Appendix L: Noise

L-1: Expanded Noise Analysis

Expanded Noise Analysis
Prepared for the
Draft EIR
County of San Luis Obispo
Los Osos Wastewater Project

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PREFACE

This Expanded Noise Analysis corresponds to Section 5.10, Noise, of the Los Osos Wastewater Project Draft EIR. For readability and reference, the numbering system for headings and page numbers in the following environmental analysis uses the same section number as that used in the Draft EIR.

This Expanded Noise Analysis of the Los Osos Wastewater Project Draft EIR is a summary of a compendium of knowledge regarding noise issues statewide, as well as those issues applicable to San Luis Obispo County and specifically the community of Los Osos. Since this body of knowledge is considerable and contained in numerous appendices, it would be difficult to present it entirely in this document and in a manner that is easily understood by the reader. In order to aid the reader in locating background information, this section is formatted to facilitate the retrieval of appended information by presenting the reader with references that address the issue at hand.

5.10 - NOISE

This section describes the existing noise setting and potential effects from project implementation on the site and its surrounding area. Descriptions and analysis in this section are based on noise modeling performed in October 2008 by Vista Environmental for Michael Brandman Associates and included in Appendix L-2 of this Draft EIR.

The following is a list of information reviewed in preparation of this section.

1. Associated Transportation Engineers. 2008. Los Osos Wastewater Treatment Project San Luis Obispo County, California Traffic & Circulation Study. This information is located in Appendix J-2 of the Draft EIR appendices.
2. California Department of Transportation. 1998 Technical Noise Supplement. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.
3. California Department of Transportation. 2004. Transportation- and Construction-Induced Vibration Guidance Manual. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.
4. County of San Luis Obispo. 1992. County of San Luis Obispo General Plan Noise Element, Part I Policy Document. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.
5. Federal Transit Administration. 2006. Transit Noise and Vibration Impact Assessment. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.
6. U.S. Department of Transportation. 2006. FHWA Roadway Construction Noise Model User's Guide. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.

5.10.1 - Introduction

Noise Fundamentals

Noise is defined as unwanted sound. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm, or when it has adverse effects on health. Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level. A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies that are audible to the human ear.

Noise Descriptors

Noise equivalent sound levels are not measured directly but are calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (L_{eq}) represents a steady-state sound level containing the same total energy as a time-varying signal over a given sample period. The peak traffic hour L_{eq} is the noise metric used by California Department of Transportation (Caltrans) for all traffic noise impact analyses.

The Day-Night Average Level (L_{dn}) is the weighted average of the intensity of a sound, with corrections for time of day and averaged over 24 hours. The time of day corrections require the addition of 10 decibels to sound levels at night between 10 p.m. and 7 a.m. While the Community Noise Equivalent Level (CNEL) is similar to the L_{dn}, it has another addition of 4.77 decibels to sound levels during the evening hours between 7 p.m. and 10 p.m. These additions are made to the sound levels at these periods because, compared with daytime hours, there is a decrease in the ambient noise levels during the evening and nighttime hours, which creates an increased sensitivity to sounds. For this reason, the sound seems louder in the evening and nighttime hours and is weighted accordingly. The County of San Luis Obispo relies on the L_{dn} noise standard to assess transportation-related impacts on noise sensitive land uses.

Noise Propagation

From the noise source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on whether the source is a point or line source, ground absorption, atmospheric effects and refraction, and shielding by natural and man-made features. Sound from point sources such as air conditioning condensers radiate uniformly outward as it travels away from the source in a spherical pattern. The noise drop-off rate associated with this geometric spreading is 6 dBA per each doubling of the distance (dBA/DD). Transportation noise sources such as roadways are typically analyzed as line sources, since at any given moment the receiver may be impacted by noise from multiple vehicles at various locations along the roadway. Because of the geometry of a line source, the noise drop-off rate associated with the geometric spreading of a line source is 3 dBA/DD.

Ground Absorption

The sound drop-off rate is highly dependent on the conditions of the land between the noise source and receiver. To account for this ground-effect attenuation (absorption), two types of site conditions are commonly used in traffic noise models: soft-site and hard-site conditions. Soft-site conditions account for the sound propagation loss over natural surfaces such as normal earth and ground vegetation. For point sources, a drop-off rate of 7.5 dBA/DD is typically observed over soft ground with landscaping, compared with a 6.0 dBA/DD drop-off rate over hard ground such as asphalt, concrete, stone and very hard packed earth. For line sources, a 4.5 dBA/DD is typically observed for soft-site conditions compared with the 3.0 dBA/DD drop-off rate for hard-site conditions. Caltrans research has shown that the use of soft-site conditions is more appropriate for the application of the Federal Highway Administration (FHWA) traffic noise prediction model used in this analysis.

