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MEMORANDUM

DATE: November 18, 2021

TO: John Powers, PMP, Project Manager III, North Region Landfills
Aimee Halligan, Senior Environmental Resources Specialist
Orange County Waste & Recycling

FROM: Nicole Dubois, Principal
J.T. Stephens, Associate/Senior Noise Specialist

SUBJECT: Noise and Vibration Impact Analysis for the Valencia Greenery Project

This memorandum has been prepared to evaluate potential noise and vibration impacts associated with the proposed Valencia Greenery Project (project) at the Olinda Alpha Landfill in Orange County, California. While the proposed project is located within unincorporated Orange County, the off-site sensitive receptors are located within the City of Brea (City). This report is intended to satisfy the County of Orange (County) requirement for a project-specific noise and vibration impact analysis by examining the impacts of the proposed project and identifying any necessary noise reduction measures to reduce project noise impacts.

PROJECT DESCRIPTION

Orange County Waste & Recycling (OCWR) is proposing a green waste composting operation at the Olinda Alpha Landfill (Landfill). The implementation of the proposed project would allow OCWR to compost a maximum of 230 tons per day (TPD) of processed green material (PGM) at the Landfill, thereby assisting the State, Orange County cities and unincorporated County areas in meeting Senate Bill (SB) 1383 and Assembly Bill (AB) 1594 requirements for organic waste recycling. The proposed Project would be developed on an approximately 9-acre (ac) pad located at the northeastern portion of the Landfill in an area that is not currently being used for active landfilling. A crushed asphalt base would be placed over the entire area that would be used for PGM storage and for composting operations. The proposed Project also includes a dirt perimeter road for access, installation and operation of solar panels, and a lined 8.9 acre foot storm water basin; the appurtenant Project features would be located on approximately 6 acres.

The proposed project would be developed in two phases. Phase 1 would include the construction of the civil components of the facility, including the construction of a composting deck, a lined stormwater pond, a fire water supply system, and expansion of the existing operation's water tanks to provide water for the composting operation. During Phase 1, open windrow composting would be utilized. Open windrow composting involves placing green waste in long rows called windrows. The windrows are turned (using a compost windrow turner or front-end loader) to improve porosity and oxygen content, mix in or remove moisture, and redistribute cooler and hotter portions of the pile.

Phase 1 is a temporary condition and anticipated to last for the first 5 to 6 months of project operation. Phase 2 of construction would include installation and construction of equipment, piping, and solar panels that constitute the Covered Aerated Static Pile (CASP) composting system. The CASP system consists of an automated system that blows air into the compost, which is covered with a synthetic semipermeable (i.e., breathable fabric) cover. According to the California Department of Resources Recycling and Recovery (CalRecycle), covering compost piles with breathable fabrics can help reduce water needs during hot, dry weather and may help avoid soggy, anaerobic piles during periods of heavy rain. Forced aeration helps avoid anaerobic conditions within covered or static piles, since normal convective air flow may be restricted by either the cover itself or the size of the pile. Covered or aerated compost systems may also help composters reduce odors as well as regulate air emissions. Figure 2 shows the site plan.

In addition to the on-site site operations, project trips would be generated for temporary construction activities and typical operations. Based on information from the applicant, construction and operation of the project will include the following two phases (with phase durations and daily truck and worker estimates):

- **Phase 1 Construction** (9.5 weeks): up to 18 workers per day
- **Phase 1 Operations** (6 months): 5 workers and 4 delivery trucks per day
- **Phase 2 Construction** (13.5 weeks): up to 18 workers per day
- **Overlap of Phase 1 Operations and Phase 2 Construction** (9.5 weeks): up to 23 workers and 4 delivery trucks per day
- **Phase 2 Operations** (ongoing): 5 workers and 12 delivery trucks per day

The overlap of Phase 1 Operations and Phase 2 Construction represents the highest trip generation of the project. Although the overlap of Phase 1 Operations and Phase 2 Construction is anticipated to last for 13.5 weeks, the peak trip-generating period during this overlap is 3.5 weeks. During this 3.5-week period, the overlap of Phase 1 Operations and Phase 2 is forecast to generate 62 average daily trips (ADT).

Existing Sensitive Land Uses in the Project Area

The project site is surrounded primarily by the existing Landfill, vacant land, and residential uses. It should be noted that there are no sensitive receptors within 1 mile or 5,280 feet (ft) of the project site. The surrounding uses include the following:

- **North:** Undeveloped land.

- **South:** Olinda Landfill and undeveloped land. Residences within the Olinda Ranch Community and Olinda Village Community are located further south, at a distance of approximately 6,000 to 8,000 feet from the project site.

- **West:** Olinda Landfill and undeveloped land.

- **East:** Undeveloped land.

