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MEMORANDUM

DATE: August 30, 2023

TO: Shab Vakili, KSP Studio

FROM: J.T. Stephens, Principal
Moe Abushanab, Noise Engineer

SUBJECT: Noise and Vibration Impact Analysis: Proposed Anaheim Extra Space Storage Project in the City of Anaheim, California

INTRODUCTION AND PROJECT DESCRIPTION

This noise and vibration impact analysis has been prepared to evaluate the potential impacts associated with the proposed Anaheim Extra Space Storage Project (project) in Anaheim, California. This report is intended to satisfy the City of Anaheim's (City) requirement for a project-specific noise and vibration impact analysis and examines the impacts of the proposed project to the existing noise-sensitive uses adjacent to the project site. To properly account for the impacts associated with the proposed project, existing noise levels are assessed based on noise measurement data gathered in the vicinity of the project site (from July 18 to July 19, 2023) and project-related noise and vibration levels generated are based on estimated construction equipment. Traffic volumes from the Transportation Analysis for the 1761 West Katella Avenue Project[1] and additional stationary sources on the project site were also evaluated.

Location and Description

The 1.93-acre project site is located at 1761 West Katella Avenue in Anaheim, Orange County, California. The project site is currently developed with an approximately 58,956-square-foot (sq ft) storage building and an approximately 3,279 sq ft commercial building. Both on-site buildings are currently operational. The project site is bounded by residential uses to the east and north and commercial uses to the west and south. Access to the project site is provided by Humor Drive. Figure 1 shows the project location, and Figure 2 provides an overview of the proposed site plan (all figures are provided in Attachment A).

The proposed project would demolish the existing 3,279 sq ft commercial building and add a two-story extra space storage building next to the existing 58,956 sq ft storage building. The proposed extra space storage building would be a total of 52,661 sq ft and would consist of approximately 588 units. In addition, the proposed project would provide 21 parking spaces on site. The proposed project would generate approximately 77 average daily trips (ADT), including 5 a.m. trips and 8 p.m. trips. The proposed project would be all-electric and would not include natural gas.

[1] LSA. 2023. *Transportation Analysis for 1761 West Katella Avenue, Anaheim, California*. February 23.

Construction would include demolition, site preparation, excavation, grading, building construction, and the installation of landscaping and irrigation, lighting, storm drain facilities, and underground utilities. Construction of the proposed project is anticipated to commence in September 2024 and occur over approximately 12 months. Site preparation, grading, and building activities would involve the use of standard earthmoving equipment such as large excavators, cranes, and other related equipment. Based on the preliminary grading plans, the proposed project would require the import of approximately 330 cubic yards of soil.

METHODOLOGY

The evaluation of noise impacts associated with the proposed project includes the following:

- A determination of the short-term construction noise and vibration levels at off-site noise-sensitive uses and comparison to the City's General Plan and Municipal Code Ordinance requirements;
- A determination of the long-term noise levels at off-site noise-sensitive uses and comparison of those levels to the City's pertinent noise standards; and
- If necessary, a determination of required mitigation measures, such as noise barriers, to reduce long-term noise impacts from all sources.

CHARACTERISTICS OF SOUND

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave, resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

Measurement of Sound

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds), decibels are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 decibels (dB) is 10 times more intense than 1 dB, 20 dB is 100 times more intense than 1 dB, and 30 dB is 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represent

1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. For a single-point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dB for each doubling of distance in a hard site environment. Similarly, line sources with intervening absorptive vegetation or line sources that are located at a great distance to the receptor would decrease 4.5 dB for each doubling of distance.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average noise level (L_{dn}) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The City uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max}, which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. L_{max} is often used together with another noise scale or noise standards in terms of percentile noise levels in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level (i.e., half the time the noise level exceeds this level, and half the time it is less than this level). The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category is audible impacts, which refers to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas.

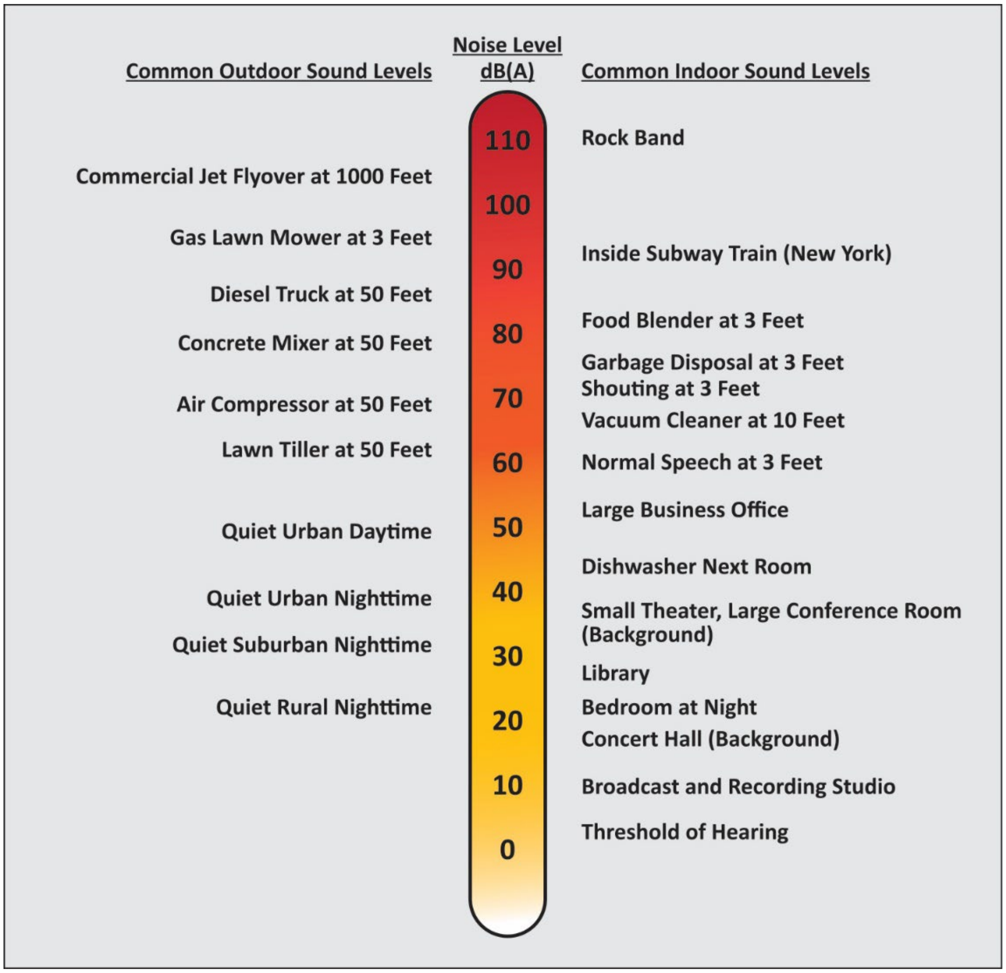
Table A lists full definitions of acoustical terms, and Table B shows common sound levels and their sources.

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of level that denotes the ratio between two quantities proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this assessment are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level for 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dB to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: *Handbook of Acoustical Measurements and Noise Control* (Harris, Cyril M., 1991).

Table B: Common Sound Levels and Noise Sources



Source: LSA (2016).

CHARACTERISTICS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may not be discernible. Typically, there is more adverse reaction to effects associated with the shaking of a building. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet (ft) of the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (FTA 2018).[2] When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, the construction of the project could result in ground-borne vibration that may be perceptible.

Ground-borne vibration has the potential to damage buildings. Although it is very rare for typical construction activities to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018).[2] Ground-borne vibration that may resulting in damage is usually measured in terms of peak particle velocity (PPV).

APPLICABLE NOISE STANDARDS

The applicable noise standards governing the project site include the criteria in the City's Noise Element of the General Plan (Noise Element) and the City of Anaheim Municipal Code (AMC).

City of Anaheim

Noise Element of the General Plan

The Noise Element provides the City's goals and policies related to noise. The City has identified the following goals and policies in the Noise Element that are applicable to the project:

Goal 1.1. *Protect sensitive land uses from excessive noise through diligent planning and regulation.*

Policies.

2. Continue to enforce acceptable noise standards consistent with health and quality of life goals and employ effective techniques of noise abatement through such means as a noise ordinance, building codes, and subdivision and zoning regulations.

3. Consider the compatibility of proposed land uses with the noise environment when preparing, revising or reviewing development proposals.

5. Encourage proper site planning and architecture to reduce noise impacts.

6. Discourage the siting of sensitive uses in areas in excess of 65 dBA CNEL without appropriate mitigation.

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[2] Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual – FTA Report No. .0123*. September.

7. Require that site-specific noise studies be conducted by a qualified acoustic consultant utilizing acceptable methodologies while reviewing the development of sensitive land uses or development that has the potential to impact sensitive land uses.

Goal 2.1. *Encourage the reduction of noise from transportation-related noise sources such as motor vehicles, aircraft operations, and railroad movements.*

Policies.

3. Require that development generating increased traffic and subsequent increases in the ambient noise level adjacent to noise-sensitive land uses provide appropriate mitigation measures.

4. Maintain roadways so that the paving is in good condition to reduce noisegenerating cracks, bumps, and potholes.

11. Encourage the development of alternative transportation modes that minimize noise within residential areas.

Goal 3.1. *Protect residents from the effects of "spill over" or nuisance noise emanating from the City's activity centers.*

Policies.

1. Discourage new projects located in commercial or entertainment areas from exceeding stationary-source noise standards at the property line of proximate residential or commercial uses, as appropriate.

3. Enforce standards to regulate noise from construction activities. Particular emphasis shall be placed on the restriction of the hours in which work other than emergency work may occur. Discourage construction on weekends or holidays except in the case of construction proximate to schools where these operations could disturb the classroom environment.

4. Require that construction equipment operate with mufflers and intake silencers no less effective than originally equipped.

5. Encourage the use of portable noise barriers for heavy equipment operations performed within 100 feet of existing residences or make applicant provide evidence as to why the use of such barriers is infeasible.

City of Anaheim Municipal Code

This project utilizes the City's noise control guidelines for determining and mitigating nontransportation or stationary noise source impacts from operations found in Section 6.70.010 of the AMC, which indicates that "no person shall, within the City, create any sound, radiated for extended periods from any premises which produces a sound pressure level at any point on the property in excess of 60 dBA (Re 0.0002 Microbar)." Section 6.70.010 of the AMC also exempts certain noise sources from the provisions of this code, including traffic sounds, sound created by emergency activities and sound created by governmental units. Sound created by construction or building repair of any premises within the City is also exempt from the applications of the AMC during the hours of 7:00 a.m. to 7:00 p.m.

State of California Green Building Standards Code

The State of California's Green Building Standards Code (CALGreen) contains mandatory measures for nonresidential building construction in Section 5.507 on Environmental Comfort. These noise standards are applied to new construction in California for controlling interior noise levels resulting from exterior noise sources. The regulations specify that acoustical studies must be prepared when nonresidential structures are developed in areas where the exterior noise levels exceed 65 dBA CNEL, such as within a noise contour of an airport, freeway, railroad, or other noise source. If the development falls within an airport or freeway 65 dBA CNEL noise contour, buildings shall be constructed to provide an interior noise level environment attributable to exterior sources that does not exceed an hourly equivalent level of 50 dBA L_{eq} in occupied areas during any hour of operation.

Federal Transit Administration

Although the City does not have daytime construction noise level limits for activities that occur within the specified hours of Section 18-63(b)(7), to determine potential CEQA noise impacts, construction noise was assessed using criteria from the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018) (FTA Manual).[3] Table C shows the FTA's Detailed Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table C: Detailed Assessment Daytime Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)
Residential	80
Commercial	85
Industrial	90

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

The following information provides standards to which potential vibration impacts will be compared.

3 Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual – FTA Report No. .0123.* September.

Federal Transit Administration

Vibration standards included in the FTA Manual (2018) are used in this analysis for ground-borne vibration impacts on surrounding buildings.

The criteria for environmental impacts resulting from ground-borne vibration are based on the maximum levels for a single event. The City's Municipal Code does not include specific criteria for assessing vibration impacts associated with damage. Therefore, for the purpose of determining the significance of vibration impacts experienced at sensitive uses surrounding the project site, the guidelines within the FTA Manual have been used to determine vibration impacts (refer to Table D, below).

Table D: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
in/sec = inches per second PPV = peak particle velocity

The FTA Manual guidelines show that a vibration level of up to 0.2 inches per second (in/sec) in PPV is considered safe for non-engineered timber and masonry buildings, which are the types of buildings located on properties adjacent to the project site. Accordingly, the 0.2 in/sec PPV threshold was used to evaluate vibration impacts at the nearest structures to the site.

THRESHOLDS OF SIGNIFICANCE

Based on *Guidelines for the Implementation of the California Environmental Quality Act* (CEQA), Appendix G, Public Resources Code, Sections 15000–15387, a project will normally have a significant effect on the environment related to noise if it will substantially increase the ambient noise levels for adjoining areas or conflict with adopted environmental plans and the goals of the community in which it is located.

The *State CEQA Guidelines* indicate that a project would have a significant impact on noise if it would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Generation of excessive ground-borne vibration or ground-borne noise levels; or
- For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

The primary existing noise sources in the project area are transportation facilities, including Humor Drive and Katella Avenue. In addition, periodic storage operations such as loading and unloading are audible at the project site.

In order to assess the existing noise conditions in the area, long-term noise measurements were conducted at the project site. Two long-term, 24-hour measurements were taken from July 18, 2023, to July 19, 2023. The locations of the noise measurements are shown on Figure 3, and the results are summarized in Table E. Noise measurement data are provided in Attachment B of this analysis.

Table E: Existing Noise Level Measurements

Location Number	Location Description	Daytime Noise Levels[1] (dBA L_{eq})	Evening Noise Levels[2] (dBA L_{eq})	Nighttime Noise Levels[3] (dBA L_{eq})	Average Daily Noise Levels (dBA CNEL)	Primary Noise Sources
LT-1	On a light pole along the northwestern corner of the Extra Space Storage facility, approximately 100 ft from the Humor Drive centerline.	47.6–59.8	51.8–55.5	40.0–50.5	56.1	Traffic on Humor Drive. Loading/ unloading. Vehicle passby.
LT-2	On a container along the center of the Extra Space Storage's eastern border, approximately 250 ft from the Katella Avenue centerline.	46.9–58.0	50.9–56.6	39.9–51.7	55.4	Traffic on Katella Avenue and Humor Drive. Loading/ unloading.

Source: Compiled by LSA (July 2023).
[1] Daytime Noise Levels = noise levels during the hours of 7:00 a.m. to 7:00 p.m.
[2] Evening Noise Levels = noise levels during the hours of 7:00 p.m. to 10:00 p.m.
[3] Nighttime Noise Levels = noise levels during the hours of 10:00 p.m. to 7:00 a.m.
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibel(s)
ft = foot/feet
L_{eq} = equivalent continuous sound level

AIRCRAFT NOISE

The project site is approximately 5 miles southeast of Fullerton Municipal Airport (FUL). Because the project site is not located within the 65 dBA CNEL and 60 dBA CNEL noise contours, no further analysis associated with aircraft noise impacts is necessary. Additionally, there are no helipads or private airstrips within 2 miles from the project area.

Sensitive Land Uses in the Project Vicinity

Certain land uses are considered more sensitive to noise than others are. Examples of these include residential areas, educational facilities, hospitals, childcare facilities, and senior housing. Land uses adjacent to the project site include the following:

- **North:** Existing multifamily residential uses.
- **Northwest:** Existing multifamily residential uses opposite Humor Drive.