Traffic Noise Prediction

The level of traffic noise depends on the three primary factors: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, the loudness of traffic noise is increased by heavier traffic volumes, higher speeds, and greater number of trucks. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires. Because of the logarithmic nature of traffic noise levels, a doubling of the traffic noise (acoustic energy) results in a noise level increase of 3 dBA. Based on the FHWA community noise assessment criteria, this change is “barely perceptible.” In other words, doubling the traffic volume (assuming that the speed and truck mix do not change) results in a noise increase of 3 dBA. The truck mix on a given roadway also has an effect on community noise levels. As the number of heavy trucks increases and becomes a larger percentage of the vehicle mix, adjacent noise levels increase.

Noise Barrier Attenuation

Effective noise barriers can reduce noise levels by 10 to 15 dBA, cutting the loudness of traffic noise in half. For a noise barrier to work, it must be high enough and long enough to block the view of a road. A noise barrier is most effective when placed close to the noise source or receiver. A noise barrier can achieve a 5-dBA noise level reduction when it is tall enough to break the line of sight. When the noise barrier is a berm instead of a wall, the attenuation of noise can be increased by another 3 dBA.

Construction Noise Assumptions

The FHWA compiled noise measurement data regarding the noise generating characteristics of several different types of construction equipment used during the Central Artery/Tunnel project in Boston. Table 5.10-1 provides a list of the construction equipment measured along with the associated noise emissions and measured percentages of typical equipment use per day. From this acquired data, the FHWA developed the Roadway Construction Noise Model (RCNM), which may be used for the prediction of construction noise. For the purposes of this analysis, the RCNM will be used to calculate the construction equipment noise emissions.

Table 5.10-1: Construction Equipment Noise Emissions and Usage Factors

Equipment	Acoustical Use Factor (Percent)	Spec 721.560 L_{max} @ 50 feet (dBA, slow)	Actual Measured L_{max} @ 50 feet (dBA, slow)
Auger Drill Rig	20	85	84
Backhoe	40	80	78
Bar Bender	20	80	N/A
Compactor (ground)	20	80	83
Compressor (air)	40	80	78
Concrete Batch	15	83	N/A
Concrete Mixer Truck	40	85	79
Concrete Pump	20	82	81
Concrete Saw	20	90	90
Crane	16	85	81
Dozer	40	85	82
Dump Truck	40	84	76
Excavator	40	85	81
Flat Bed Truck	40	84	74
Front End Loader	40	80	79
Generator	50	82	81
Grader	40	85	N/A
Jackhammer	20	85	89
Paver	50	85	77
Pneumatic Tools	50	85	85
Pumps	50	77	81
Roller	20	85	80
Tractor	40	84	N/A
Vibrating Hopper	50	85	87
Vibratory Concrete Mixer	20	80	80
Welder/Torch	40	73	74
Source: Federal Highway Administration, 2006.			

Groundborne Vibration Fundamentals

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

Vibration Descriptors

Several different methods are used to quantify vibration amplitude, such as the maximum instantaneous peak in the vibrations velocity, which is known as the peak particle velocity (PPV) or the root mean square (rms) amplitude of the vibration velocity. Because of the typically small amplitudes of vibrations, vibration velocity is often expressed in decibels; it is denoted as (L_v) and is based on the rms velocity amplitude. A commonly used abbreviation is "VdB," which in this text, is when L_v is based on the reference quantity of 1 microinch per second.

Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans, whose threshold of perception is around 65 VdB. Offsite sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible groundborne noise or vibration. Exhibit 5.10-1 illustrates typical vibration levels and the associated human response.

Vibration Propagation

The propagation of groundborne vibration is not as simple to model as airborne noise. This is because noise in the air travels through a relatively uniform medium, while groundborne vibrations travel through the earth, which may contain significant geological differences. There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a push-pull fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse or side-to-side and perpendicular to the direction of propagation.

As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly, depending on the soil, but it has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests.