal noise standards that directly regulate environmental noise related to the construction or operation of the proposed project. With regard to noise exposure and workers, the Office of Safety and Health Administration (OSHA) regulations safeguard the hearing of workers exposed to occupational noise. Federal regulations also establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205, Subpart B. The federal truck pass-by noise standard is 80 dB at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

Federal Transit Authority Vibration Standards

The FTA has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. The vibration damage criteria adopted by the FTA are shown in **Table 4**.

Table 4. Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12
SOURCE: FTA, 2006.	

The FTA has also adopted the following standards for groundborne vibration impacts related to human annoyance: Vibration Category 1 – High Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional. The FTA defines Category 1 as buildings where vibration would interfere with operations, such as vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and research operations. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference. The vibration thresholds associated with human annoyance for these three land-use categories are shown in **Table 5**. No thresholds have been adopted or recommended for commercial and office uses.

Table 5. Groundborne Vibration Impact Criteria for General Assessment

Land Use Category	Frequent Events [a]	Occasional Events [b]	Infrequent Events [c]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[d]	65 VdB[d]	65 VdB[d]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

[a] Frequent Events" is defined as more than 70 vibration events of the same source per day.
[b] Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
[c] Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.
[d] This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.
SOURCE: FTA, 2006

2.2 State Regulations and Standards

Noise Standards

The California Department of Health Services has established guidelines for land use and noise exposure compatibility that are listed in **Table 6**. In addition, the California Government Code (Section 65302(g)) requires a noise element to be included in general plans, and requires that the noise element: (1) identify and appraise noise problems in the community; (2) recognize Office of Noise Control guidelines; and (3) analyze and quantify current and projected noise levels.

In addition, state noise regulations include requirements for the construction of new residential structures that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are collectively known as the California Noise Insulation Standards and are found in California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor ceiling assemblies must block or absorb sound. For limiting noise from exterior sources, the noise insulation standards set forth an interior standard of DNL 45 dBA in any habitable room and, where such units are proposed in areas subject to noise levels greater than DNL

60 dBA require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard. If the interior noise level depends upon windows being closed, the design for the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment.

Table 6. California Community Noise Exposure (Ldn or CNEL)

Land Use	Normally Acceptable[a]	Conditionally Acceptable[b]	Normally Unacceptable[c]	Clearly Unacceptable[d]
Single-family, Duplex, Mobile Homes	50 - 60	55 - 70	70 - 75	above 75
Multi-Family Homes	50 - 65	60 - 70	70 - 75	above 75
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 - 70	60 - 70	70 - 80	above 80
Transient Lodging – Motels, Hotels	50 - 65	60 - 70	70 - 80	above 75
Auditoriums, Concert Halls, Amphitheaters	---	50 - 70	---	above 70
Sports Arena, Outdoor Spectator Sports	---	50 - 75	---	above 75
Playgrounds, Neighborhood Parks	50 - 70	---	67 - 75	above 75
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 - 75	---	70 - 80	above 80
Office Buildings, Business and Professional Commercial	50 - 70	67 - 77	above 75	---
Industrial, Manufacturing, Utilities, Agriculture	50 - 75	70 - 80	above 75	---

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

b Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction 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 new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

d Clearly Unacceptable: New construction or development should generally not be undertaken.

SOURCE: FTA, 2006.

The state has also established the California Noise Insulation Standards (Title 24, California Code of Regulations) that provide an interior standard of 45 dB Ldn/CNEL for any habitable room. In addition, it requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than 60 dB Ldn/CNEL. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Additionally, the state has noise limits for vehicles licensed to operate on public roads. For heavy trucks, the state pass-by standard is consistent with the federal limit of 80 dB. The state pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

Vibration Standards

There are no state vibration standards applicable to the proposed project. In addition, the California Department of Transportation's (Caltrans) *Transportation and Construction Vibration Guidance Manual* (2013), does not provide official Caltrans standards for vibration. However, this manual provides guidelines that can be used as screening tools for assessing the potential for adverse vibration effects related to structural damage and human perception. The manual is meant to provide guidance related to vibration issues associated with the construction, operation, and maintenance of Caltrans projects. The vibration criteria established by Caltrans for assessing structural damage and human perception are shown in **Tables 7** and **8**, respectively.

Table 7. Caltrans 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: Caltrans, 2006.

Table 8. Caltrans Vibration Annoyance Potential Criteria

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

Source: Caltrans, 2006.

2.3 Local Regulations and Standards

The City of Highland outlines their noise regulations and standards within the Noise Element from the General Plan and the Noise Ordinance from the Municipal Code.

Noise Regulations

The City categories land uses into designated noise zones to assign appropriate interior and exterior noise standards. The appropriate noise standards for residential land uses require noise levels to be below 60 dBA CNEL for exterior areas and 45 dBA for interior areas.

Construction Noise Regulations

The City of Highland Noise Ordinance, section 8.50.060(l) states that the following activities and noise sources shall not be subject to the provisions of (the Noise Control) Chapter:

> *Construction, repair or excavation work performed pursuant to a valid written agreement with the city or any of its political subdivisions, which the agreement provides for noise mitigation measures.*

3.0 THRESHOLDS OF SIGNIFICANCE

Appendix G of the California Environmental Quality Act (CEQA) Guidelines states that a project could have a significant adverse effect related to noise if any of the following would occur:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

3.1 Noise Criteria

The *CEQA Guidelines* does not define the levels at which permanent and temporary increases in ambient noise are considered “substantial.” Therefore, the significance of the project’s noise impacts can be determined by comparing estimated project-related noise levels to existing no-project noise levels. With respect to the traffic noise environment, the average healthy ear can barely perceive a noise level change of 3 dBA. A change from 3 to 5 dBA may be noticed by some individuals who are sensitive to changes in noise. A 5 dBA increase is readily noticeable, while the human ear perceives a 10 dBA increase as a doubling of sound (Caltrans 2013). Thus, a significant impact related to a substantial increase in traffic noise would occur if the project results in an increase of 5 dBA, which would be readily noticeable.

3.2 Vibration Criteria

The *CEQA Guidelines* do not define the levels at which groundborne vibration or groundborne noises are considered “excessive.” The City does not have a significance threshold to assess vibration impacts during construction. Additionally, there are no federal, state, or local vibration regulations or guidelines directly applicable to the proposed project. However, publications of the FTA and Caltrans are two of the seminal works for the analysis of vibration relating to transportation and construction-induced vibration. The proposed project is not subject to FTA or Caltrans regulations; nonetheless, these guidelines serve as a useful tool to evaluate vibration impacts. For the purpose of this analysis, the vibration criteria for structural damage and human annoyance established in the most recent Caltrans’ *Transportation and Construction Vibration Guidance Manual* (2013), which are shown previously in Tables 8 and 9, are used to evaluate the potential vibration impacts of the project on sensitive receptors.

4.0 METHODOLOGY

The primary sources of noise associated with the proposed project would be construction activities and project-related traffic volumes associated with the operational developments. Secondary sources of noise would include new stationary sources (such as heating, ventilation, and air conditioning units) associated with the new residential uses. The increase in noise levels generated by these activities and other sources associated with the proposed project have been quantitatively estimated and compared to the applicable noise standards and thresholds of significance.

Additionally, groundborne vibration would be generated during the construction activities. Thus, the groundborne vibration levels generated by these sources have also been quantitatively estimated and compared to applicable thresholds of significance.

4.1 Construction Noise Levels

For the purpose of this analysis, an approximate estimate of the construction noise levels is conducted based on the general assessment approach recommended by the FTA. The FTA's general construction noise assessment approach recommends assessing the two noisiest pieces of construction equipment operating concurrently at the center of the project site (FTA 2006). The maximum noise level was predicted at a reference distance 50 feet.

4.2 Traffic Generated Noise Levels

Traffic generated noise from implementation of the proposed project were calculated based on information provided in the Traffic Impact Analysis Report that was prepared for the proposed project by Linscott Law & Greenspan (LLG 2017). The noise levels were calculated using the FHWA's Highway Traffic Noise Prediction Model version 2.5 (TNM 2.5). From the modeling data, existing noise levels in the project area are compared to noise levels with operation of the proposed project to determine whether a substantial increase in noise would occur.

4.3 Groundborne Vibration from Construction and Operation

Groundborne vibration levels resulting from construction activities were estimated using data published by the FTA in its *Transit Noise and Vibration Impact Assessment* (2006) document. Potential vibration levels resulting from construction activities are identified at the nearest off-site sensitive receptor location, which for the purpose of this analysis is assumed to be adjacent sensitive uses, which are the residences located approximately 100 feet to the north and west of the project site. The potential vibration levels at off-site sensitive locations resulting from implementation of the proposed project are analyzed against the vibration thresholds established by Caltrans to determine whether an exceedance of allowable vibration levels would occur.

5.0 NOISE ASSESSMENT

This noise impact assessment is conducted to determine the significance of the impact created by construction and operation of the proposed project on the noise sensitive land uses adjacent to the project area. Construction may affect ambient noise as a result of construction equipment and vehicles traveling to/from construction sites by construction workers. Operation related impacts would be generated primarily from vehicle and truck trips and from mechanical equipment, such as HVAC units.