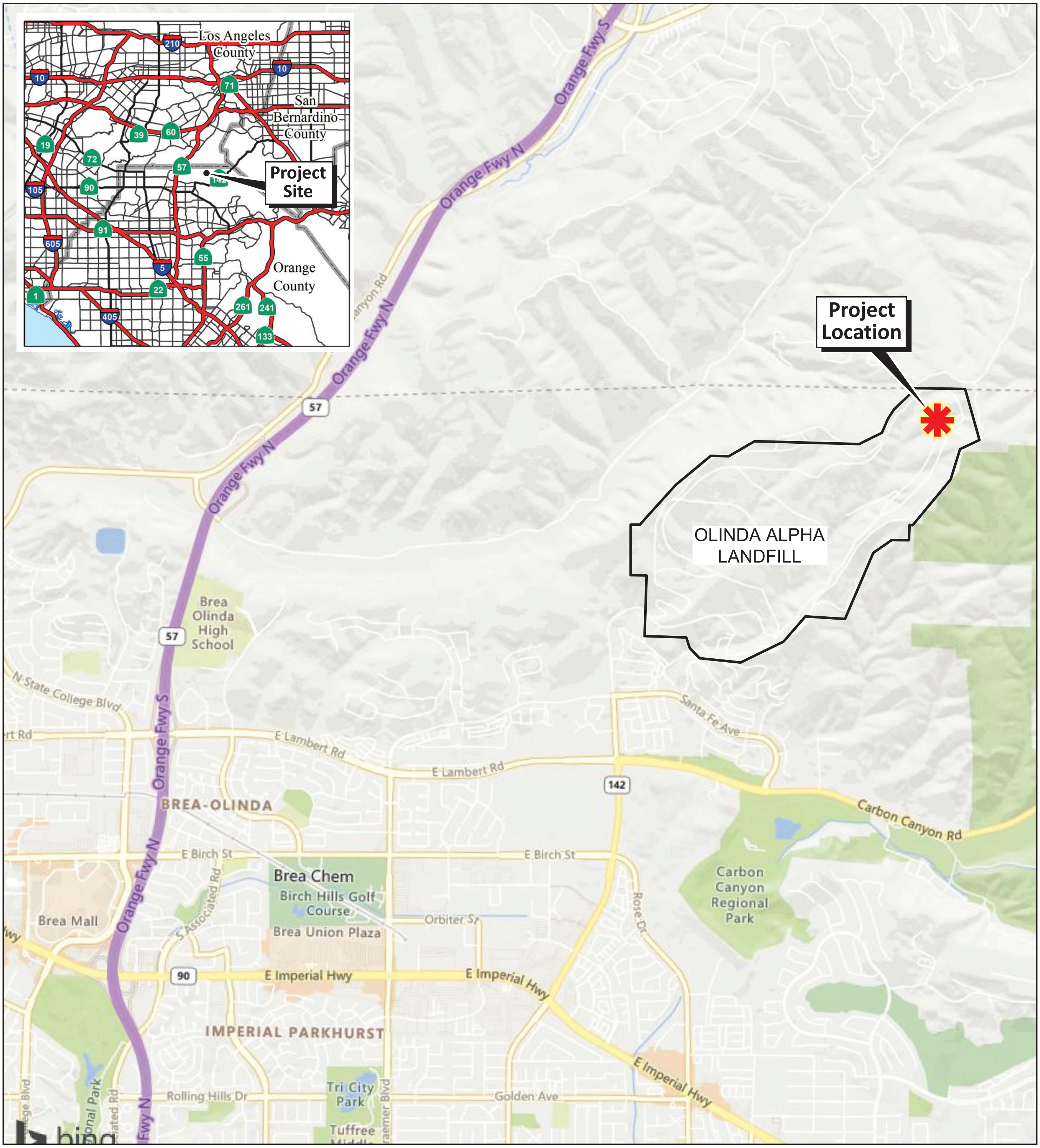

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FIGURE 1

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SOURCE: Bing Maps

Valencia Greenery Project

Project Location

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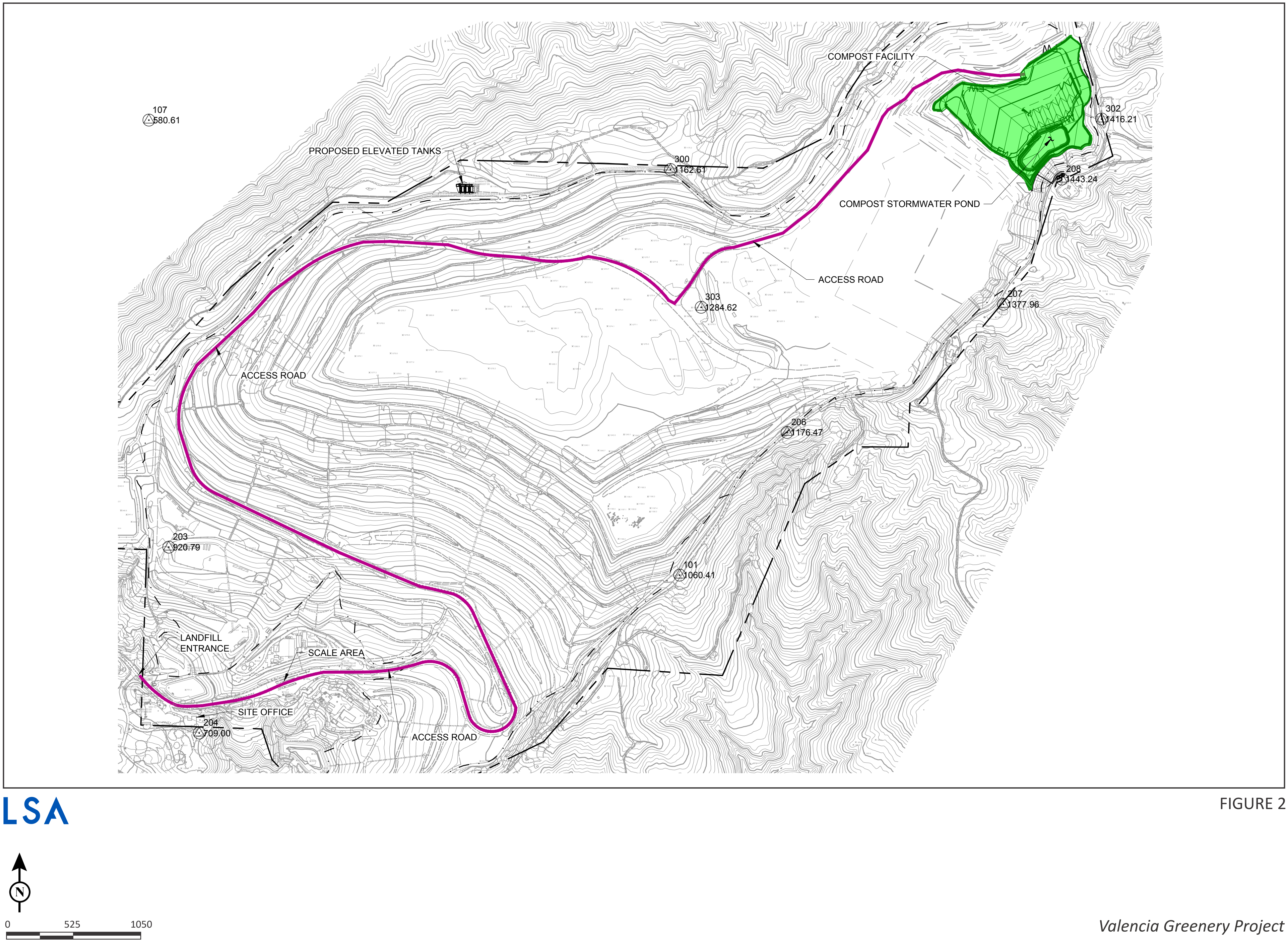

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FIGURE 2

SOURCE: Tetra Tech

Valencia Greenery Project

Site Plan

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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 sound wave, which results in the tone's range from high to low. Loudness is the strength of a sound, and it describes a noisy or quiet environment; it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound wave combined with the reception characteristics of the human ear. Sound intensity refers to the power carried by sound waves per unit area in a direction perpendicular to that area. 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 pressure level and its effect on adjacent sensitive land uses.

Measurement of Sound

Sound pressure level is measured with the A-weighted decibel 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. Decibels, unlike linear units (e.g., inches or pounds), 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) represents 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 sound's loudness. 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 levels dissipate exponentially with distance from their noise sources. 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. Line source sound levels decrease 4.5 dB for each doubling of distance in a relatively flat environment with absorptive vegetation.

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 noise occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise 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 relaxation and sleeping 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. It 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. 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 includes audible impacts that refer 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 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes 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 sound levels higher than 85 dBA. Exposure to high sound levels affects the entire system, with prolonged sound 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 sound exposure above 90 dBA would result in permanent cell damage. When the sound level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of sound is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by a feeling of pain in the ear (i.e., the threshold of pain). A sound level of 160–165 dBA will result in dizziness or a 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 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 sound level that denotes the ratio between two quantities that are 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., the number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high-frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. (All sound levels in this report are A-weighted unless reported otherwise.)
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period, respectively.
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 dBA to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dBA 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 dBA 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. It is usually a composite of sound from many sources from 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 1991)

Table B: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	—
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	—
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	—
Near Freeway Auto Traffic	70	Moderately Loud	Reference level
Average Office	60	Quiet	One-half as loud
Suburban Street	55	Quiet	—
Light Traffic; Soft Radio Music in Apartment	50	Quiet	One-quarter as loud
Large Transformer	45	Quiet	—
Average Residence without Stereo Playing	40	Faint	One-eighth as loud
Soft Whisper	30	Faint	—
Rustling Leaves	20	Very Faint	—
Human Breathing	10	Very Faint	Threshold of Hearing
—	0	Very Faint	—

Source: Compiled by LSA (2016).

FUNDAMENTALS 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 be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. 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 sitting 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. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

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) from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (Federal Transit Authority [FTA] 2018). 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, both construction of the project and the freight train operations could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than ground-borne noise.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration 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). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where "L_v" is the vibration velocity in decibels (VdB), "V" is the RMS velocity amplitude, and "V_{ref}" is the reference velocity amplitude, or 1×10^{-6} inches/second (in/sec) used in the United States. Table C illustrates human response to various vibration levels, as described in the Transit Noise and Vibration Impact Assessment Manual (FTA 2018).

Table C: Human Response to Different Levels of Ground-Borne Noise and Vibration

Vibration Velocity Level	Noise Level		Human Response
	Low Frequency[1]	Mid Frequency[2]	
65 VdB	25 dBA	40 dBA	Approximate threshold of perception for many humans. Low-frequency sound is usually inaudible; mid-frequency sound is excessive for quiet sleeping areas.
75 VdB	35 dBA	50 dBA	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level unacceptable. Low-frequency noise is acceptable for sleeping areas; mid-frequency noise is annoying in most quiet occupied areas.
85 VdB	45 dBA	60 dBA	Vibration is acceptable only if there are an infrequent number of events per day. Low-frequency noise is unacceptable for sleeping areas; mid-frequency noise is unacceptable even for infrequent events with institutional land uses, such as schools and churches.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018)
[1] Approximate noise level when vibration spectrum peak is near 30 Hz.
[2] Approximate noise level when vibration spectrum peak is near 60 Hz.
dBA = A-weighted decibels
FTA = Federal Transit Administration
Hz = Hertz VdB = vibration velocity decibels

REGULATORY SETTING

Federal Regulations

Federal Transit Administration

The County of Orange and the City of Brea do not have specific limits or thresholds for vibration. Vibration standards included in the *FTA Manual* are used in this analysis for ground-borne vibration impacts on human annoyance, as shown in Table D.

Table D: Vibration Annoyance Criteria

Land Use	Maximum L_v (VdB)[1]	Description of Use
Workshop	90	Distinctly feelable vibration. Appropriate for workshops and nonsensitive areas.
Office	84	Feelable vibration. Appropriate for offices and nonsensitive areas.
Residential Day	78	Feelable vibration. Appropriate for computer equipment and low-power optical microscopes (up to 20X).
Residential Night and Operating Rooms	72	Vibration not feelable, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power microscopes (100X) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018)
[1] As measured in 1/3-octave bands of frequency over the frequency range 8 to 80 Hz.
Hz = hertz
L_V = velocity in decibels
VdB = vibration velocity decibels

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table E lists the potential vibration building damage criteria, as suggested in the *FTA Manual*. FTA guidelines show that a vibration level of up to 0.5 in/sec in PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster) and would not result in any vibration damage. For a nonengineered timber and masonry building, the building vibration damage criterion is 0.2 in/sec in PPV.

Table E: 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
Nonengineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

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

County Regulations

While the proposed project is located within the limits of Orange County, the surrounding sensitive receptors are located within the City of Brea. Noise regulations for Orange County are described below.

County of Orange Noise Element of the General Plan

The County's Standard Conditions of Approval within the County of Orange Noise Element of the General Plan (County of Orange 2002) require that all heavy vehicles or equipment, fixed or mobile, operated within 1,000 ft of a dwelling shall be equipped with properly operating and maintained mufflers. All operations shall comply with Orange County Noise Ordinance Division 6 (Noise Control) County of Orange 2016). Stockpiling and/or vehicle staging areas shall be located as far as practicable from dwellings.

County of Orange Noise Ordinance

Sections 4-6-5 and 4-6-6 of the County's Noise Ordinance (County of Orange 2020) are designed to control unnecessary, excessive, and annoying sound from sources on private property by specifying noise levels that cannot be exceeded. Table F defines the exterior and interior noise level limits for noise from one property to adjacent residential land uses.

In addition, Section 4-6-7 of the County's Noise Ordinance (County of Orange 2020) addresses construction noise and states that construction activity noise is exempt from the County's noise standards if conducted between the hours of 7:00 a.m. and 8:00 p.m. Monday through Saturday. Construction noise is prohibited on Sundays and national holidays. Should construction occur outside the exempt hours, the standards presented in Table F would be applicable.

Table F: County of Orange—Nontransportation Noise Standards

Land Use	Location	Time Period	L_{50} (30 minutes)[1]	L_{25} (15 minutes)[2]	L_{8} (5 minutes)[3]	L_{2} (1 minute)[4]	L_{max} (Anytime)[5]
Residential	Exterior	7:00 AM to 7:00 PM	55	60	65	70	75
		10:00 PM to 7:00 AM	50	55	60	65	70
	Interior	7:00 AM to 7:00 PM	—	—	55	60	65
		10:00 PM to 7:00 AM	—	—	45	50	55

Source: General Plan—Noise Ordinance (County of Orange 2020).
Note: Each of the noise levels set forth in this table shall be reduced by 5 dBA for impacts of simple tone noises or noises consisting of speech or music.
[1] The noise standard for a cumulative period of more than 30 minutes in any hour
[2] The noise standard plus 5 dBA for a cumulative period of more than 15 minutes in any hour
[3] The noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour
[4] The noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour
[5] The noise standard plus 20 dBA or the maximum measured ambient noise level for any period of time
dBA = A-weighted decibels
L_{max} = maximum instantaneous noise level

City Regulations

While the proposed project is located within the limits of Orange County and the County is the Lead Agency for the purposes of the California Environmental Quality Act (CEQA), the surrounding sensitive receptors are located within the City of Brea. Noise regulations for the City are presented below.

City of Brea Municipal Code.

Sections 8.20.050 and 8.20.060 of the City's Municipal Code, Exterior and Interior Noise Standards (City of Brea 2020), addresses the creation or permitting the creation of any noise that exceeds the standards shown in Table G within a residential district.

Table G: City of Brea Noise Standards

Land Use	Location	Time Period	L_{50} (30 minutes)[1]	L_{25} (15 minutes)[2]	L_{8} (5 minutes)[3]	L_{2} (1 minute)[4]	L_{max} (Anytime)[5]
Residential	Exterior	7:00 AM to 10:00 PM	55	60	65	70	75
		10:00 PM to 7:00 AM	50	55	60	65	70
	Interior	7:00 AM to 10:00 PM	—	—	55	60	65
		10:00 PM to 7:00 AM	—	—	45	50	55

Source: Municipal Code (City of Brea 2020).
Note: Each of the noise levels set forth in this table shall be reduced by 5 dBA for impacts of simple tone noises or noises consisting of speech or music.
[1] The noise standard for a cumulative period of more than 30 minutes in any hour
[2] The noise standard plus 5 dBA for a cumulative period of more than 15 minutes in any hour
[3] The noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour
[4] The noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour
[5] The noise standard plus 20 dBA or the maximum measured ambient noise level for any period of time
dBA = A-weighted decibels
L_{max} = maximum instantaneous noise level

EXISTING SETTING

Overview of the Existing Noise Environment

The primary existing noise sources in the project area are wind, birds, occasional distant heavy equipment movement and back-up beeps, and occasional aircraft flyovers. Traffic noise is not audible at the project site.

Existing Sensitive Land Uses in the Project Vicinity

The project site is surrounded by the current landfill and open space. The closest residences are located within the Olinda Ranch Community and Olinda Village Community, which range from approximately 6,000 to 8,000 feet from the project site.

Ambient Noise Measurements

To assess the existing noise conditions, noise measurements were gathered in the vicinity of the proposed project site. The locations of those noise measurements are shown on Figure 3. Three long-term, 24-hour measurements (LT-1 through LT-3) and two 20-minute short-term measurements (ST-1 and ST-2) were taken from April 21 to April 22, 2021. Table H shows the results of the noise measurements. The existing hourly noise levels range from 34.1 dBA L_{eq} to 52.3 dBA L_{eq}, and the maximum noise levels range from 38.4 dBA L_{max} to 70.1 dBA L_{max} at the surrounding off-site sensitive receptors (all locations other than LT-1). Noise measurement survey sheets are presented in Attachment A.

Table H: Existing Noise Level Measurements

Location	Description	Range of Daytime Noise Levels (dBA L_{eq})	Range of Evening Noise Levels (dBA L_{eq})	Range of Nighttime Noise Levels (dBA L_{eq})	Existing Maximum Noise Levels (dBA L_{max})
LT-1	Eastern edge of Olinda Alpha Landfill, on utility pole near the highest tower.	59.7-67.4	56.9-60.2	42.2-59.9	52.5 – 80.0
LT-2	Corner of Sandpiper Way and Lark Lane, on light pole.	45.8-52.2	42.1-45.0	39.1-48.0	43.2 - 70.0
LT-3	Near the north end of Lilac Lane, on utility pole.	42.8-52.0	38.7-41.8	34.1-49.7	39.3 - 69.5
ST-1[1]	West end of Trolley Court, on sidewalk.	45.9-52.3	42.2-45.1	39.1-48.1	43.3 - 70.1
ST-2[1]	On curve of E. Hillside Road and N. Brea Hills Avenue, on the sidewalk.	41.4-47.4	40.1-40.9	39.1-43.6	38.4 – 65.2

Source: Compiled by LSA Associates, Inc. (April 21-22, 2021).

[1] Hourly and maximum noise levels are estimated based on the noise contour for LT-2, which is a location with a similar noise environment.

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

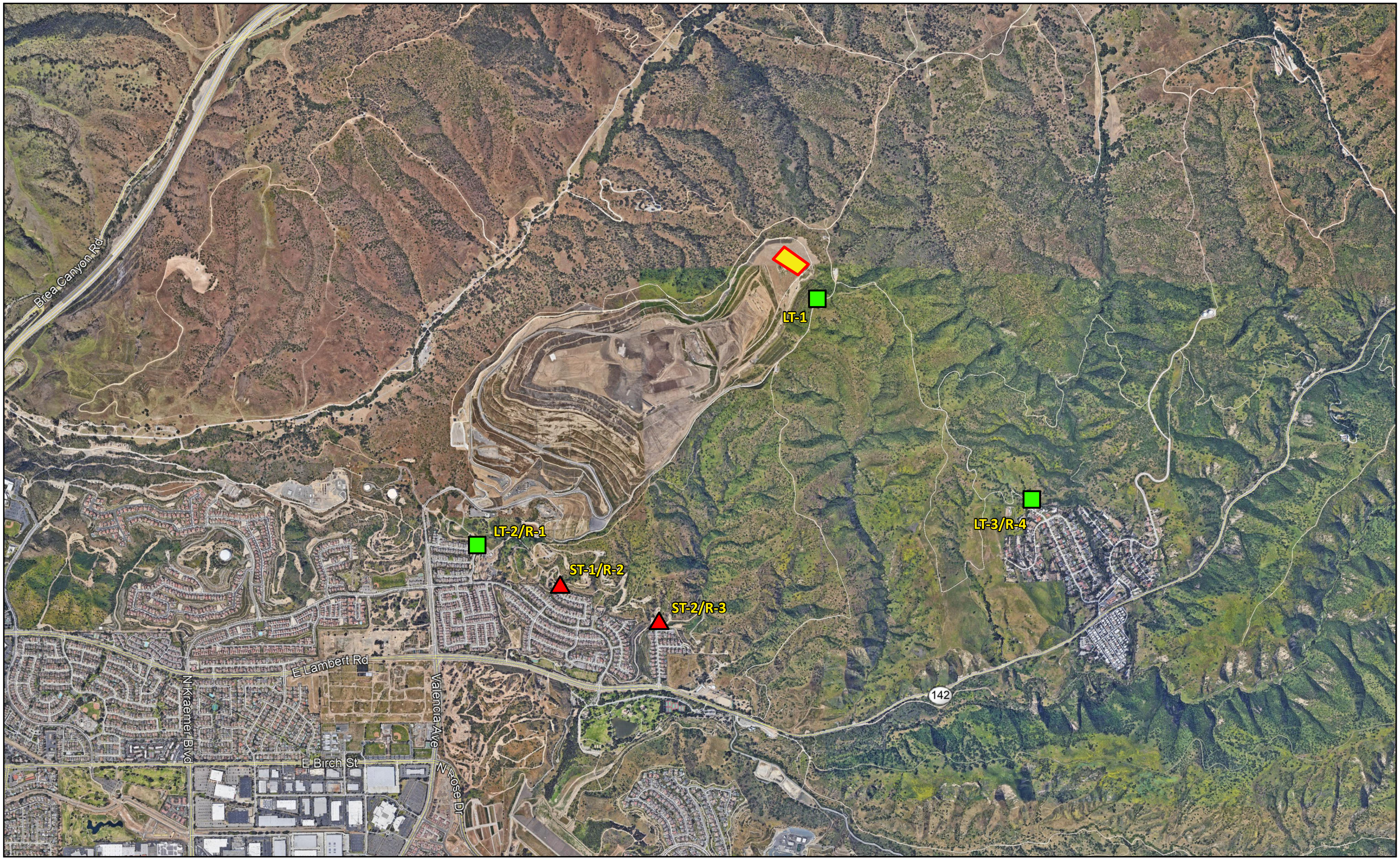

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FIGURE 3

LEGEND

- Project Site Boundary
ST-1 - Short-Term Noise Monitoring Location
LT-1 - Long-Term Noise Monitoring Location
R-1 - Receptor Location

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SOURCE: Google Earth, 2021

Valencia Greenery

Noise Monitoring and Receptor Locations

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METHODOLOGY

The Noise Element of the County's General Plan (County of Orange 2012) and the Noise Ordinance within the County Code (County of Orange 2020) provide criteria for assessing potential noise impacts. Additionally, the Noise Ordinance within the City's Municipal Code (City of Brea 2020) provides criteria for assessing operational impacts to sensitive receptors. Where appropriate, if the Lead Agency does not provide criteria to analyze a potential impact (i.e., vibration damage), guidance from the federal level is often used. Therefore, for the purposes of this analysis, the FTA criteria will be utilized to evaluate potential vibration impacts. The evaluation of noise and vibration impacts associated with the proposed project includes the following:

- Determination of the noise levels from on-site stationary sources associated with the proposed project using reference noise data at off-site noise-sensitive uses, and comparison of these levels to the County's and City's pertinent noise standards

- Determination of the vibration levels at off-site noise-sensitive uses and comparison to the vibration building damage and/or human annoyance criteria recommended by the FTA

- Determination of the potential mitigation measures to reduce operational noise and vibration impacts to all off-site noise-sensitive land uses

THRESHOLDS OF SIGNIFICANCE

A project would normally have a significant effect on the environment related to noise and vibration if the answer to any of the following questions is yes:

a. Would the project 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?

b. Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels?

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 mi 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 not located within the vicinity of a private airstrip. The project site is approximately 10 mi northeast of Fullerton Municipal Airport and does not fall within the Fullerton Municipal Airport Planning Area. Due to the distance of the airport from the project site, there would be no noise-related impacts due to airport activities following project implementation, and no mitigation would be required. This topic will not be analyzed further.

The following criteria were used to respond to the questions above to determine whether the proposed project would result in a significant noise impact:

- For off-site transportation-related impacts:

- Where the existing ambient noise level is less than 65 dBA and a project-related permanent increase in ambient noise levels of 5 dBA CNEL or greater occurs, or
- Where the existing ambient noise level is greater than 65 dBA and a project-related permanent increase in ambient noise levels of 3 dBA CNEL or greater occurs.

- For off-site non-transportation-related stationary source impacts, including operations:
  - If project operations would generate noise levels in excess of the maximum allowable noise levels for the surrounding receptors.
- For off-site vibration impacts:
  - Exceedance of the FTA standards of 0.2 PPV in/sec and 72 VdB as listed above in Tables D and E for vibration.

IMPACTS

Short-Term Construction Noise Impacts

Two types of short-term noise impacts would occur during construction on the project site. First, construction crew commutes and the transport of construction equipment to the project site would incrementally increase noise levels on access roads leading to the site. Due to the unique nature of the proposed project, the off-site traffic noise impacts related to construction are analyzed along with project operations below, which would occur simultaneously.

The second type of short-term noise impact is related to noise generated during construction activities on the project site. Construction is completed 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 vary as construction progresses. While the proposed project has two separate phases of construction, the same equipment will be used during each phase. Therefore, the analysis below would be applicable for both phases. 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 I lists the typical construction equipment noise levels (L_{max}) recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor.

Table I: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Maximum Noise Level (L_{max}) at 50 ft
Backhoe	40	80
Dozers	40	85
Excavators	40	85
Grader	40	85
Loaders	40	80
Paver	20	85
Paving Equipment	50	85
Roller	20	85
Tractor	40	80

Source: Roadway Construction Noise Model (Federal Highway Administration 2006), Measured Equipment Database (Global Acoustics 2019)
Note: Noise levels reported in this table are rounded to the nearest whole number.
ft = feet
L_{max} = maximum instantaneous sound level
Spec = specification

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

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

Using the equations from the methodology above and the reference information in Table I, the composite noise level of each phase at a distance of 50, consistent with the CalEEMod modeling assumptions, is presented in Table J.

Table J: Potential Noise Impacts by Phase

Phase	Equipment (Quantity)	Composite Maximum Noise Level at 50 ft (dBA L_{max})
Site Preparation	Tractor, Loader, Backhoe (4), Dozer (3)	93
Grading	Tractor, Loader, Backhoe (3), Dozer (1), Grader (1), Excavator (1)	92
Paving	Paver (2), Paving Equipment (2), Roller (2)	93

Source: Compiled by LSA Associates, Inc. (2021).
dBA = A-weighted decibels
L_{max} = maximum instantaneous noise level

In order to calculate the noise levels expected to result from construction stationary source activities during each phase of construction, the software SoundPLAN was used. SoundPLAN is a noise modeling program that allows 3-D calculations to be made taking into account topography, ground attenuation, and shielding from structures and walls. Within the model, the noise library allows for the input of many noise sources and calculates the composite noise levels experienced at any receptor necessary. Noise model results of construction activities indicate that maximum noise levels at the nearest sensitive receptor would approach 34.3 dBA L_{max}. Graphics showing the SoundPLAN printouts are shown in Attachment B.

Table K provides the maximum construction noise level at each sensitive receptor. Per the County Code, construction noise is exempt during the hours of 7:00 a.m. and 8:00 p.m. Monday through Saturday; however, the results of the construction noise modeling indicate that maximum noise levels would be well below the applicable maximum noise levels standards and would be below existing ambient noise levels. Compliance with the applicable construction hours would reduce project construction impacts to a less than significant impact. With incorporation of the Standard Conditions of Approval, as listed in the County's General Plan Noise Element, the overall noise levels generated during construction would be minimal. No mitigation is required.

Table K: Summary of Construction Noise Levels

Receptor	Distance[1] (ft)	Maximum Noise Level (dBA L_{max})	County of Orange / City of Brea Maximum Noise Level Threshold Daytime/Nighttime (dBA L_{max})
R-1: Single Family Homes at Sandpiper Way and Lark Lane	7,740	34.3	75 / 70
R-2: Single Family Homes at Western terminus of Trolley Court	7,180	33.3	75 / 70
R-3: Single Family Homes at Hillside Road and Brea Hills Avenue	6,960	33.5	75 / 70
R-4: Single Family Homes at Northern terminus of Lilac Lane	5,940	27.3	75 / 70

Source: Compiled by LSA Associates, Inc. (2020).

[1] Distances reflect the nearest structure of each land use category in a given direction to the nearest activity boundary. The SoundPLAN model determines the maximum noise level at the receptor regardless of distance to the boundary.

dBA = A-weighted decibels

ft = feet

L_{max} = maximum instantaneous noise level

Short-Term Construction Vibration Impacts

This construction vibration impact analysis discusses the level of human annoyance using vibration levels in VdB and will assess the potential for building damage using vibration levels in PPV (in/sec) because vibration levels calculated in RMS are best for characterizing human response to building vibration, whereas vibration levels in PPV are best used to characterize potential for damage. As shown in Table E, the FTA guidelines indicate that a vibration level up to 102 VdB (equivalent to 0.5 PPV [in/sec]) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage (FTA 2018). For a non-engineered timber and masonry building, the construction vibration damage criterion is 94 VdB (0.2 PPV [in/sec]). For a fragile building, the construction vibration damage criterion is 90 VdB (0.12 PPV [in/sec]).

Table L shows the PPV and VdB values at a distance of 25 ft from the construction vibration source. As shown in Table L, bulldozers and other heavy-tracked construction equipment generate approximately 87 VdB of ground-borne vibration when measured at a distance of 25 ft, based on the Transit Noise and Vibration Impact Assessment Manual (FTA 2018). Project construction is expected to use equipment similar to a large bulldozer and a loaded truck. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project boundary (assuming the construction equipment would be used at or near the project boundary) because vibration impacts normally occur within the buildings.

The formula for vibration transmission is provided below.

$$L_v dB(D) = L_v dB(25\text{ feet}) - 30\text{ Log }(D/25)$$

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

Table L: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 feet	
	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 = microinches per second
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

Table M lists the projected vibration levels from various construction equipment expected to be used on the project site to the nearest buildings in the project vicinity. For typical construction activity, the equipment with the highest vibration generation potential is the large bulldozer, which would generate 87 VdB (0.089 PPV [in/sec]) at 25 ft, respectively. As shown in Table M, the closest residence would experience vibration levels of up to 16 VdB (0.0002 PPV [in/sec]).

Table M: Summary of Construction Vibration Levels

Land Use	Direction	Equipment/Activity	Reference Vibration Level (VdB) at 25 ft	Reference Vibration Level (PPV) at 25 ft	Distance[1] (ft)	Maximum Vibration Level (VdB)	Maximum Vibration Level (PPV)
Residential	South	Large Bulldozer	87	0.089	5,940	16	0.0002

Source: Compiled by LSA (June 2021)
Note: Reference vibration levels are associated with a large bulldozer.
[1] Distances reflect the nearest structure of each land use category in a given direction to the nearest project construction boundary. All other structures of each land use category in the given direction would experience lower vibration levels.
ft = feet
PPV = peak particle velocity
VdB = vibration velocity decibels

These vibration levels would not have the potential to result in community annoyance because vibration levels would not exceed the FTA's community annoyance threshold of 78 VdB for residential uses. In addition, these vibration levels would not exceed the FTA vibration damage threshold of 94 VdB (0.2 PPV [in/sec]) for non-engineered timber and masonry buildings which was used because the structures were observed to be constructed of non-engineered timber. Therefore, vibration levels generated by project construction activities would be less than significant. No vibration reduction measures are required.

Project Off-Site Traffic Noise Impacts

Construction crew commute trips and operations delivery trucks would reach up to 62 trips per day when Phase 1 of operation and Phase 2 of construction overlap as presented in the *Transportation Memorandum for the Valencia Greenery Project* (LSA 2021). Based on previously gathered counts of 6,230 on Valencia Avenue north of East Lambert Road and applying a 1 percent growth factor per year, the existing ADT along Valencia Avenue south of the project site is approximately 6,420. The following equation was used to determine potential impacts of the project:

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

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 approximately 0.4 dBA CNEL is expected along streets adjacent to the project site. A noise level increase of less than 1 dBA would not be perceptible to the human ear; therefore, the traffic noise increase in the vicinity of the project site resulting from the proposed project would be less than significant. No mitigation is required.

Project Off-Site Stationary Noise Impacts

The project would use equipment on site for composting activities during project operation. It was anticipated that a cover turner, windrow turner, dry deck screens, a chipper/grinder, and a conveyor would be introduced to current daily operations. The same equipment would be used for each of the two phases of project operations. Table N below presents the assumed reference noise levels of the additional equipment used during project operations.

Table N: Operations Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Maximum Noise Level (L_{max}) at 50 ft
Cover and Windrow Turners	100	78
Dry Dock Screens	100	75
Emergency Generator	100	85
Chipper/Grinder	100	76
Conveyor Belt	100	70

Source: Roadway Construction Noise Model (Federal Highway Administration 2006), Measured Equipment Database (Global Acoustics 2019), Noise Navigator Sound Level Database (3M 2015)
Note: Noise levels reported in this table are rounded to the nearest whole number.
ft = feet
L_{max} = maximum instantaneous sound level
Spec = specification

It was assumed that the turners would generate levels of 78 dBA L_{max} during project operations at 50 ft. The dry deck screens would generate noise levels of 75 dBA L_{max} at a distance of 50 ft. The chipper/grinder would generate noise levels of 76 dBA L_{max} at a distance of 50 ft. The conveyor belt would generate noise levels of 70 dBA L_{max} at a distance of 50 ft. A composite equivalent continuous noise level of the newly added equipment would be 83.2 dBA L_{eq} at 50 ft based on an acoustical usage factor of 100 percent for all of the equipment described above.

Table O shows the noise levels from the project stationary equipment used for composting at the nearest noise-sensitive locations located approximately 6,125 ft to 8,030 ft to the south. Noise generated from on-site composting equipment would potentially reach up to 28.3 dBA L_{eq}. Noise levels generated by the operations of the proposed project would not exceed the City's daytime exterior standard of 55 dBA L_{eq} or nighttime exterior standard of 50 dBA L_{eq} for residential land uses.

The proposed project would also include the installation of an emergency generator. While the necessity of operations would only occur during emergency conditions and compliance with the County's noise standards is not required, noise levels at the surrounding receptors would approach 23.3 dBA L_{eq}. Graphics showing the SoundPLAN printouts are shown in Attachment B.

Table O: Summary of Off-Road Equipment Noise Levels

Land Use	Distance from Composting Site (ft)	Composite Noise Level (dBA L_{eq})	County of Orange / City of Brea Average Noise Level Threshold Daytime/Nighttime (dBA L_{eq})
R-1: Single Family Homes at Sandpiper Way and Lark Lane	8,030	28.3	55/50
R-2: Single Family Homes at Western terminus of Trolley Court	7,395	27.3	
R-3: Single Family Homes at Hillside Road and Brea Hills Avenue	7,170	28.0	
R-4: Single Family Homes at Northern terminus of Lilac Lane	6,125	21.8	

Source: Compiled by LSA (August 2019)
dBA = A-weighted decibels L_{eq} = equivalent continuous sound level
ft = feet

Project Off-Site Vibration Impacts

The proposed project would potentially generate vibration from off-site loaded truck operations during each of the construction and operations phases. It was assumed that the loaded trucks would generate a vibration level of 86 VdB (0.076 PPV [in/sec]) at 25 ft. The closest residences to the roadways that would be used by trucks to haul materials to the site are located along Valencia Avenue, approximately is 55 ft from the roadway. At a distance of 55 ft the off-site truck operations would generate ground-borne vibration levels of 76 VdB (0.032 PPV [in/sec]). These vibration levels would not have the potential to result in community annoyance because vibration levels would not exceed the FTA's community annoyance threshold of 78 VdB for residential. Also, these vibration levels would not exceed the FTA vibration damage threshold of 0.2 PPV [in/sec] for non-engineered timber and masonry buildings which was used because the structures in the project vicinity were observed to be constructed of non-engineered timber. 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. Therefore, vibration levels generated from project operations would be less than significant. No vibration reduction measures are required.

CONCLUSION

With compliance of the following County Standard Conditions of approval, noise generated during construction and operation of project equipment would be reduced to the extent feasible. No short-term or long-term noise and vibration reduction measures are required.

Standard Conditions of Approval

As presented in the County of Orange Noise Ordinance, the County's Standard Conditions of Approval require that all heavy vehicles or equipment, fixed or mobile, operated within 1,000 ft of a dwelling shall be equipped with properly operating and maintained mufflers. Stockpiling and/or vehicle staging areas shall be located as far as practicable from dwellings.

REFERENCES

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Global Acoustics Pty Ltd. 2019. GreenSPOT Hunter Valley Recycling Facility. January.

Harris, Cyril M., editor. 1991. *Handbook of Acoustical Measurements and Noise Control*, Third Edition.

LSA Associates, Inc. (LSA). 2021. *Transportation Memorandum for the Valencia Greenery Project*. October.

Orange County Airport Land Use Commission. 2004. Airport Environs Land Use Plan for Fullerton Municipal Airport, November 18.

United States Environmental Protection Agency (EPA). 1978. *Protective Noise Levels, Condensed Version of EPA Levels Document*. EPA 550/9-79-100. November.

Attachments:
A: Noise Monitoring Fieldwork Sheets
B: SoundPLAN Printouts

ATTACHMENT A

NOISE MONITORING FIELDWORK SHEETS

Noise Measurement Survey – 24 HR

Project Number: SWT1701.05
Project Name: Valencia Greenery

Test Personnel: Corey Knips
Equipment: LD 706RC

Site Number: LT-1 Date: 4/21/2021

Time: From 10:00 a.m. To 10:00 a.m.

Site Location: Eastern edge of Olinda Alpha Landfill, on utility pole near the highest tower.

Primary Noise Sources: Landfill operations and aircraft.

Comments:

Photo:

Noise Measurement Survey – 24 HR

Project Number: SWT1701.05
Project Name: Valencia Greenery

Test Personnel: Corey Knips
Equipment: LD 706RC

Site Number: LT-2 Date: 4/21/2021

Time: From 10:00 a.m. To 10:00 a.m.

Site Location: Corner of Sandpiper Way and Lark Lane, on light pole.

Primary Noise Sources: Landfill operations (faint) and aircraft.

Comments:

Photo:

Noise Measurement Survey – 24 HR

Project Number: SWT1701.05

Project Name: Valencia Greenery

Test Personnel: Corey Knips

Equipment: LD 706RC

Site Number: LT-3 Date: 4/21/2021

Time: From 11:00 a.m. To 11:00 a.m.