- **East:** Existing single-family residential uses.
- **South:** Existing commercial uses Opposite Katella Avenue.
- **Southeast:** Existing commercial uses.
- **West:** Existing commercial uses opposite Humor Drive.

The nearest sensitive receptors are:

- **North:** Existing multifamily residential buildings approximately 33 ft north of the project site property line.
- **East**: Existing single-family homes approximately 40 ft from the project site property line.

PROJECT IMPACT ANALYSIS

The proposed project would result in short-term construction noise and vibration impacts and long-term mobile-source noise and vibration impacts as described below.

Short-Term Construction-Related Impact Analysis

Project construction would result in short-term noise and vibration. Maximum construction noise would be short-term, generally intermittent depending on the construction phase, and variable depending on receiver distance from the active construction zone. The duration of various types of construction noise and vibration would vary from 1 day to several weeks, depending on the phase of construction. The levels and types of impacts that may occur during construction are described below.

Construction Noise Analysis

Two types of short-term noise would occur during project construction, including: (1) equipment delivery and construction worker commutes; and (2) project construction operations.

The first type of short-term construction noise would result from the transport of construction equipment and materials to the project site and construction worker commutes. These transportation activities would incrementally raise noise levels on access roads leading to the site. It is expected that larger trucks used in equipment delivery would generate higher noise impacts than trucks associated with worker commutes. The single-event noise from equipment trucks passing at a distance of 50 ft from a sensitive noise receptor would reach a maximum level of 84 dBA L_{max}. However, the pieces of heavy equipment for construction activities would be moved on site just once and would remain on site for the duration of each construction phase. This one-time trip, when heavy construction equipment is moved on and off site, would not add to the daily traffic noise in the project vicinity. The total number of daily vehicle trips would be minimal when compared to existing traffic volumes on the affected streets, and the long-term noise level changes associated with these trips would not be perceptible. Therefore, equipment transport noise and construction-related worker commute impacts would be short term and would not result in a significant off-site noise impact. No mitigation is required.

The second type of short-term noise impact is related to noise generated during demolition, site preparation, grading, building construction, architectural coating, and paving on the project site.

Construction is undertaken in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the project site. Therefore, the noise levels would vary as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table F lists the maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 ft between the construction equipment and a noise receptor. Typical operating cycles for these types of construction equipment may involve 1–2 minutes of full-power operation followed by 3–4 minutes at lower power settings.

Table F: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Maximum Noise Level (L_{max}) at 50 ft
Compressor	100	81
Concrete Mixer	40	85
Concrete Pump	40	85
Crane	16	83
Dozer	40	80
Forklift	20	75
Front [End] Loader	40	79
Generator	100	78
Grader	8	85
Scraper	40	88
Welder	40	74

Sources: *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances* (USEPA 1971); Roadway Construction Noise Model (FHWA 2006).
ft = foot/feet
L_{max} = maximum instantaneous sound level

In addition to the reference maximum noise level, the usage factor provided in Table F is utilized to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right)$$

where: *L_{eq} (equip)* = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period

E.L. = Noise emission level of the particular piece of equipment at a reference distance of 50 ft

U.F. = Usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time

D = Distance from the receiver to the piece of equipment

Each piece of construction equipment operates as an individual point source. Utilizing the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq\ (composite) = 10 * \log_{10}\left(\sum_{1}^{n} 10^{\frac{Ln}{10}}\right)$$

Table G shows the composite noise levels of one piece of equipment type for each construction phase at a distance of 50 ft from the construction area. Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq\ (at\ distance\ X) = Leq\ (at\ 50\ feet) - 20 * \log_{10}\left(\frac{X}{50}\right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA, while halving the distance would increase noise levels by 6 dBA.

Table G: Construction Noise Levels by Phase

Phase	Duration (days)	Equipment	Composite Noise Level at 50 ft (dBA L_{eq})	Distance to Sensitive Receptor (ft)[1]	Noise Level at Receptor (dBA L_{eq})
Demolition	10	1 concrete/industrial saw, 1 dozer, and 3 tractors	86	110	79
Site Preparation	15	1 grader, 1 dozer, and 1 tractor	85	110	78
Grading	10	1 grader, 1 dozer, and 2 tractors	85	110	78
Building Construction	230	1 crane, 1 forklift, 1 generator set, 1 tractor, and 3 welders	83	110	76
Paving	10	1 cement and mortar mixer, 1 paver,1 paving equipment, 1 roller, and 1 tractor	85	110	79
Architectural Coating	115	1 air compressor	74	110	67

Source: Compiled by LSA (2023).

[1] Distances are from the average location of construction activity for each phase, assumed to be the center of the project site. Residential uses to the north are 30 feet from the edge of construction activity.

dBA L_{eq} = average A-weighted hourly noise level

ft = foot/feet

As presented above, Table H shows the construction phases, the expected duration of each phase, the equipment expected to be used during each phase, the composite noise levels of the equipment at 50 ft, the distance of the nearest sensitive receptor from the average location of construction activities (a distance of 110 ft from the center of the project site), and noise levels expected during each phase of construction. These noise level projections do not take into account intervening topography or barriers. Attachment C provides construction noise calculations.

It is expected that average noise levels during construction at the nearest sensitive receptor, the multifamily residential uses to the north, would approach 79 dBA L_{eq} during the demolition and paving phases, which would occur for a duration of approximately 10 days. Average noise levels during other construction phases would range from 67 dBA L_{eq} to 78 dBA L_{eq}. Noise levels at the nearest off-site commercial uses (existing office building) to the southeast would reach an average noise level of 73 dBA L_{eq} during the daytime hours. These predicted noise levels would only occur when all construction equipment is operating simultaneously; therefore, these noise levels are assumed to be conservative in nature.

Although the project construction-related short-term noise levels have the potential to be higher than the ambient noise in the project vicinity, construction noise would cease to occur once the project construction is completed. Furthermore, the construction-related noise levels would be below the 80 dBA L_{eq} and 85 dBA L_{eq} criteria established by FTA for residential and commercial uses, respectively. The project would be constructed in compliance with the requirements of the City's Noise Ordinance, which states that construction activities shall only occur between the hours of 7:00 a.m. and 7:00 p.m. With incorporation of best business practices for noise reduction, the overall noise levels generated will be minimized, and construction noise impacts would be less than significant. No mitigation is required.

Construction Vibration Building Damage Potential

Ground-borne noise and vibration from construction activity would be low. Table H provides reference PPV values and vibration levels (in terms of VdB) from typical construction vibration sources at 25 ft. While there is currently limited information regarding vibration source levels specific to the equipment that would be used for the project, to provide a comparison of vibration levels expected for a project of this size, a large bulldozer would generate 0.089 PPV (in/sec) of ground-borne vibration when measured at 25 ft, based on the FTA Manual. As shown previously in Table D, it would take a minimum of 0.2 PPV (in/sec) to cause any potential building damage to non-engineered timber and masonry buildings.

Table H: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 ft	
	PPV (in/sec)	L_V (VdB)[1]
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

[1] RMS VdB re 1 µin/sec.

µin/sec = micro-inches per second
ft = foot/feet
FTA = Federal Transit Administration
in/sec = inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity in decibels

The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project construction boundary (assuming the construction equipment would only be used at or near the project setback line). The formula for vibration transmission is provided below:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

The closest structures to the external construction activities are the garages associated with the residential uses to the north, which are within approximately 5 ft from the project's northern construction boundary. Using the reference data from Table H and the equation above, it is expected that vibration levels generated by dump trucks and other large equipment within 10 ft of the project boundary would generate ground-borne vibration levels of 0.352 PPV (in/sec) or higher at the closest structures to the project site. This vibration level would exceed the 0.2 in/sec PPV threshold considered safe for non-engineered timber and masonry buildings, which would result in a potentially significant impact. The distance from large construction equipment with a reference vibration level of 0.089 in/sec PPV at 25 ft for which the 0.2 in/sec threshold would no longer be exceeded is 15 ft. Vibration levels at all other buildings would be lower. Therefore, construction would not result in any vibration damage, and impacts would be less than significant with the incorporation of Mitigation Measure NOI-1, as detailed below.

Mitigation Measure NOI-1 **Construction Vibration Damage.** Due to the close proximity to surrounding structures, the City of Anaheim (City) Director of Community Development, or designee, shall verify, prior to issuance of demolition or grading permits, that the approved plans require that the construction contractor shall implement the following mitigation measures during project construction activities to ensure that damage does not occur at surrounding structures:

- Identify structures that are located within 15 feet (ft) of heavy construction activities and that have the potential to be affected by ground-borne vibration. This task shall be conducted by a qualified structural engineer as approved by the City's Director of Community Development, or designee.

- Once the construction equipment list finalized, a comparison of the proposed equipment to be used and the assumed equipment vibration levels presented in Table 7-4 of the Federal Transit Administration's *Noise and Vibration Impact Assessment Manual – FTA Report No. .0123* (FTA Manual) shall be completed. If it is determined that the proposed equipment would generate lower vibration levels than assumed, further vibration mitigation would not be necessary. However, if levels would potentially exceed the FTA Damage Criteria presented in Table 7-5 of the FTA Manual, the applicant shall develop a vibration monitoring and construction contingency plan for approval by the City Director of Community Development, or designee, to identify structures where monitoring would be conducted; set up a vibration monitoring schedule; define structure-specific vibration limits; and address the need to conduct photo, elevation, and crack surveys to document before-and-after construction conditions. Construction contingencies would be identified for when vibration levels approached the limits.

- If a vibration monitoring and construction contingency plan is deemed necessary, vibration monitoring during initial construction activities would be required. Monitoring results may indicate the need for more or less intensive measurements.
- When vibration levels approach limits, suspend construction and implement contingencies, as identified in the approved vibration monitoring and construction contingency plan, to either lower vibration levels or secure the affected structures.

Long-Term Off-Site Traffic Noise Impact Analysis

In order to assess the potential traffic impacts related to the proposed project, LSA estimates that the proposed project would result in a net increase of 44 ADT based on the proposed increase in square footage. Based on the ADTs provided by the City of Anaheim (*Daily Traffic Counts*[2]), the ADT along Katella Avenue in the project vicinity is approximately 34,100 based on projections for the year 2007. While the existing ADT is likely higher, using 34,100 ADT as the existing count would be a conservative approach. The following equation was used to determine the potential impacts of the project:

$$\text{Change in CNEL} = 10 \log_{10} [V_{e+p}/V_{existing}]$$

Where: $V_{existing}$ = the existing daily volume

V_{e+p} = existing daily volumes plus project

Change in CNEL = the increase in noise level due to the project

The results of the calculations show that an increase of less than 0.01 dBA CNEL is expected along Katella Avenue. A noise level increase of less than 3 dBA would not be perceptible to the human ear; therefore, the traffic noise increase along Katella Avenue resulting from the proposed project would be less than significant. No mitigation is required.

Long-Term Operational Noise Impact Analysis

Adjacent off-site land uses would be potentially exposed to stationary-source noise impacts from the proposed on-site heating, ventilation, and air conditioning (HVAC) equipment and truck deliveries and loading and unloading activities. The potential noise impacts to off-site sensitive land uses from the proposed operations are discussed below. To provide a conservative analysis, it is assumed that within any given hour, two heavy trucks would maneuver to park near the loading

2 City of Anaheim. 2007. *Daily Traffic Counts* – Average Daily Traffic Volume Table.

zone north of the proposed building. HVAC equipment is expected to run continuously for the duration of a 24-hour period. To determine the future noise impacts from project operations to the noise sensitive uses, a 3-D noise model, SoundPLAN, was used to incorporate the site topography as well as the shielding from the proposed building on site. A graphic representation of the operational noise impacts is presented in Attachment D.

Heating, Ventilation, and Air Conditioning Equipment

The project is estimated to have four rooftop HVAC units on the proposed storage building to provide ventilation. The HVAC equipment could operate 24 hours per day and would generate sound power levels (SPLs) of up to 87 dBA SPL or 72 dBA L_{eq} at 5 ft, based on manufacturer data (Trane).[3]

Truck Deliveries and Truck Loading and Unloading Activities

Noise levels generated by delivery trucks would be similar to noise readings from truck loading and unloading activities, which generate a noise level of 75 dBA L_{eq} at 20 ft based on measurements taken by LSA.[4] During this process, noise levels are associated with the truck engine noise, air brakes, and backup alarms. These noise levels would occur for a shorter period of time (less than 5 minutes). Maximum noise levels that occur during the truck movement process taken by LSA were measured to be 86 dBA L_{max} at a distance of 20 ft.

Trash Bin Emptying Activities

The project is estimated to have one trash dumpster south of the proposed building. The trash emptying activities would take place for a period less than 1 minute and would generate SPLs of up to 118.6 dBA SPL or 84 dBA L_{eq} at 50 ft, based on reference information within SoundPLAN. Trash bin emptying activities would only occur during daytime hours.

Table I, below, shows the combined hourly noise levels generated by HVAC equipment, truck delivery activities, and trash bin emptying activities at the closest off-site land uses. The project-related noise level impacts would range from 49.3 dBA L_{eq} to 50.8 dBA L_{eq} at the surrounding sensitive receptors. These levels would be well below the City's exterior noise standard of 60 dBA L_{eq}. Because project noise levels would not generate a noise level exceeding the City's thresholds by 3 dBA or more, the impact would be less than significant, and no noise reduction measures are required.

Long-Term Ground-Borne Noise and Vibration from Vehicular Traffic

The proposed project would not generate vibration levels related to on-site operations. In addition, vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Based on a reference vibration level of 0.076 in/sec PPV, structures more than 20 ft from the roadways that contain project trips would experience vibration levels below the most conservative standard of 0.12 in/sec PPV; therefore, vibration levels generated from project-related

3 Trane. n.d. Fan Performance - Product Specifications RT-PRC023AU-EN.

4 LSA. 2016. *Operational Noise Impact Analysis for Richmond Wholesale Meat Distribution Center.*

traffic on the adjacent roadways would be less than significant, and no mitigation measures are required.

Table I: Exterior Noise Level Impacts

Receptor	Direction	Existing Quietest Daytime Noise Level (dBA L_{eq})	Project-Generated Noise Levels (dBA L_{eq})	Potential Operational Noise Impact?[1]
Multifamily Residential	North	47.6	50.8	No
Single-family Residential	East	46.9	49.3	No

Source: Compiled by LSA (2023).

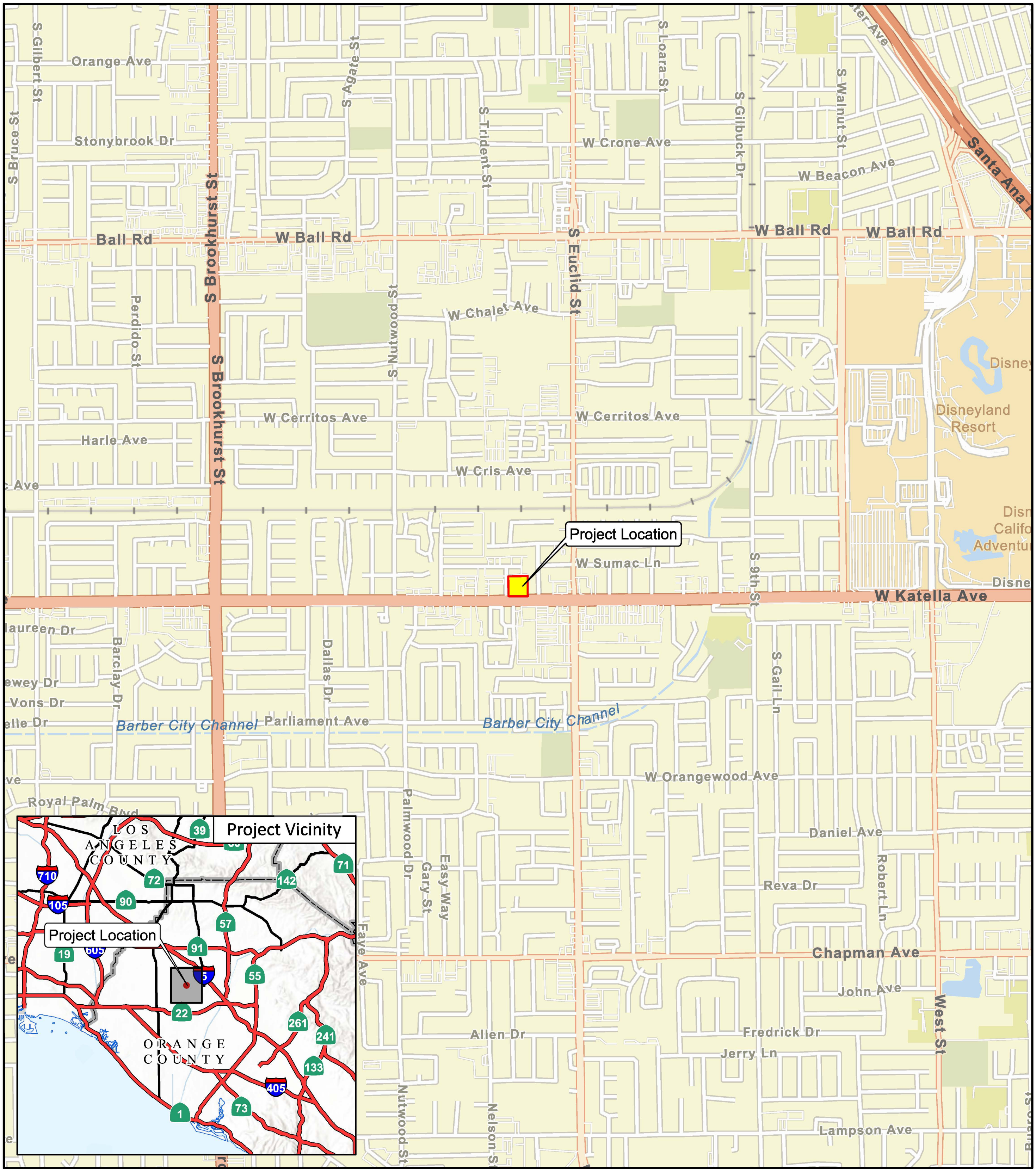
[1] A potential operational noise impact would occur if (1) the quietest daytime ambient hour is less than 60 dBA L_{eq} and project noise impacts are greater than 60 dBA L_{eq}, OR (2) the quietest daytime ambient hour is greater than 60 dBA L_{eq} and project noise impacts are 3 dBA greater than the quietest daytime ambient hour.

dBA = A-weighted decibels L_{eq} = equivalent noise level

Attachments:
A: Figures
B: Noise Measurement Data
C: Construction Noise Calculations
D: SoundPLAN Noise Model Printouts

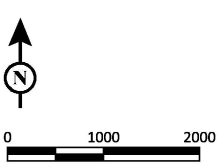
ATTACHMENT A

FIGURES



Project Site

FIGURE 1



Extra Space Storage 1761 West Katella Project

Project Location

SOURCE: Esri World Street Map (2023)

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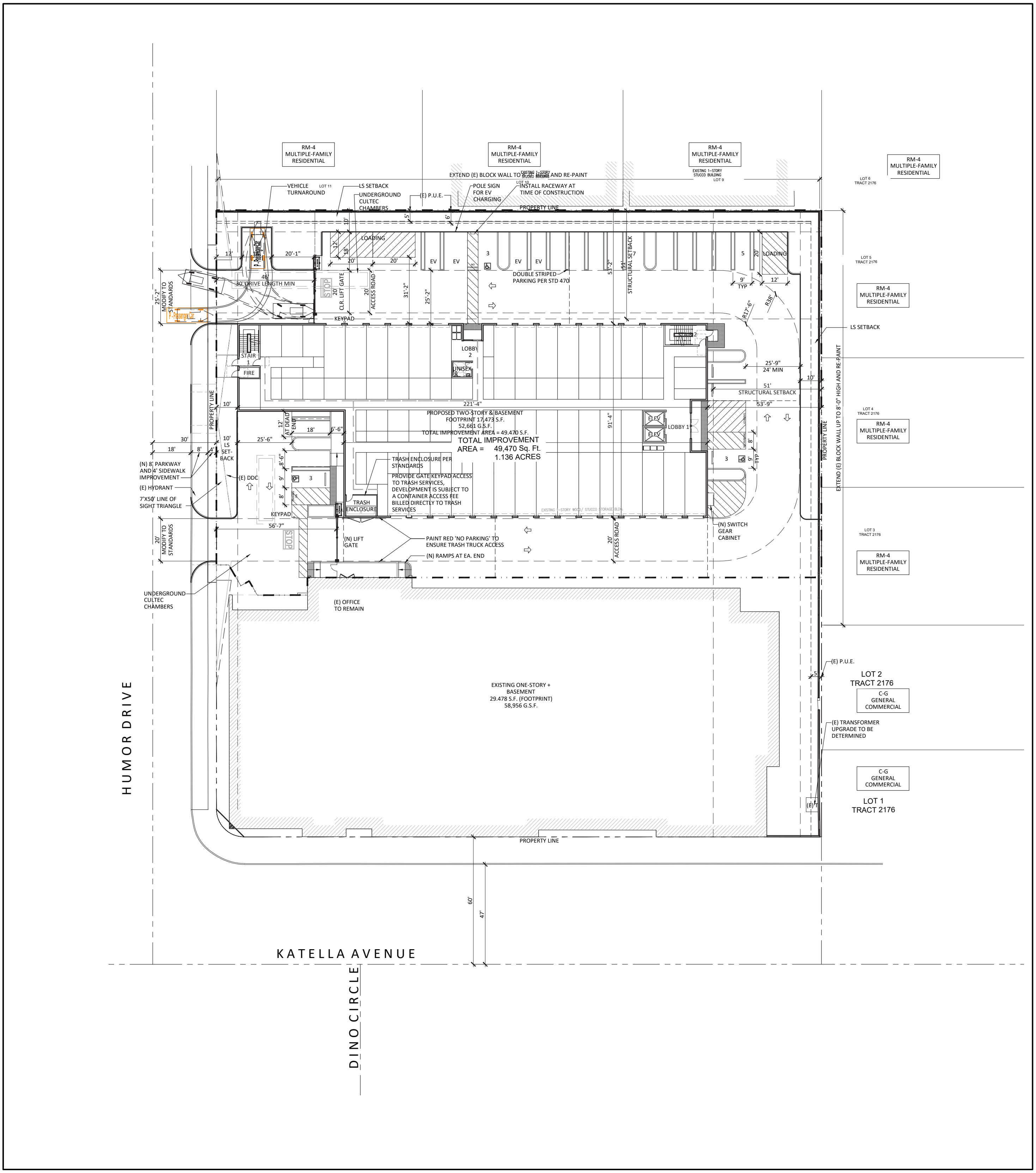

LSA

FIGURE 2

0 30 60
FEET

SOURCE: KSP Studios

Extra Space Storage 1761 West Katella Project

Conceptual SitePlan

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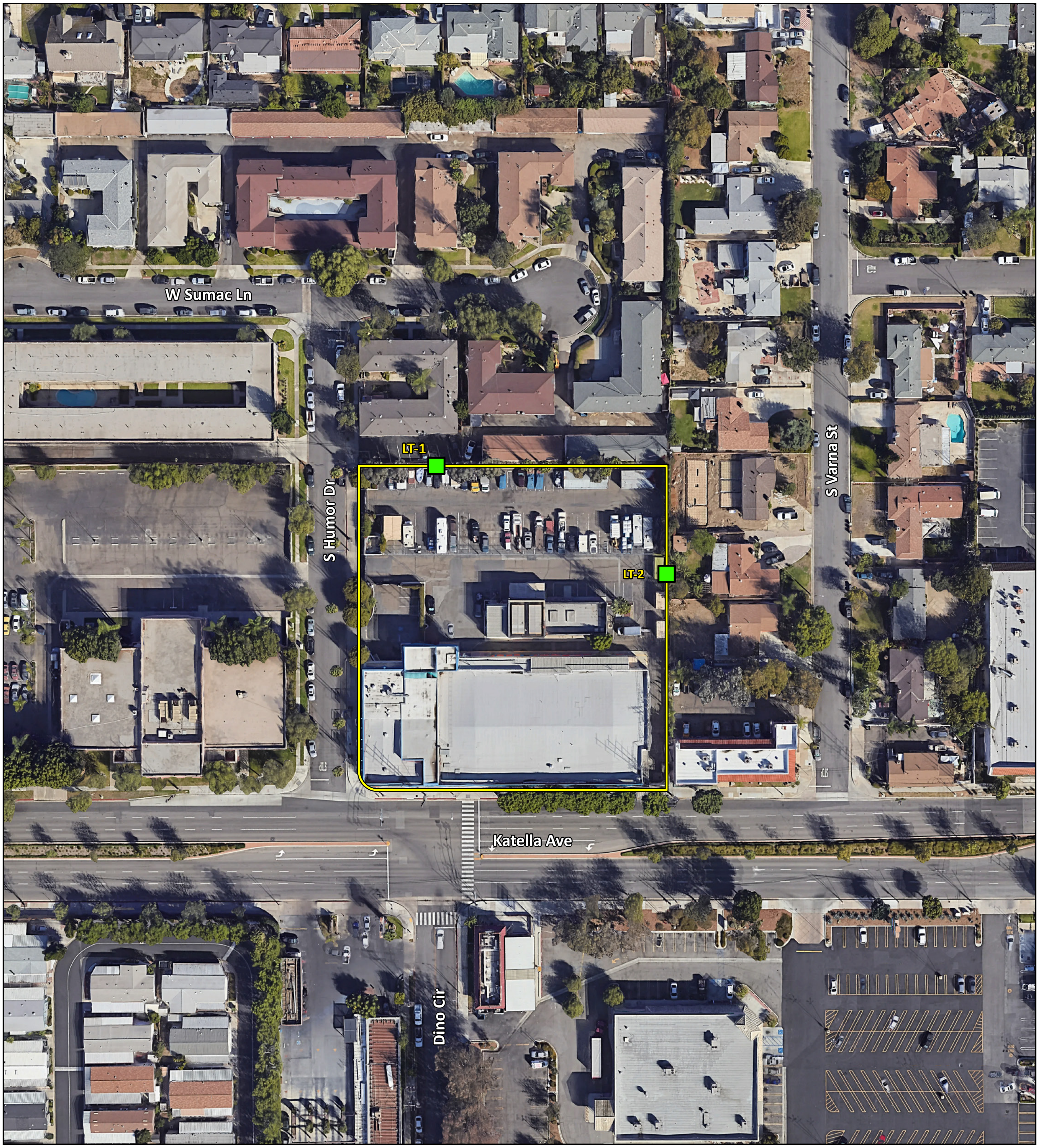

LSA

LEGEND

- Project Site Boundary

LT-1 - Long-term Noise Monitoring Location

FIGURE 3

N

0 62.5 125

FEET

SOURCE: Google Earth, 2023

Extra Space Storage 1761 West Katella Project

Noise Monitoring Locations

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ATTACHMENT B

NOISE MEASUREMENT DATA

ATTACHMENT B

NOISE MEASUREMENT DATA

Noise Measurement Survey – 24 HR

Project Number: 20220838
Test Personnel: Kevin Nguyendo
Project Name: Anaheim Extra Space
Equipment: Spark 706RC (SN:906)

Site Number: LT-1 Date: 7/18/23
Time: From 1:00 p.m. To 1:00 p.m.

Site Location: Located on a light pole along the northwestern corner of the Extra Space Storage facility at 1761 W Katella Ave, Anaheim, CA 92804.

Primary Noise Sources: Vehicle traffic noise on Humor Drive. Loading and unloading activity Noise from trucks and cars on the project site.

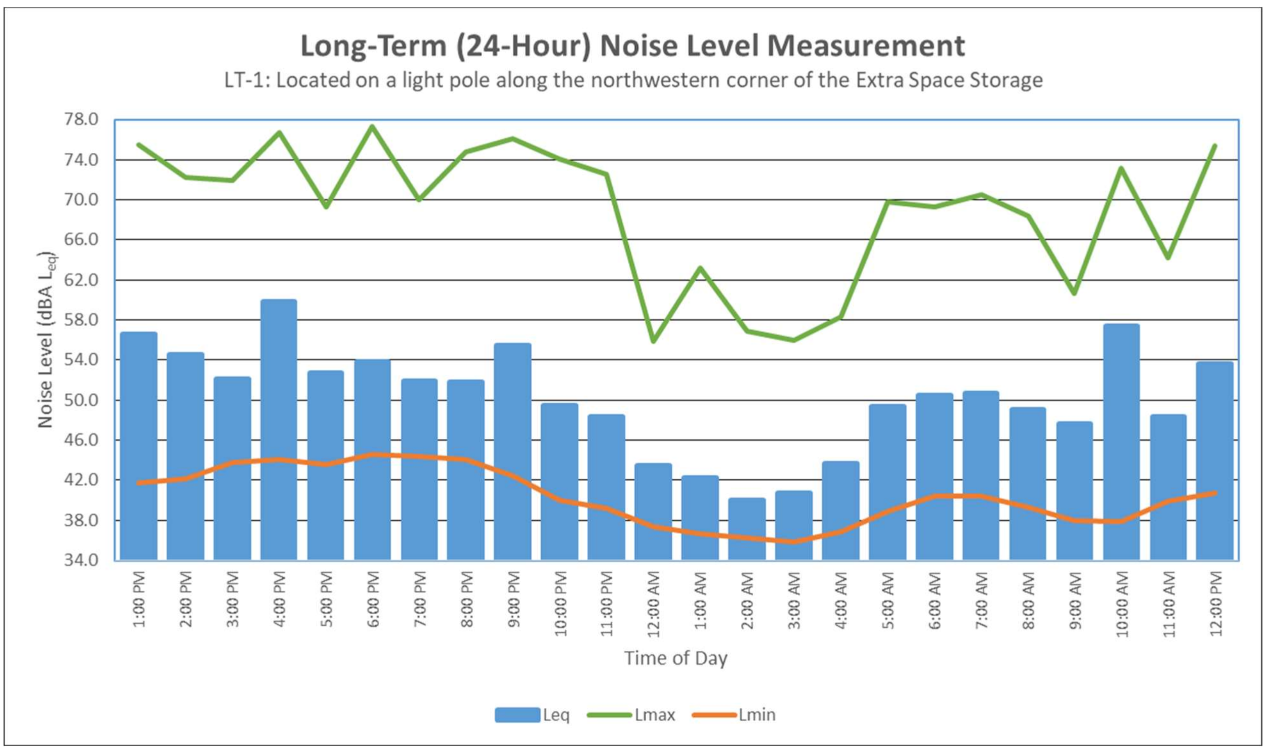
Comments:

Photo:

Long-Term (24-Hour) Noise Level Measurement Results at LT-1

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
1:00 PM	7/18/23	56.5	75.5	41.7
2:00 PM	7/18/23	54.5	72.2	42.1
3:00 PM	7/18/23	52.1	71.9	43.8
4:00 PM	7/18/23	59.8	76.7	44.1
5:00 PM	7/18/23	52.7	69.3	43.6
6:00 PM	7/18/23	53.8	77.3	44.6
7:00 PM	7/18/23	51.9	70.0	44.4
8:00 PM	7/18/23	51.8	74.8	44.1
9:00 PM	7/18/23	55.5	76.1	42.4
10:00 PM	7/18/23	49.4	74.1	40.0
11:00 PM	7/18/23	48.4	72.5	39.2
12:00 AM	7/19/23	43.5	55.9	37.4
1:00 AM	7/19/23	42.3	63.2	36.6
2:00 AM	7/19/23	40.0	56.9	36.2
3:00 AM	7/19/23	40.7	56.0	35.8
4:00 AM	7/19/23	43.6	58.3	36.8
5:00 AM	7/19/23	49.4	69.8	38.9
6:00 AM	7/19/23	50.5	69.3	40.4
7:00 AM	7/19/23	50.6	70.5	40.4
8:00 AM	7/19/23	49.0	68.4	39.3
9:00 AM	7/19/23	47.6	60.6	38.0
10:00 AM	7/19/23	57.3	73.2	37.9
11:00 AM	7/19/23	48.4	64.2	39.9
12:00 PM	7/19/23	53.7	75.4	40.7

Source: Compiled by LSA Associates, Inc. (2023).
dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: 20220838
Project Name: Anaheim Extra Space

Test Personnel: Kevin Nguyendo
Equipment: Spark 706RC (SN:224)

Site Number: LT-2 Date: 7/18/23

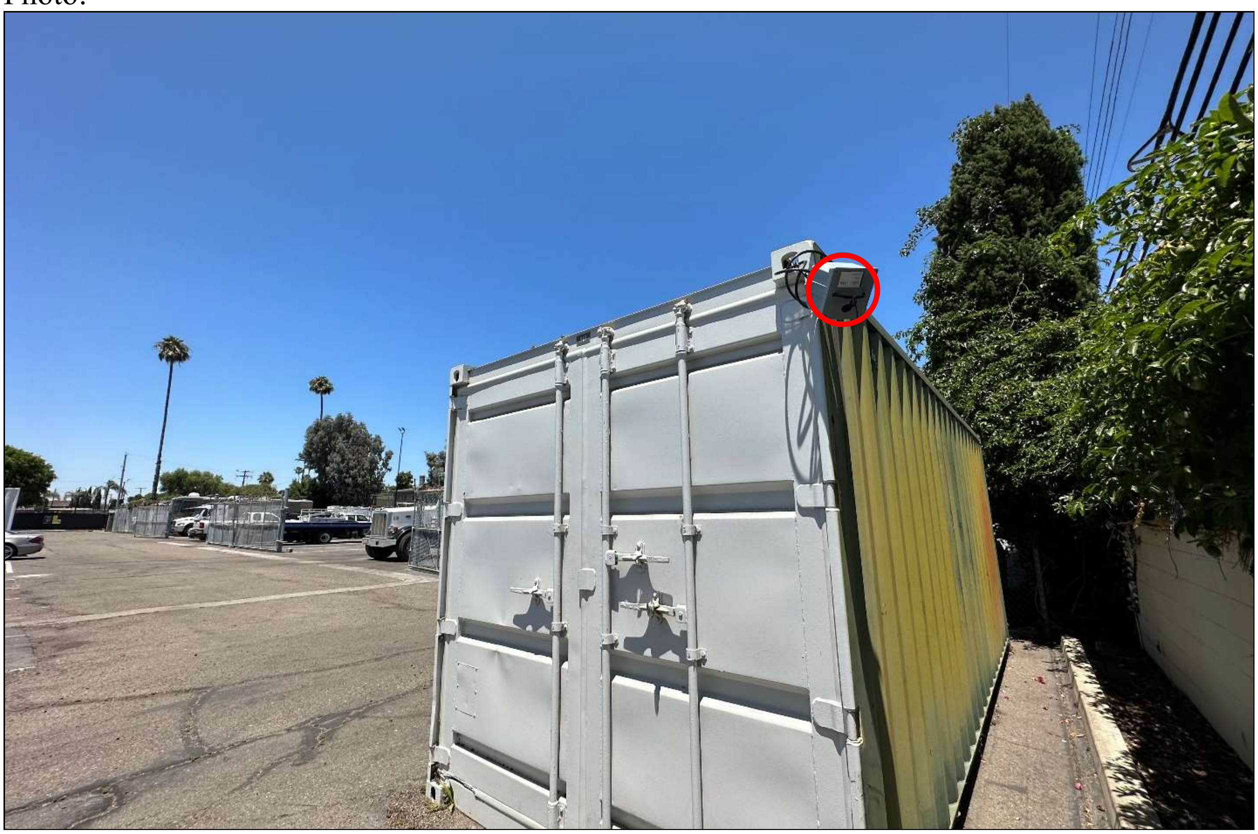
Time: From 1:00 p.m. To 1:00 p.m.

Site Location: Located on a container along the center of the Extra Space Storage's eastern border on 1761 W Katella Ave, Anaheim, CA 92804.

Primary Noise Sources: Faint vehicle traffic noise on Humor Dr and Katella Ave. Loading and unloading activity Noise from trucks and cars on the project site.

Comments:

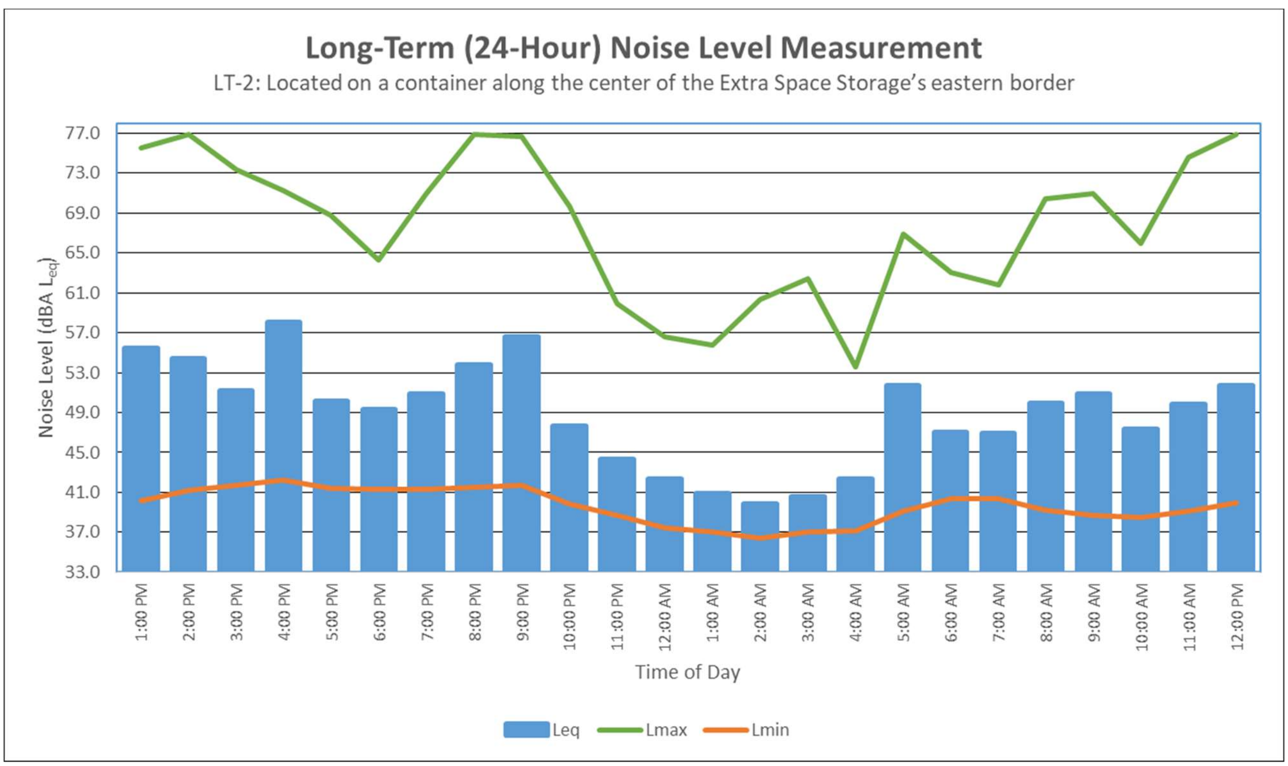
Photo:



Long-Term (24-Hour) Noise Level Measurement Results at LT-2

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
1:00 PM	7/18/23	55.5	75.5	40.2
2:00 PM	7/18/23	54.4	76.9	41.2
3:00 PM	7/18/23	51.2	73.3	41.7
4:00 PM	7/18/23	58.0	71.3	42.2
5:00 PM	7/18/23	50.1	68.8	41.4
6:00 PM	7/18/23	49.3	64.3	41.3
7:00 PM	7/18/23	50.9	71.0	41.3
8:00 PM	7/18/23	53.8	76.9	41.5
9:00 PM	7/18/23	56.6	76.7	41.7
10:00 PM	7/18/23	47.7	69.7	39.8
11:00 PM	7/18/23	44.4	59.9	38.7
12:00 AM	7/19/23	42.4	56.6	37.5
1:00 AM	7/19/23	40.9	55.8	37.0
2:00 AM	7/19/23	39.9	60.3	36.4
3:00 AM	7/19/23	40.6	62.4	37.0
4:00 AM	7/19/23	42.4	53.6	37.1
5:00 AM	7/19/23	51.7	66.9	39.1
6:00 AM	7/19/23	47.1	63.0	40.4
7:00 AM	7/19/23	46.9	61.8	40.4
8:00 AM	7/19/23	50.0	70.4	39.2
9:00 AM	7/19/23	50.9	71.0	38.7
10:00 AM	7/19/23	47.3	66.0	38.5
11:00 AM	7/19/23	49.8	74.6	39.1
12:00 PM	7/19/23	51.7	76.9	39.9

Source: Compiled by LSA Associates, Inc. (2023).
dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum measured sound level



ATTACHMENT C

CONSTRUCTION NOISE CALCULATIONS

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Concrete Saw	1	90	20	50	0.5	90	83
Dozer	1	82	40	50	0.5	82	78
Tractor	1	84	40	50	0.5	84	80
					Combined at 50 feet	**91**	**86**
					Combined at Receptor 110 feet	**85**	**79**

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	1	84	40	50	0.5	84	80
					Combined at 50 feet	**89**	**85**
					Combined at Receptor 110 feet	**82**	**78**

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	1	84	40	50	0.5	84	80
					Combined at 50 feet	**89**	**85**
					Combined at Receptor 110 feet	**82**	**78**

Phase:Building Construstion

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	1	75	20	50	0.5	75	68
Generator	1	81	50	50	0.5	81	78
Tractor	1	84	40	50	0.5	84	80
Welder / Torch	1	74	40	50	0.5	74	70
					Combined at 50 feet	**87**	**83**
					Combined at Receptor 110 feet	**81**	**76**

Phase:Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Drum Mixer	1	80	50	50	0.5	80	77
Paver	1	77	50	50	0.5	77	74
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Tractor	1	84	40	50	0.5	84	80
Roller	1	80	20	50	0.5	80	73
					Combined at 50 feet	**89**	**85**
					Combined at Receptor 110 feet	**82**	**79**

Phase:Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Compressor (air)	1	78	40	50	0.5	78	74
					Combined at 50 feet	**78**	**74**
					Combined at Receptor 110 feet	**71**	**67**

Sources: RCNM

[1]- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

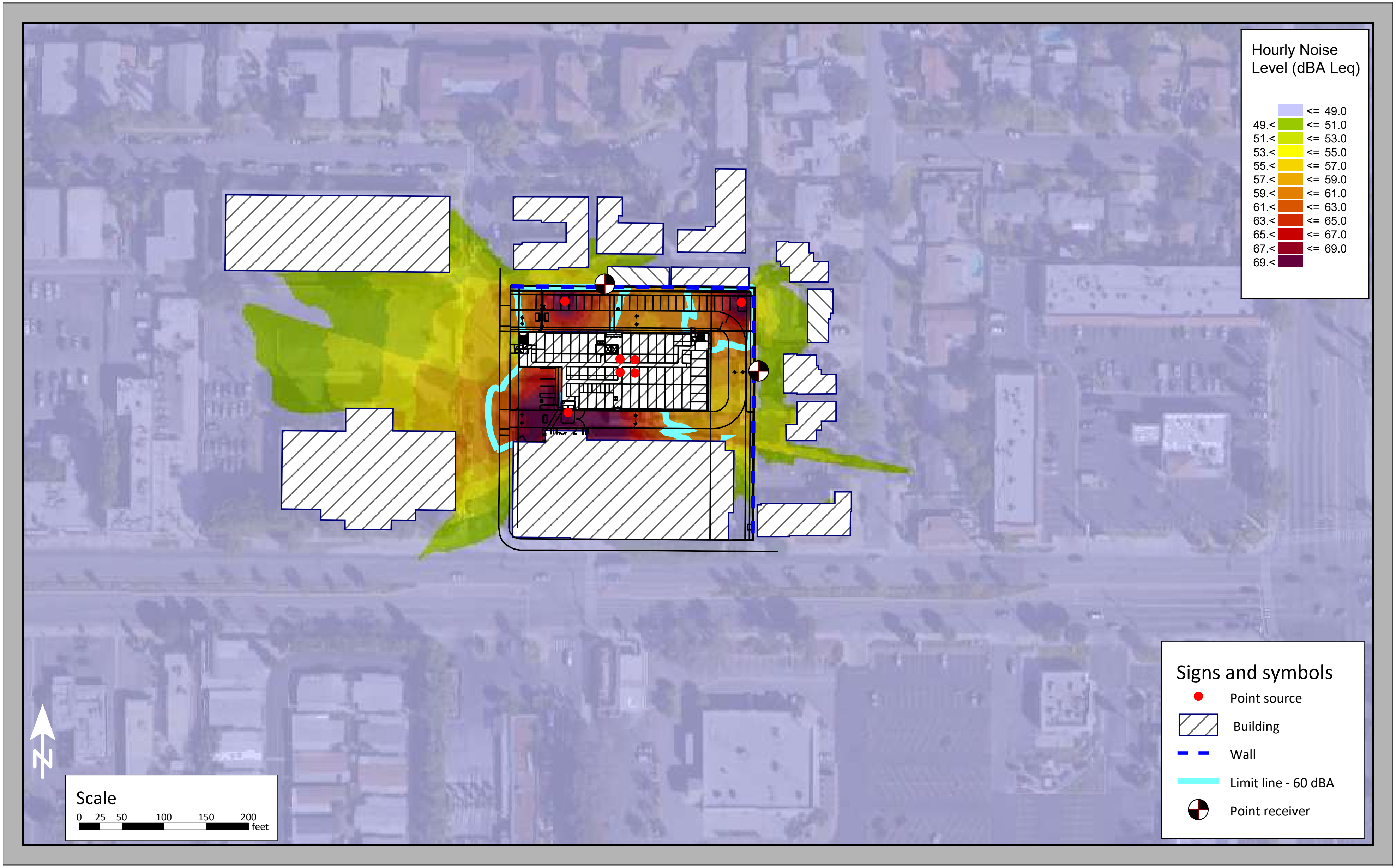
ATTACHMENT D

SOUNDPLAN NOISE MODEL PRINTOUT

Anaheim Extra Space

Project No. 20220838

Project Operational Noise Levels



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ATTACHMENT C

CONSTRUCTION NOISE CALCULATIONS

ATTACHMENT D

SOUNDPLAN NOISE MODEL PRINTOUT