5.1 Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies

Construction

Construction, although short-term, can be a significant source of noise. Construction activity noise levels fluctuate depending on the particular type, number, and duration of uses of various pieces of construction equipment. Construction of the proposed project would require the use of heavy construction equipment for activities such as excavation, grading, installation of utilities, paving, and building fabrication. Development activities would also involve the use of smaller power tools, generators, and other sources of noise. During each stage of construction, a different mix of equipment operating noise levels would occur and would vary based on the amount of equipment in operation and the location of the activity.

The FHWA has compiled data for outdoor noise levels for typical construction activities. **Table 9** provides average (L_{eq}) noise levels produced by various types of construction equipment at a distance of 50 feet between the equipment and noise receptor. These noise levels would diminish with distance from a construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 84 dBA L_{eq} measured at 50 feet from the noise source to the receptor would reduce to 78 dBA L_{eq} at 100 feet from the source to the receptor.

Table 9. Construction Equipment Noise Levels

Construction Equipment	Noise Level at 50 Feet (dBA, L_{eq})
Air Compressor	78
Backhoe	78
Chain Saw	84
Compactor	83
Concrete Mixer	79
Concrete Pump	81
Dozer	82
Generator	81
Grader	85
Dump Truck	76
Paver	77
Pneumatic Tools	85
Jackhammer	89
Roller	80
Front End Loader	79
Scraper	84
Tractor	84
Truck	75
Source: FHWA Construction Noise Handbook.	

The construction activities would expose the nearby existing uses to increased noise levels. The highest construction noise would occur during the excavation and grading activities. As shown in **Table 9**, use of grading equipment generates noise levels of approximately 85 dBA at a distance of 50 feet; at a distance of 100 feet the noise would attenuate to approximately 79 dBA.

As described above, the closest sensitive receptors to the project site would be the adjacent mobile home single-family residences to the west. The loudest construction related exterior noise would be approximately 79 dBA Leq at this receptor (100 feet from the site) when the loudest equipment is used.

However, the City's Municipal Code, because the project site is not adjacent to residential uses, construction noise is exempt as long as it does not occur any earlier than one-half hour before sunrise or to terminate no later than one-half hour after sunset Monday through Sunday. The proposed project would not involve the need for construction during these hours, and the construction activities related to the project would be consistent with the City's Municipal Code. Thus, the proposed project would be in compliance with the City's construction related noise standards, and impacts would be less than significant.

Operation

With respect to operational noise levels, the City has established exterior noise standards that are correlated with land use classifications. As described above, the exterior noise standards are 60 dBA CNEL during the daytime and 55 dBA during the nighttime for residential land uses.

Traffic Generated Noise

Ambient noise levels within and surrounding the project area are influenced primarily by traffic on local roadways. With respect to vehicle traffic generated by the project, approximately 2,047 daily trips are anticipated (LLG 2017). The increase in traffic resulting from implementation of the project would increase the ambient noise levels at land uses fronting roadways. To evaluate the future traffic noise environment in the project area, the future traffic noise levels were estimated based on future traffic volumes provided in the project's traffic study using the FHWA's TNM 2.5 model. As described above in Section 3.1, *Noise Criteria*, a significant impact related to a substantial increase in noise would occur if the project results in an increase of 5 dBA, which would be readily noticeable.

As shown in **Table 10**, existing noise levels at sensitive receptors in the project area range from 48.9 dBA to 68.3 dBA. Traffic resulting from the proposed project would increase noise levels to a maximum of 0.5 dBA. Because the project related increase in noise is less than the 5 dBA threshold, noise impacts would be less than significant.

Table 10. Increase in Noise Levels from Operational Traffic

Receptor	Existing CNEL	Existing with Project CNEL	Increase
R1	48.9	49.3	0.4
R2	52.7	53.2	0.5
R3	59.1	59.6	0.5
R4	61.6	62.1	0.5
R5	56.4	56.9	0.5
R6	63	63.5	0.5
R7	61.8	62.3	0.5
R8	64	64.5	0.5
R9	56.4	56.9	0.5
R10	67.9	68.1	0.2
R11	62.3	62.4	0.1
R12	68.3	68.4	0.1

Stationary Equipment Noise

Once the proposed residences are operational, noise levels generated at the project site would occur from new stationary equipment such as heating, ventilation, and air conditioning (HVAC) units that would be installed for the building. Although the operation of this equipment would generate noise, the design of these onsite HVAC units and exhaust fans would be required to comply with the noise limit regulations of the City's Noise Element that does not allow exterior noise to exceed 55 dBA CNEL between 10:00 p.m. and 7:00 a.m., and 60 dBA CNEL between 7:00 a.m. and 10:00 p.m. Meeting these exterior standards would also meet the City's interior noise standards with implementation of standard construction, which would be required by the City. Therefore, impacts related to generation of noise in excess of standards would not occur from operation of the proposed project.