Site Location: Near the north end of Lilac Lane, on utility pole.

Primary Noise Sources: Landfill operations (faint) and aircraft.

Comments:

Photo:

Project Number: SWT1701.05
Project Name: Valencia Greenery
Test Personnel: Corey Knips

LSA
LSA Associates, Inc.

Noise Measurement Survey

Site Number: ST-1 Date: 4/21/21 Time: From 11:07 a.m. To 11:27 a.m.

Site Location: End of Trolley Court, on sidewalk

Primary Noise Sources: Traffic on Carbon Canyon Road (faint), birds, faint aircraft noise. Cannot discern landfill operations noise over the faint traffic noise

Measurement Results

	dBA
L_{eq}	44.2
L_{max}	62.9
L_{min}	35.1
L_{peak}	83.8
L_2	52.1
L_8	48.0
L_{25}	42.7
L_{50}	40.0
L_{90}	37.3
L_{99}	36.0
SEL	75.0

Comments:

413

Equipment: Larson Davis 831 SLM

Atmospheric Conditions:

Maximum Wind Velocity (mph)	Average Wind Velocity (mph)	Temperature (F)	Relative Humidity (%)	Comments
4.1	1.1	62.5	56.3	

Project Number: SWT1701.05
Project Name: Valencia Greenery
Test Personnel: Corey Knips

LSA
LSA Associates, Inc.

Noise Measurement Survey

Site Number: ST-2 Date: 4/21/21 Time: From 11:46 a.m. To 12:06 p.m.

Site Location: On curve of E. Hillside Road and N. Brea Hills Avenue, on the sidewalk

Primary Noise Sources: Operations at the landfill, Traffic on Carbon Canyon Road

Measurement Results

	dBA
L_{eq}	44.3
L_{max}	58.0
L_{min}	37.7
L_{peak}	78.9
L_2	50.5
L_8	46.4
L_{25}	44.0
L_{50}	42.8
L_{90}	41.0
L_{99}	40.3
SEL	75.1

Comments:

.414

Equipment: Larson Davis 831 SLM

Atmospheric Conditions:

Maximum Wind Velocity (mph)	Average Wind Velocity (mph)	Temperature (F)	Relative Humidity (%)	Comments
7.6	2.3	64.4	57.1	

LSA

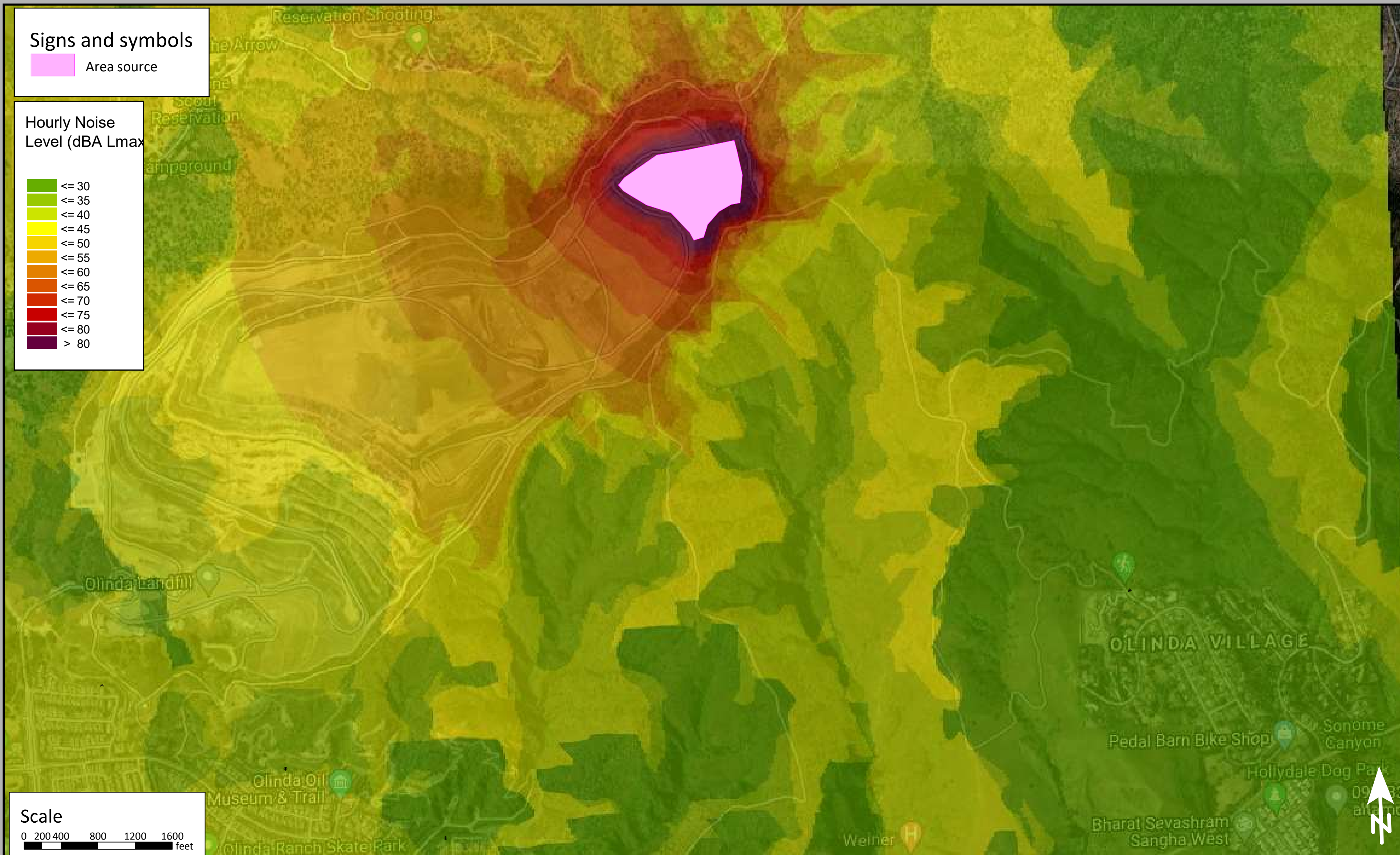
ATTACHMENT B

SOUNDPLAN PRINTOUTS

Valencia Greenery

Project No. SWT1701.05

Project Construction Noise Levels - Max



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Valencia Greenery

Project No. SWT1701.05

Project Operations Noise Levels