5.2 Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels

Construction

As described previously, construction activities for the project would include excavation and grading activities, which has the potential to generate groundborne vibration. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to slight structural damage at the highest levels. Site ground vibrations from construction activities very rarely reach the levels that can damage structures, but they can be perceived in the audible range and be felt in buildings very close to a construction site.

The construction that would occur by the project would involve the temporary use of construction equipment, which can result in the generation of groundborne vibration levels. The various PPV vibration velocities for several types of construction equipment that can generate perceptible vibration levels are identified in **Table 11.** As shown, vibration velocities could range from approximately 0.003 to 0.089 inch-per-second PPV at 25 feet from the source activity, depending on the type of construction equipment in use. For the purpose of this analysis, the vibration level for a large bulldozer provided in **Table 11** was used to evaluate vibration source levels at the nearest sensitive receptor from construction activity. In comparison to the Caltrans vibration criteria provided in **Tables 7 and 8**, vibration impacts from construction activities would not exceed the criteria.

Table 11. Vibration Source Levels for Construction Equipment at 25 Feet

Equipment	PPV (in/sec) at 25 Feet	PPV (in/sec) at 50 Feet	PPV (in/sec) at 100 Feet
Large Bulldozer	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Jackhammer	0.035	0.012	0.004
Small Bulldozer	0.003	0.001	<0.000
SOURCE: FTA, 2006			

As described above, the closest sensitive uses to the project site are the residences, which are modern structures that are located 100 feet away. At this distance, the maximum vibration of 0.011 in/sec PPV is estimated to occur during construction. **Table 11** shows that the vibration levels generated would be below levels that could create structural damage to modern buildings (0.5 in/sec PPV), and below the strongly perceptible level for human response (0.9 in/sec PPV). Thus, vibration at 100 feet away from construction activity would be less than significant, and construction of the project would not generate excessive generation of ground-borne vibration.

Operation

The proposed warehousing uses do not involve activities or operation of stationary or mobile equipment that would result in high vibration levels, which are more typical for large industrial projects that employ heavy machinery. During project operations, the primary source of vibration would likely be delivery/garbage truck circulation within and adjacent to the project area. However, the FTA's *Transit Noise and Vibration Impact Assessment* states that it is unusual for vibration from vehicular sources (including buses and trucks) to be perceptible, even in locations close to major roads. As such, no sources of "excessive" groundborne vibration or noise levels are anticipated during project operations.

5.3 A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Traffic Noise

As described above in Section 3.1, *Noise Criteria*, the significance of the project's noise impacts in regards to traffic noise is determined by comparing estimated project-related noise levels, and a substantial increase in noise would occur if the project resulted in an increase of 5 dBA or more. As shown in Table 12, the project would result in maximum noise increase of 0.5 dBA. Because the project related increase in noise is less than the 5 dBA threshold, impacts related to a substantial permanent increase in ambient noise would be less than significant.

Onsite Stationary Noise Sources

As described previously, in Section 5.1, equipment on the project site, including HVAC units and exhaust fans would be installed in compliance with the City's Noise Element, such that it would not cause noise to exceed the City's noise limit. Therefore, onsite stationary noise equipment associated with the proposed project would not result in a substantial permanent increase in ambient noise levels, and impacts would be less than significant.

5.4 A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

As shown in Table 13, Existing noise levels at sensitive receptors in the project area range from 46.4 dBA to 68.8 dBA; and as described previously, in Section 5.1. The loudest construction related exterior noise would be approximately 79 dBA at the closest residences where existing noise is approximately 66 dBA CNEL. The loudest construction noise would occur during excavation activities. However, this noise level is not anticipated to occur throughout the entire course of a construction day, as construction equipment and activities rarely operate continuously for a full day at a construction site. Typically, the operating cycle for construction equipment would involve one or two minutes of full power operation followed by three or four minutes at lower power settings. Additionally, construction equipment engines would likely be intermittently turned on and off over the course of a construction day.

Therefore, implementation of the proposed project would result in a less than significant impact related to a substantial temporary or periodic increase in ambient noise levels.

5.5 For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels

The project site is over approximately 2.9 miles east of the Ontario International Airport. The project site is not located within the Airport Land Use Plan of the airport. Due to the distance of the facilities from the project site, people residing or working in the project area would not be exposed to excessive noise levels related to the airport; and impacts would not occur.

5.6 For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels

The proposed project is not located in the vicinity of a private airstrip. Therefore, the proposed project would not expose people working in the area to excessive noise levels associated with a private airstrip.

6.0 REFERENCES

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Appendix A Noise Modeling Results

(See attached electronic files)