4.5 Noise and Vibration

This section addresses noise and vibration in the vicinity of the Project Site. It describes the existing noise and vibration environment, outlines significance criteria for noise and vibration impacts on humans from future activities at the site, and proposes mitigation measures for significant impacts where applicable. The analysis is based on measurement and monitoring of noise and vibration levels in and around the site and a review of noise and vibration studies and applicable regulations. Section 4.2, Biological Resources, addresses noise and vibration impacts on biological resources.

4.5.1 Environmental Setting

The environmental setting addresses the characteristics of noise and vibration and the noise and vibration environment in the proposed Project area.

4.5.1.1 Characteristics of Noise

Sound is most commonly experienced by people as pressure waves passing through the air. These rapid fluctuations in air pressure are processed by the human auditory system to produce the sensation of sound. Noise is defined as unwanted sound that may be disturbing or annoying. The character of noise is defined by its loudness, pitch, and how it varies with time.

Loudness and Sound Level

Human perception of loudness is logarithmic rather than linear. For this reason, sound level is usually measured on a logarithmic decibel (dB) scale, which is calculated from the ratio of the sound pressure to a reference pressure level. The reference pressure for sound in the air is 20 microPascals (µPa), which is represented as zero on the decibel scale. This value approximates the lowest pressure level detectable by a healthy human ear.

Pitch and Frequency

The rate at which sound pressure changes occur is called the frequency of the sound. Frequency is usually measured as the number of oscillations per second or Hertz (Hz). Frequencies that can be heard by a healthy human ear span the range from 20 to 20,000 Hz. Towards the lower end of this range (20 to 100 Hz) are low-pitched sounds, including those that might be described as “rumble” or “boom.” Towards the higher end of the range (greater than 5,000 Hz) are high-pitched sounds, such as “screech” or “hiss.”

A-Weighting, dBA

Humans are more sensitive to some sound frequencies than others. Therefore, it is common practice to apply an audio filter to measured sound levels to approximate the response of the human ear. This filter is called the A-weighting filter, which emphasizes sounds between 500 and 5,000 Hz and attenuates the frequencies outside of that range. The resulting measure is the A-weighted decibel, or dBA, which is used almost universally in the assessment of noise impact on humans. Table 4.5-1 shows typical noise levels that might be found in both outdoor and indoor environments.

Table 4.5-1 Common Environmental Noise Levels

Outdoor Environment	Noise Level (dBA)	Indoor Environment
	120	
Jet flyover at 1,000 feet ——		
	110	—— Rock concert
Pile driver at 100 feet ——	100	
		—— Night club with live music
	90	
Large truck pass-by at 50 feet ——		
	80	—— Noisy restaurant
Gas lawn mower at 50 feet ——		
	70	—— Vacuum cleaner at 10 feet
Commercial and urban area daytime ——		—— Normal speech at 5 feet
	60	
Suburban daytime ——		—— Active office environment
	50	
Urban area nighttime ——		—— Quiet office environment
	40	
Suburban nighttime ——		—— Library
Quiet rural areas ——	30	—— Quiet bedroom at night
Wilderness area ——	20	
		—— Quiet recording studio
	10	
Threshold of human hearing ——	0	—— Threshold of human hearing

Multiple Sources – Decibel Addition

Decibel noise levels produced by two or more sources are added logarithmically and not in the more familiar arithmetic way. For example, two similar sources with a noise level of 50 dBA combine to produce a total noise level of 53 dBA. Three similar sources with a noise level of 50 dBA would result in a total noise level of 55 dBA.

Logarithmic addition also applies when noise produced by a new source is added to an existing background noise level. For example, a noise source that produces a noise level of 48 dBA in an area where the existing background noise level is 45 dBA will result in a total noise level of 50 dBA.

Time-Varying Noise Descriptors

Some sources, such as air-conditioning equipment, produce continuous noise with a steady level that does not change with time. Other sources may be transient in nature, such as passing trains or aircraft. Between these two extremes are constant sources that vary gradually with time, such as distant freeway traffic, and intermittent sources that vary rapidly with time, such as traffic on a surface street. A location may receive noise contributions from a number of sources that fall into some or all of these categories, resulting in a complex time-varying noise environment. For this reason, meaningful measurement and analysis of environmental noise usually requires time-dependent noise descriptors.

The equivalent sound level, or L_{eq} , is a sound energy average, calculated over a stated time period. Environmental noise assessments commonly use 1-hour, A-weighted L_{eq} values.

The day-night noise level, or L_{dn}, is an A-weighted sound energy average calculated over 24 hours, with a 10 dBA weighting added to sound levels between the hours of 10:00 p.m. and 7:00 a.m. to reflect the increased annoyance of noise at night. The community noise equivalent level (CNEL) is similar to the L_{dn}, but with an additional 5 dBA weighting applied to sound levels during the evening, from 7:00 p.m. to 10:00 p.m.

Time-varying noise environments may also be expressed in terms of the noise level that is exceeded for certain percentages of the total measurement time. These statistical noise levels are denoted L_N, where “L” is the noise level exceeded for “N” percent of the time. For example, the L_{50} is the noise level exceeded for 50 percent of the measurement time and the L_{25} is the noise level exceeded for 25 percent of the measurement time. For a 1-hour measurement period, the L_{50} would be the noise level exceeded for 30 minutes in that hour, and the L_{25} would be the noise level exceeded for 15 minutes.

The maximum and minimum sound levels measured over a stated period are denoted by L_{max} and L_{min} respectively.

Sound Propagation

Noise levels produced by a source reduce with increased distance, depending on several factors, discussed in the following subsections.

Geometric Spreading

Sound from a single source, referred to as a “point source,” spreads outward as a series of spherical waves. The sound level of a point source reduces at a rate of 6 dBA for each doubling of distance. A busy highway does not behave as a simple point source; the movement of vehicles on a highway approximates a "line source," in which the sound waves spread out in a cylindrical pattern. The sound level of a line source reduces at a rate of 3 dBA for each doubling of distance.

Atmospheric Absorption

As sound propagates through the air, some of the sound energy is absorbed by air molecules. The sound energy absorbed increases dramatically at frequencies greater than 1,000 Hz. As a result, high frequencies tend to disappear at distances greater than 0.25 miles from the source, while low frequencies are minimally absorbed. For the middle of the speech frequency range (2,000 Hz), the absorption is typically 0.15 dB per 100 feet (at 68 degrees Fahrenheit [°F] and 70 percent humidity), whereas it can be as high as 2.3 dB per 100 feet for 8,000 Hz and as low as 0.01 db per 100 feet for 125 Hz. Temperature and humidity have strong effects on the absorption rate.

Ground Effects

The path between the noise source and the receptor is often very close to the ground. This introduces two additional mechanisms by which sound is attenuated as it radiates from the source, in addition to the geometric spreading losses.

First is ground absorption, due to imperfect reflection of the sound waves by the ground surface. The amount of absorption depends on the nature of the ground surface. For an acoustically "hard" site, such as a parking lot or smooth body of water, very little attenuation due to ground absorption will occur. On a site with acoustically "soft" ground surfaces, such as tilled soil, grass, or scattered bushes and trees, there may be an appreciable amount of attenuation due to ground absorption. High frequency sounds are generally attenuated more than low frequencies by ground absorption.

Second is the destructive interference between the direct sound wave and the sound wave reflected off the ground surface. This phenomenon, often called the "ground effect," is generally limited to the frequency range of 200 to 600 Hz.

Barriers and Shielding

A solid barrier placed between the source and the receptor can significantly reduce the noise level at the receptor. The amount of attenuation provided by "shielding" the noise source depends on the size and location of the barrier and the frequency content of the noise produced by the source. To be effective, a sound barrier must generally be at least large enough, in both height and width, to block sightlines between the noise source and the receptor. Barriers very close to either the source or the receptor provide the most effective noise reduction.

A wide barrier that is just high enough to block the line of sight to the noise source will reduce noise levels by approximately 5 dBA. A higher barrier will increase the amount of attenuation; it is not uncommon to achieve a noise reduction of 15 dBA or more with a sufficiently wide and tall barrier and favorable topography between the source and receptor. A barrier is more effective at attenuating high frequencies, since low frequencies diffract more easily around the perimeter of the barrier.

Permanent or temporary barriers may be purpose-built to attenuate noise transfer between source and receptor. Natural terrain, such as hills or berms, and man-made structures, such as buildings, can also perform well as noise barriers, even though it is not their primary function.

Wind and Temperature Effects

When a wind is blowing there will be a vertical wind gradient because the layer of air next to the ground is stationary. A wind gradient results in sound waves propagating upwind being bent upwards and those propagating downwind being bent downwards. As wind speed increases, sounds will travel farther downwind, but not as far upwind. In addition, as wind stability increases, sound propagates farther. The amount that the wind affects noise propagation is a function of the wind speed, wind direction, and elevation of the source and receptor.

In general, as the temperature increases, the air absorbs more of the sound energy and sounds do not travel as far. As humidity increases, sound propagates farther.

Temperature and wind gradients can result in measured sound levels being different to those predicted from geometrical spreading and atmospheric absorption considerations alone.

These differences may be as great as 10 dB. These effects are particularly important where sound is propagating over distances greater than 500 feet.

Human Response to Noise

On the decibel scale, a 10-dB increase in sound level represents a perceived doubling of loudness. Conversely, a decrease of 10 dB in sound level is perceived as being half as loud. It is widely accepted that a change of 3 dBA is barely perceptible to most people, while most people would readily perceive an increase or decrease of 5 to 6 dBA in noise level.

Federal Highway Administration (FHWA) studies have documented impacts to communities associated with increases in transportation noise levels (FWHA 2006). An L_{dn} less than 50 produces no annoyance in the community, while an L_{dn} of 60 produces annoyance in approximately 10 percent of the population, and an Ldn of 70 produces annoyance in 25 percent of the population. Actual case studies of community reaction to newly introduced noise sources indicate there is no public reaction to noise up to approximately 3 dBA, with sporadic complaints with an increase of 3 of 5 dBA, and widespread complaints after an increase of 10 dBA (FHWA 2006).

The noise impact criteria developed by the FHWA indicate that the level of impact is a function of the amount of environmental noise existing in the community, and the greater the existing noise levels, then the less tolerance there is for a noise increase. For example, if the existing noise levels are 45 dBA, then a project contribution of 6 dBA (51 dBA total) would be the threshold for a moderate impact. With an existing noise level of 50 dBA, a project could contribute 3 dBA above the existing noise levels (53 dBA total) to reach the threshold for moderate impacts. Note that these levels are for linear noise sources, such as roadways.

Pure Tones

Noise in which a single frequency stands out, is said to contain a "pure tone." Sources that produce pure tones are often described as being "tonal" and tend to be more noticeable, and potentially annoying, to humans than sources that do not contain pure tones. In assessing the subjective impact of tonal noise, it is common practice to take this increased annoyance into account by adding a 5 dBA penalty to the measured noise level.

Modeling Noise Impacts

Models are often used to estimate noise levels from proposed activities and to estimate noise levels under a range of meteorological conditions. In addition, modeling can estimate the effect of noise mitigation devices, such as sound walls and noise blankets. Noise models can incorporate a variety of environmental conditions, including the level of ground absorption, humidity, temperature inversions, atmospheric absorption, terrain, building reflections, and road type, as well as sources including automobiles, railroads, aircraft, and industry. Both A-weighted and octave band analysis can be performed with models. In addition, models incorporate a number of standards and methods, including International Organization for Standards (ISO) 9613 and the FHWA Traffic Noise Model (TNM).

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors to predict environmental noise levels at a distance from a variety of sources. ISO 9613 requires noise estimation using a downwind propagation under a mildly developed temperature inversion (both of which enhance sound propagation) and provides a case representation of potential effects during conditions that favor transmission of sound to the receptor. Since these conditions do not occur every day, model predictions using the ISO 9613 requirements are conservative.

In March 1998, the FHWA released the TNM, which was developed to aid compliance with policies and procedures under FHWA regulations. The FHWA TNM addresses five different vehicle types (automobiles, medium trucks, heavy trucks, buses, and motorcycles), constant- and interrupted-flow traffic, and different pavement types, as well as the effects of graded roadways.

The primary noise models currently available that incorporate ISO 9613 and TNM are SoundPlan and Computer Aided Noise Abatement (CadnaA). Each of these high-end computational models enables a wide range of analysis. SoundPlan was utilized in this EIR analysis.

Noise Mitigation

Since industry-related noise can often impact sensitive receptors, many mitigation methods are available to reduce this noise, including walls, engine exhaust silencers, mufflers, acoustical equipment enclosures, noise-absorbing blankets and padding, and sound-dampening flooring and siding materials. Properly installed acoustical materials can reduce noise by up to 40 dB, averaged over the frequency range.

The noise-reducing efficiency of insulating and acoustical materials is greater for higher frequency noise. For example, sound with a frequency of 4,000 Hz could be reduced as much as 50 to 60 dB by the same materials that would reduce 125 Hz frequency noise by less than 10 dB. Therefore, the choice of material and noise barrier design are functions of the type of equipment generating the noise.

A sound transmission class (STC) number, expressed as a frequency, rates insulating and noise barrier material as an average decibel loss across several sound frequencies. The stated STC for a given material is generally the maximum decibel reduction achievable with a perfect enclosure. Table 4.5-2 lists several barrier materials and their STC ratings.

Both the engine operation and the exhaust system of internal combustion engines generate noise. Advanced silencers and mufflers can reduce exhaust system noise levels by 10 dBA for industrial grade and by as much as 40 dBA for hospital grade silencers (Universal 2006).

Table 4.5-2 Sound Loss by Various Noise Barrier Materials

Sound Transmission Class of Materials	STC (dB)
Concrete, 12 inches thick	53
Concrete block wall, unpainted	44
Metal panel, 4 inches thick (solid and perforated)	41
Metal panel, 2 inches thick (solid and perforated)	35
Fiberglass curtain, 2 inches with barrier of 2.5 pounds per square foot	33
Steel wall, 3/16 inch thick	31
Gypsum wallboard, 5/8 inch thick	30
Fiberglass curtain, 1 inch, barrier of 1.3 pounds per square foot	27
Wood door, solid core, closed	27
Plasterboard, 3/8 inch	26
Barrier material, density of 1.5 pounds per square foot	27
Barrier material, density of 2.5 pounds per square foot	33
Steel, 22-gauge	25

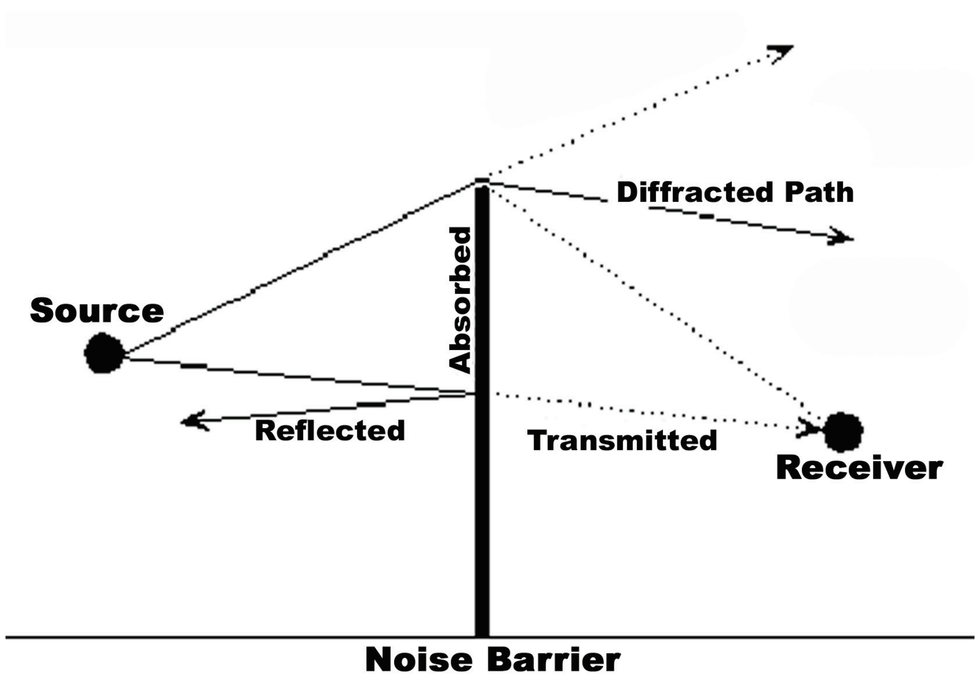
Note: STC = Sound Transmission Class, a single number rating derived from decibel loss data at several frequencies.
Source: Smock & Schonthaler

The change in noise before and after installing a noise barrier between a source and receptor is the insertion loss. The following procedures comply with the American National Standards Institute ANSI S12.8-1998 “Methods for Determining the Insertion Loss of Outdoor Noise Barriers” (ANSI 1998).

Noise barriers attenuate sound in four ways: diffraction, absorption, reflection, and reduced transmission. Diffraction mechanisms reduce noise by extending the distance that noise waves travel to the receiver from the source (see Figure 4.5-1). The noise barrier material absorbs some noise energy, while some noise is transmitted through the barrier but at a reduced energy level, and some noise is reflected from the barrier and does not reach the receiver.

Transmitted noise is typically not taken into consideration when modeling noise attenuation by noise barriers because this noise is typically significantly lower than the source noise (FHWA 2000). The highest noise is from the diffracted portion of the attenuated noise.

Figure 4.5-1 Noise Attenuation Mechanisms



Source: Adopted from FHWA 2000

4.5.1.2 Characteristics of Vibration

Vibration is acoustic energy transmitted as pressure waves through a solid medium, such as soil or concrete. Like noise, the rate at which pressure changes occur is called the frequency of the vibration, measured in Hz. Vibration may be the form of a single pulse of acoustical energy, a series of pulses, or a continuous oscillating motion.

Ground-Borne Vibration

The way that vibration is transmitted through the ground depends on the soil type, the presence of rock formations or man-made features, and the topography between the vibration source and the receptor location. These factors vary considerably from site to site and make accurate prediction of vibration levels at receptors distant from the source extremely difficult (often impossible) in practice.

As a general rule, vibration waves tend to dissipate and decrease in magnitude with distance from the source. Also, the high-frequency vibrations are generally attenuated rapidly as they travel through the ground, so that the vibration received at locations distant from the source tends to be dominated by low-frequency vibration. The frequencies of ground-borne vibration most perceptible to humans range from less than 1 to 100 Hz.

When ground-borne vibration arrives at a building, there is usually an initial ground-to-foundation coupling loss. However, once the vibration energy is in the building structure it can be amplified by the resonance of the walls and floors. Occupants can perceive vibration as motion of the building elements (particularly floors) and also rattling of lightweight components, such as windows, shutters, or items on shelves. Vibrating building surfaces can also radiate noise, which is typically heard as a low-frequency rumbling known as ground-borne noise. At very high levels, low-frequency vibration can damage buildings.

Vibration Levels

Vibration may be defined in terms of the displacement, velocity or acceleration of the particles in the medium material. In environmental assessments, where human response is the primary concern, velocity is commonly used as the descriptor of vibration level, expressed in millimeters per second. The amplitude of vibration can be expressed in terms of the wave peaks or as an average, called the root mean square. The root mean square level is generally used to assess the effect of vibration on humans. Table 4.5-3 shows vibration levels for typical sources of ground-borne vibration and Table 4.5-4 shows the extent to which vibration from various activities can affect neighboring areas.

Vibration can produce several types of wave motion in solids, including compression, shear, and torsion, so the direction in which vibration is measured is significant and should generally be stated as vertical or horizontal. Human perception also depends to some extent on the direction of the vibration energy relative to the axes of the body. In whole-body vibration analysis, the direction parallel to the spine is usually denoted as the z-axis, while the axes perpendicular and parallel to the shoulders are denoted as the x- and y-axes respectively.

Table 4.5-3 Typical Levels of Ground-Borne Vibration

Source	Typical Velocity at 50 feet (inches/second)	Human or Building Response
Blasting from construction projects	0.10	Minor cosmetic damage to fragile buildings
Bulldozers and other heavy tracked construction equipment.	0.055	Workplace annoyance; difficulty with vibration-sensitive tasks
Commuter rail, upper range	0.022	
Rapid transit rail, upper range	0.0098	Distinctly perceptible Residential annoyance for infrequent events
Commuter rail, typical range	0.0079	
Drilling Rig at 50’	0.0062	
Bus or truck over bump	0.0039	Barely perceptible Residential annoyance for frequent events
Rapid transit rail, typical range	0.0031	
Bus or truck typical	0.0020	Threshold of perception
Background vibration	0.0004	None

Source: Adapted from Transit Noise and Vibration Impact Assessment, FHWA 2006. Drilling vibrations from Baldwin Hills CSD 2008

Table 4.5-4 Vibration Levels of Various Equipment

Equipment	Velocity (inches per second)			
	50 feet	100 feet	700 feet	1,200 feet
Pile Driver, impact, sheetpiling	0.537	0.190	0.010	0.005
Pile Driver, sonic (high value)	0.260	0.092	0.005	0.002
Clam shovel drop	0.070	0.025	0.001	0.001
Caisson drilling	0.031	0.011	0.001	0.000
Large bulldozer	0.030	0.011	0.001	0.000
Jackhammer	0.012	0.004	0.000	0.000

Source: New York 2006, FHWA 1995, ADL 2000

4.5.1.3 Noise and Vibration Environment in the Project Area

Various sources of noise and vibration are distributed in the vicinity of the Project Site. There are fixed, permanent sources that operate either continuously or intermittently day and night; these include intermittent pumps at the nearby Ocean View Avenue water reservoir area. The site is also bound and divided by surface streets, including Colima Road, Mar Vista Street, and small, residential streets including Catalina Avenue, San Lucas Drive, and Lodosa Drive. Colima Road, a busy arterial north-south route, lies just to the east. The flow of cars, trucks, buses, and motorcycles on these streets is a source of environmental noise affecting the neighborhoods in the site vicinity day and night.

Aircraft flyovers are a continual occurrence in the area, including commercial jet movements in and out of Los Angeles International Airport, light airplanes, and helicopters. The intermittent noise of air traffic is apparent throughout the day, evening, and night, although flyovers after midnight are less frequent than during the day. During noise monitoring at the Project Site, as many as 22 airplanes per hour flew over the Project Site.

The closest railroad lies along Lambert Road approximately 1.6 miles south of the site.

Baseline Noise Monitoring

In December 2009, MRS used a Quest 1900 type 1 data-logging noise meter to measure noise in areas around the Project Site. MRS monitored six locations around the perimeter of the proposed Project Site for three periods (day, evening and night) of up to 1 hour each over a 24-hour period. These locations, shown in Figure 4.5-2 and described in Table 4.5-5, represent the closest residential and recreational sensitive receptors to the proposed Project Site.

Figure 4.5-2 Baseline Noise Monitoring Sites

The intent of noise monitoring is to determine typical "baseline" ambient noise levels at each location. The results of the noise monitoring are shown as equivalent noise level (L_{eq}). The community noise levels are also summarized in Table 4.5-3 as L_{dn} and CNEL.

Noise monitoring locations were chosen to record noise levels at a range of typical environments, including locations that are quiet residential (Sites 1 and 2), residential areas impacted by traffic noise (Site 3), recreational areas impacted by traffic noise (Sites 4 and 5), and quiet recreational areas within the Preserve (Site 6). Most areas surrounding the Project Site would fall into one of these categories. These baseline measurements can be used to estimate baseline noise levels at other locations within the same category.

Table 4.5-5 Description of Noise Monitoring Sites

Site	Location	Range Measured						Ldn	CNEL
		Daytime 7:00 a.m. – 7:00 p.m.		Evening 7:00 p.m. – 10:00 p.m.		Nighttime 10:00 p.m. – 7:00 a.m.			
		L_{eq}	L_{50}	L_{eq}	L_{50}	L_{eq}	L_{50}		
1	The end of Ocean View Avenue near the closest residence to the City Water reservoir	46.7	40.1	46.4	41	46.8	39.9	53.2	53.4
2	The end of Catalina Avenue near the Preserve entrance gate	48.4	46.1	48.3	46.8	47.7	43.1	54.2	54.5
3	The corner of Mar Vista Street and Catalina Avenue	64.7	62.9	65.5	62.2	58.4	41.4	66.5	67.4
4	The Preserve boundary within the Preserve near the Colima Road entrance	50.5	50	48.4	47.1	43.1	41.9	51.5	52.0
5	The Pescadero overview area in the Preserve	56.2	55.8	54.7	53.7	47.7	44.8	56.7	57.4
6	Along the Preserve nature trail (Deer Loop) closest to the proposed Project Site	47.7	40.9	46.5	42	47.4	35.0	53.8	54.0

Contributions to noise levels in the area during the noise monitoring included traffic, aircraft flyovers, and nearby residential sources (e.g., dogs barking, lawnmowers, yard work) occurring from time to time, but tending to be of fairly short duration. Airport flyovers occurred as frequently as 22 times per hour during the daytime and were a significant source of noise. Aircraft noise impacts were less during the evening and nighttime with minimal aircraft noise after midnight. Traffic noise was another significant noise source, particularly at Mar Vista Street and Colima Roads. Mar Vista Street was heavily impacted with traffic during the daytime periods close to 5:00 p.m., with traffic backed up past Catalina Avenue from the stoplight at Colima Road. Monitoring locations farther from traffic, such as at the end of Ocean View Avenue, the end of Catalina Avenue, and within the Preserve, had minimal traffic noise impacts.

Baseline Traffic Noise Modeling

Traffic noise can be a substantial contributor to area noise levels. The City of Whittier General Plan states that "traffic is a primary source of noise" in the Whittier area. The FHWA publishes modeling guidelines that can be used to estimate traffic noise a given distance away from a roadway. The noise levels are based on the recent traffic counts, the percentage of medium- and heavy-duty trucks, and the roadway configuration. The FHWA model was run for Mar Vista Street west of Colima Road at Catalina Avenue and for Colima Road north of Mar Vista Street. The CNEL 50 feet from the road centerline were an estimated 69 and 74 dBA, respectively.

Penn Street has substantially less traffic than Mar Vista or Colima Road, but has a higher percentage of trucks as Penn Street is the access route for the Savage Canyon Landfill. FHWA noise modeling estimates that current noise levels along Penn Street are 63 dBA CNEL at 50 feet from the roadway centerline. SoundPlan modeling along Penn Street estimates a peak hour noise level during the daytime of 67 dBA near Painter Ave. and about 65 dBA near Penn Park.

Baseline Vibrations

The noise monitoring did not detect any vibration levels along the edge of the Preserve or at sensitive receptors. The only sources of vibration in the area were large trucks moving along Colima Road. Large trucks would not be expected to produce detectable vibrations levels beyond 50 to 100 feet from the roadway (see Table 4.5-3).

Experiences at Nearby Oil Sites

There are currently no operations at the proposed Project site. However, there are oil and gas operations proximate to the Preserve are that could provide insight into the impacts on noise that oil. The Applicant owns the Honolulu Terrace operations along Honolulu Terrace Road. The Honolulu Terrace facility is immediately adjacent to residences near the edge of the Preserve north-west of the proposed Project site. Phone records from 2005 to 2010 from the City of Whittier contain noise complaints related to the Honolulu Terrace facility. In 2005-2006, numerous calls complained of noise related to banging pipes, engine noise, pump noises, and other noises. The City of Whittier contracted with Arup Acoustics to study ways to reduce noise impacts on nearby residences (Arup 2006). These measures were implemented in the 2006-2007 timeframe. Since that time, only a few complaints have been logged annually. This EIR analysis utilized the results of the ARUP studies.

The Baldwin Hills Oilfield in Inglewood implemented measures in response to historical odor releases and noise impacts that lead to an EIR and the establishment of a community services district. The community services district implemented several odor and noise related measures, included extensive noise modeling and drilling operations monitoring. To date, dozens of wells have been drilled with noise reduction measures and real-time, 24-hour monitoring of noise levels. This analysis examined the results of their studies. These experiences indicate that, with mitigation, noise associated with oil and gas operations and drilling can be substantially reduced.

4.5.2 Regulatory Setting

The Los Angeles County Code, the City of Whittier Municipal Code, and the City of Whittier General Plan address noise standards. Since portions of the proposed Project (i.e., the pipeline) lie within the County and the County addresses noise issues that the City Code and City General Plan do not, the County Code is also discussed.

4.5.2.1 Los Angeles County Code

Chapter 12.08 of the Los Angeles County Code regulates control of noise and vibration.

Noise

Section 12.08.390, subsection A, of the Code prescribes exterior standards to be applied to all receptor properties, based on certain exterior noise levels, which are reproduced in Table 4.5-6.

Table 4.5.6 Exterior Noise Standards for Los Angeles County

Noise Zone	Designated Noise Zone Land Use (Receptor Property)	Time Interval	Exterior Noise Level (dBA)
I	Noise-sensitive area	Anytime	45
II	Residential properties	10:00 p.m. to 7:00 a.m. (nighttime)	45
		7:00 a.m. to 10:00 p.m. (daytime)	50
III	Commercial properties	10:00 p.m. to 7:00 a.m. (nighttime)	55
		7:00 am to 10:00 p.m. (daytime)	60
IV	Industrial properties	Anytime	70

Source: Los Angeles County Code, section 12.08.390, subsection A

The residential uses in the vicinity of the site are in Noise Zone II, as defined by the County Code. From discussions with the Los Angeles County Department of Public Health, it is understood that urban parks are generally considered to be in Noise Zone III (Cartegena 2007). However, the Preserve may be considered a noise-sensitive area, although the Code typically designates those as schools and day care centers.

Paragraph 12.08.390, subsection B, of the County Code states:

> …no person shall operate or cause to be operated, any source of sound at any location within the unincorporated county, or allow the creation of any noise on property owned, leased or otherwise controlled by such as person which causes the noise level, when measured on any other property either incorporated or unincorporated, to exceed any of the following noise standards:
>
> **Standard No. 1** shall be the exterior noise level which may not be exceeded for a cumulative period of more than 30 minutes in any hour. Standard No. 1 shall be the applicable noise level from [Table 4.5.6]; or, if the ambient L_{50} exceeds the foregoing level, then the ambient L_{50} becomes the exterior noise level for Standard No. 1.
>
> **Standard No. 2** shall be the exterior noise level which may not be exceeded for a cumulative period of more than 15 minutes in any hour. Standard No. 2 shall be the applicable noise level from [Table 4.5.6] plus 5 dB; or, if the ambient L_{25} exceeds the foregoing level, then the ambient L_{25} becomes the exterior noise level for Standard No. 2.
>
> **Standard No. 3** shall be the exterior noise level which may not be exceeded for a cumulative period of more than five minutes in any hour. Standard No. 3 shall be the applicable noise level from [Table 4.5.6] plus 10 dB; or, if the ambient $L_{8.3}$ exceeds the foregoing level, then the ambient $L_{8.3}$ becomes the exterior noise level for Standard No. 3.
>
> **Standard No. 4** shall be the exterior noise level which may not be exceeded for a cumulative period of more than 1 minute in any hour. Standard No. 4 shall be the applicable noise level from [Table 4.5.6] plus 15 dB; or, if the ambient $L_{1.7}$ exceeds the foregoing level, then the ambient $L_{1.7}$ becomes the exterior noise level for Standard No. 4.
>
> **Standard No. 5** shall be the exterior noise level which may not be exceeded for any period of time. Standard No. 5 shall be the applicable noise level from [Table above] plus 20 dB; or, if the ambient L_0 exceeds the foregoing level, then the ambient L_0 becomes the exterior noise level for Standard No. 5.

It is understood that the L_0 statistical noise level referred to in the County Code definition of exterior Noise Standard Number 5 is the maximum noise level in any hour, usually denoted as the L_{max}. For the purposes of this section, L_{max} and L_0 noise levels are therefore interchangeable.

Section 12.08.410 of the Code requires that the noise level limits be reduced by 5 dB for any source that emits a pure tone or impulsive noise. According to the County Code:

> "Pure tone noise" means any sound which can be judged as audible as a single pitch or a set of single pitches by the health officer, for the purposes of this chapter, a pure tone shall exist if the one-third octave band sound-pressure level in the band with the tone exceeds the arithmetic average of the sound-pressure levels of the two contiguous one-third octave bands by 5 dB for center frequencies of 500 Hertz and above, and by 8 dB for center frequencies between 160 and 400 Hertz, and by 15 dB for center frequencies less than or equal to 125 Hertz.
>
> "Impulsive noise" means a sound of short duration, usually less than one second and of high intensity, with an abrupt onset and rapid decay.

Construction Noise

Section 12.08.440 of the Code addresses construction noise and states:

> Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of 7:00 p.m. and 7:00 a.m. or at any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by variance issued by the health officer is prohibited.

Section 12.08.440 of the Code also defines maximum allowable noise levels for construction noise at affected structures, which are reproduced in Table 4.5-7.

Vibration

Section 12.08.560 of the Los Angeles County Code states:

> Operating or permitting the operation of any device that creates vibration which is above the vibration perception threshold of any individual at or beyond the property boundary of the source, or at 150 feet (46 meters) from the source ft on a public space or public right-of-way is prohibited. The perception threshold shall be a motion velocity of 0.01 in/sec over the range of 1 to 100 Hz.

Table 4.5-7 Construction Noise Limits in Los Angeles County

Equipment Type	Time Interval	Maximum dBA Noise Level at Affected Building			
		Single-Family Residential	Multi-Family Residential	Semi-Residential/ Commercial	Business
Non-scheduled, intermittent, short-term operation (less than 10 days) of mobile equipment.	Daily 7:00 a.m. to 8:00 p.m., except Sundays and legal holidays,	75	80	85	85
Non-scheduled, intermittent, short-term operation (less than 10 days) of mobile equipment.	Daily 8:00 p.m. to 7:00 a.m., and all day Sunday and legal holidays	60	64	70	85
Repetitively scheduled and relatively long-term operation (periods of 10 days or more) of stationary equipment.	Daily 7:00 a.m. to 8:00 p.m., except Sundays and legal holidays	60	65	70	-
Repetitively scheduled and relatively long-term operation (periods of 10 days or more) of stationary equipment.	Daily, 8:00 p.m. to 7:00 a.m., and all day Sunday and legal holidays	50	55	60	-

Source: Los Angeles County Code, section 12.08.440, subsection B

The limit of 0.01 inches per second vibration velocity prescribed by the Code equates to a vibration velocity of 0.254 millimeters per second. This figure agrees with the baseline values of acceptable vibration defined in American National Standards Institute (ANSI) S3.29-1983 “Guide to the Evaluation of Human Exposure to Vibration in Buildings.”

Exemptions for Operation of Oil and Gas Wells

The Los Angeles County Code lists a number of activities that are exempt from the noise and vibration controls of Chapter 12.08. This list of exemptions includes the following oil and gas well operations, as described by section 12.08.570, subsection M, of the Code:

- Normal well servicing, remedial, or maintenance work performed within an existing well that does not involve drilling or redrilling and that is restricted to the hours between 7:00 a.m. and 10:00 p.m.; and
- Drilling or redrilling work done in full compliance with the conditions of permits issued under Chapter 5, Article 1 of the County Zoning Ordinance as amended, as set out in Title 22 of this Code.

Exemption for Emergencies

Emergencies are also exempt from the provisions of Chapter 12.08 of the Los Angeles County Code, as described by section 12.08.570, subsection A, of the Code:

> Emergency Exemption. The emission of sound for the purpose of alerting persons to the existence of an emergency, or the emission of sound in the performance of emergency work.

According to section 12.08.130 of the Code:

> "Emergency machinery, vehicle or alarm" means any machinery, vehicle or alarm used, employed, performed or operated in an effort to protect, provide or restore safe conditions in the community or for the citizenry, or by private or public utilities when restoring utility service.

According to section 12.08.140 of the Code:

> "Emergency work" means any work performed for the purpose of preventing or alleviating the physical trauma or property damage threatened or caused by an emergency.

4.5.2.2 City of Whittier Municipal Code

Chapter 8.32 of the City of Whittier Municipal Code regulates control of noise and vibration. This Chapter was updated in January, 2010 and replaced text that prescribed specific noise limits, similar to the County Code above. The current City Municipal Code is more general in nature and does not prescribe specific noise limits.

Section 8.32.030 of the City Municipal Code specifies:

> It shall be unlawful for any person to willfully make or continue, or cause to be made or continued, any excessive or unreasonable noise, which disturbs the peace or quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitiveness residing in the area.

Section 8.32.040 discusses loud, annoying, and unnecessary noises, and specifically defines horns and signaling devices (section F), erection or demolition of buildings, the grading and excavation of land, the start up and use of heavy equipment (e.g., dump trucks and graders), and the use of jack hammers. These noises would be in violation of the Municipal Code except on weekdays between the hours of 7 a.m. and 6 p.m. and on Saturdays 8 a.m. to 5 p.m. (section L).

Section 8.32.060 indicates that the official's normal hearing faculties shall be the primary means of noise detection.

The current City Municipal Code does not address vibration.

4.5.2.3 City of Whittier General Plan

The City of Whittier General Plan Noise Element addresses noise goals and policies, implementation programs, compatibility guidelines and roadway noise levels. Goals and policies that apply to the Proposed Project include:

- Policy 2.1: Control, at their source, any sounds which exceed accepted community noise levels
- Policy 2.3: Encourage attenuation devices and limited hours of operation for new recreational developments so that neighborhood noise, especially during evening and nighttime hours, can be reduced.

The General Plan Noise Element also contains noise compatibility guidelines that indicate the acceptability of noise exposure levels for different land uses. The Noise Element indicates that projects should incorporate noise mitigation measures if they will exceed normally acceptable levels as defined by the guidelines. Figure 4.5-3 shows these guidelines.

4.5.2.4 City of Whittier Resolutions, Ordinances, and Agreements

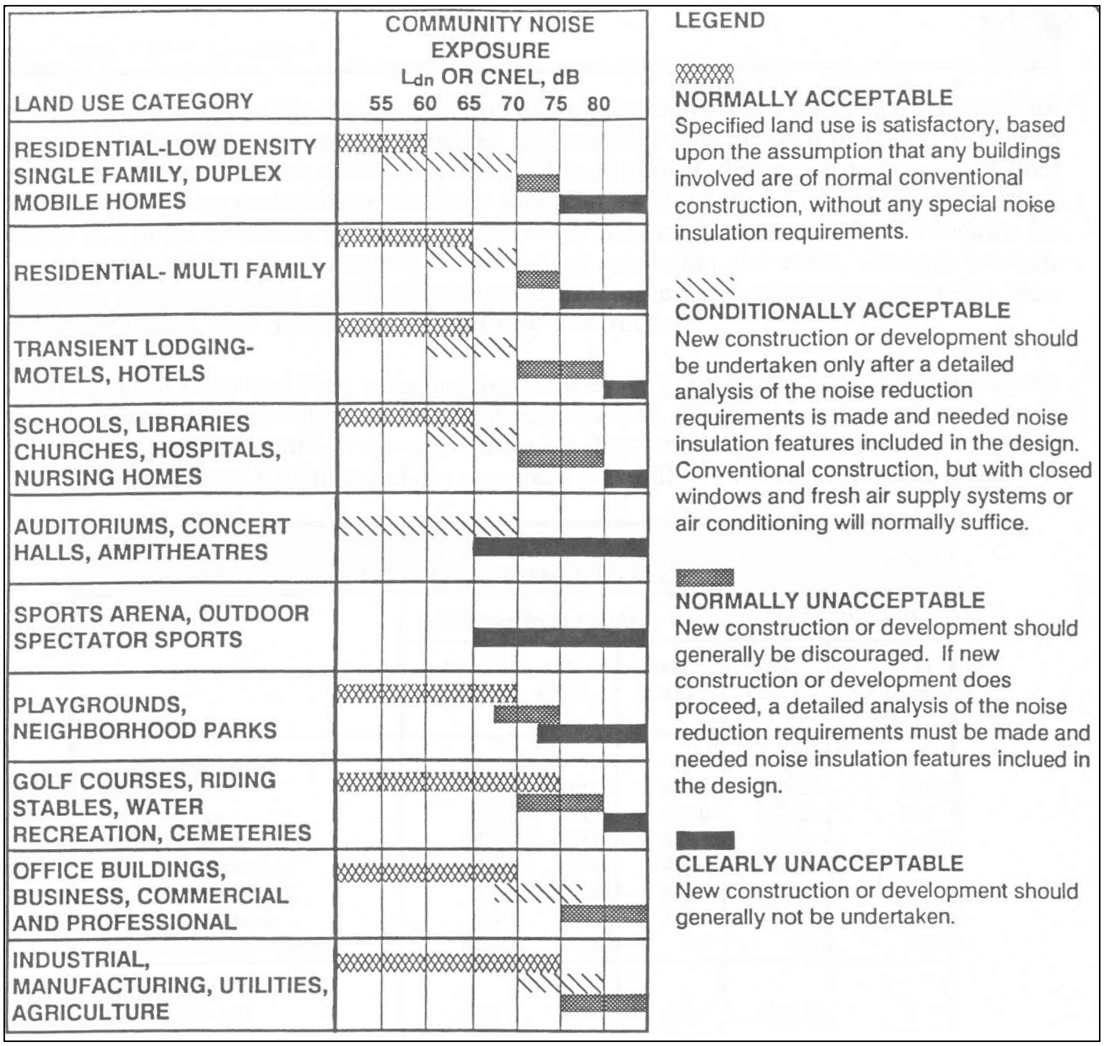
The City of Whittier addressed oil and gas development codified in resolution 4302, ordinance number 2047, and in agreements and permits with existing oil and gas projects (Matrix Honolulu Terrace). The City Public Works Department is responsible for conducting annual inspections of facilities in order to ensure compliance with these requirements as well as some other requirements (such as South Coast Air Quality Management District requirements).

Resolution 4302 was passed in 1970 and addresses permit fees, operations and drilling (such as roads, fencing, blow-out prevention requirements and sound proofing), abandonment requirements, inspections, notices, storage facilities, and fire prevention.

Ordinance number 2047 was passed in 1975 specifically to regulate Seaboard Oil and Gas Company. It includes a number of requirements related to lighting, soundproofing, operations and maintenance of the well drilling operations, and landscaping.

The current agreement with Matrix, signed in 2006 and related to the Honolulu Terrace operations, addresses issues such as aesthetics, fire safety, inspections, odor control, and noise control.

Figure 4.5-3 City of Whittier General Plan Noise Guidelines



Source: City of Whittier 1993

4.5.2.5 Significance Criteria

Significance criteria for new well drilling, well workovers, and gas and oil plant operations are based on existing ambient noise levels measured at the perimeter of the site during December 2009, which are considered the "baseline" condition, expressed, A-weighted equivalent noise levels (L_{eq}, dBA). Noise produced by the proposed Project operations shall be considered significant if any of the following conditions apply:

- Operations or drilling cause neighboring use, property line CNEL noise levels to exceed the City of Whittier General Plan Noise Levels; 60 dBA CNEL at a residential receptors, 65 dBA at schools, or 70 dBA at neighborhood parks.
- Operations or drilling cause hourly, A-weighted equivalent noise levels at the property line of a neighboring residential use to be more than 3 dBA above the minimum existing baseline value.
- Operations or drilling cause hourly, A-weighted equivalent noise levels at the property line of a neighboring non-residential use (school or recreational area) to be more than 5 dBA above the minimum existing baseline average value.
- Operations or drilling that produces noise that includes a pure tone or pure tones when measured at a neighboring residential property.
- Vibration levels at neighboring use property line exceed the County of Los Angeles Code Vibration Levels of 0.01 inches per second vibration velocity limit.
- Construction activities occur outside of the City of Whittier Municipal Code timeframe of 7 a.m. to 6 p.m. weekdays or 8 a.m. to 5 p.m. on Saturdays or noise levels exceed the applicable jurisdictions noise standards for construction.

Significance Criteria Rationale

The significance criteria for operations (including drilling) are based on CNEL noise levels. The intent is to provide a relatively simple, easily understood description of the noise environment that does not require complex analysis to measure or enforce.

The General Plan CNEL levels are the highest "normally acceptable" value listed in the General Plan since the proposed Project would require mitigation measures. The General Plan does not specify a noise level for Preserve-type areas, so the neighborhood parks category was used to define the limit for the Preserve areas.

A Project noise level contributing a 3 to 5 dBA increase over the baseline noise level was also selected as a significance criterion. An increase over baseline rather than a new threshold value was selected because some baseline noise levels currently exceed or approach the normally acceptable 60 dBA CNEL and some levels are substantially below the 60 dBA CNEL level. This level is derived from typical human response to changes in noise level; a change of 3 to 5 dBA is generally acknowledged as the point at which most people would readily perceive an increase or decrease in noise level. The lower value was selected for residential locations with nighttime occupancy (nighttime usually produces the lowest hourly, A-weighted equivalent noise level), whereas the higher value was used for areas that generally do not have nighttime occupancy.

A pure tone shall be deemed to exist if the one-third octave band sound-pressure level in the band with the tone exceeds the arithmetic average of the sound-pressure levels of the two contiguous one-third octave bands by 5 dB for center frequencies of 500 Hertz and above, and by 8 dB for center frequencies between 160 and 400 Hertz, and by 15 dB for center frequencies less than or equal to 125 Hertz.

Impulse noise levels are not addressed in the City of Whittier noise ordinance. However, impulse noises can cause disturbances to receptors. Impulse noise levels are included in hourly averages as it only takes a few, loud impulse noises to cause an exceedance of the 3-5 dBA criteria discussed above. As an example, a single, loud impulse noise could cause the hourly average noise level during nighttime hours to exceed the significance criteria.

Since the City of Whittier General Plan and Municipal Code do not address vibration, the County of Los Angeles Code has been used, which defines a vibration limit of 0.01 inches per second.

4.5.3 Analysis of Proposed Project

During the Drilling and Testing Phase, Design and Construction Phase, and Operations and Maintenance Phase, the Project could potentially generate noise and vibration impacts. The construction phase would generally be short term and the operational phase would be long term. The SoundPlan Noise Modeling software was used to determine noise impacts by evaluating several factors to estimate the noise levels, including terrain, meteorological conditions, and ground type as well as the characteristics of the source noise. The following sections discuss the modeling and the resulting impacts and mitigation measures.

Noise levels generated by traffic were included in the SoundPlan noise model for Catalina Avenue and the North Access Road to the Landfill. The FHWS noise model estimates noise level increases along Mar Vista Street, Penn Street, and Colima Road due to increased Project traffic during operations to be less than 0.10 dBA due to the small additional traffic added relative to the current traffic on the roadways.

Impact #	Impact Description	Phase	Residual Impact
N.1	Construction machinery would increase noise levels.	Design and Construction	Less Than Significant With Mitigation

Several construction activities would generate noise, including clearing the site for drilling, grading, constructing the Processing Facility Area and Gas Plant Area, installing permanent processing equipment, and pipeline construction. Construction would last from a few weeks for pad clearing to approximately 2 years for the Processing Facility Area and Gas Plant Area (see Section 2.0, Project Description).

The estimated construction noise levels at some of the receptor locations would be higher than the measured background due to the construction activities.

Estimates of noise levels from construction equipment utilized the FHWA and the Environmental Protection Agency (EPA) studies documenting noise generated by equipment as well as the equipment requirements and use detailed by the Applicant in Section 2.0, Project Description. The worst-case scenario for noise levels would be grading and transporting soil from those areas. However, even in the worst-case scenario, construction would only generate noise during daytime.

Noise modeling utilizing the SoundPlan model indicated that residences along Catalina Avenue, Ocean View Avenue, Romero Drive, and San Lucas Drive and near the proposed Project Site would experience noise levels from 52 to 56 dBA peak hour average during daytime for grading.

The ranger residence, immediately south of the Processing Facility Area and approximately 600 feet away, would experience daytime average noise levels up to 61 dBA (hourly average). The school play yard would experience average daytime noise levels up to 57 dBA. The noise level at the closest recreational area along the Loop Trail would experience a daytime average hour of up to 66 dBA. Although these noise levels would be within the General Plan limits, they would exceed the current baseline daytime levels by up to 18 dbA and would be clearly noticeable. This would be considered a significant impact if the construction activity occurred outside of the City Municipal Code allowed hours for construction.

During construction, construction vehicles would use Catalina Avenue and the North Access Road, which would increase noise levels. Construction noise levels with traffic would peak at a 54 dBA hourly average during daytime construction hours at Catalina Avenue. Short-period noise levels (e.g., a passing truck) could range up to 62 dBA at the closest residence property line.

During the Design and Construction Phase, construction truck traffic would utilize Penn Street after the North Access Road is constructed to the Landfill and Penn Street. FHWA modeling along Penn Street for the Design and Construction Phase indicates that noise levels would increase by 0.4 dBA CNEL if soil is deposited at the Landfill (so soil trucks do not utilize Penn Street) or by 1.1 dBA CNEL increase if soil trucks use Penn Street (to transport soil to another location). SoundPlan modeling indicates that noise levels along Penn Street would increase by 1.4 dBA, 50 feet from the roadway centerline, during the peak hour if trucks transport soil along Penn Street.

This would be considered a significant impact if the construction traffic occurred outside of the City Municipal Code allowed hours for construction.

Construction of the pipeline along Colima Road would generate noise at nearby residences. This would be considered a significant impact if the construction traffic occurred outside of the City Municipal Code allowed hours for construction. Some portions of the pipeline would be constructed within the County of Los Angeles unincorporated areas. Construction activities in these areas would need to comply with the County Municipal Code requirements as detailed above. Impacts from construction would be similar to the impacts associated with the Loop Trail and pad grading. This would be below the County Municipal Code level of 75 dBA. Failure to comply with County requirements for construction within the County could also be a significant impact.

Mitigation Measures

N-1a *Limit all construction activity at the Project Site (including deliveries and arriving and departing workers) to the hours from 7:00 a.m. to 6:00 p.m., Monday through Friday, and from 8:00 a.m. to 5:00 p.m. on Saturdays and prohibit activities on Sundays and federal holidays. In addition, for construction work within the County of Los Angeles unincorporated areas, the Applicant shall ensure that noise levels do not exceed County municipal code levels with a noise study and monitoring and measures, including high grade mufflers, engine tuning, and management of backup alarms. All contracts with construction personnel shall specify the allowable work hours and the study and monitoring requirements.*

N-1b *Maintain all construction machinery according to the manufacturers' specifications and ensure that mufflers and silencers are maintained properly. Back-up OSHA noise indicators shall be ambient sensitive and self-adjusting to minimize backup indicator noise or flaggers shall be used in the place of backup alarms (as allowed by OSHA).*

N-1c *Relocate the construction parking and staging area farther from the school and residences on Catalina Avenue to an area north of the Ranger Residence or equivalent.*

Residual Impacts

Limiting the construction hours would ensure that the applicable codes for construction-related noise would not be exceeded.

Studies by the FHWA indicate that backup alarms constitute 41 percent of complaints from construction noise (FHWA 2006). Measures to reduce or eliminate the use of backup indicators (some signaling, either alarms or flaggers are required by the Occupational Safety and Health Administration [OSHA]) and to maintain construction equipment would reduce the impact of construction noise on nearby sensitive receptors.

Construction noise could exceed County thresholds for construction along Colima Road within the County of Los Angeles. Noise monitoring, in combination with measures, such as equipment muffling, engine tuning, and management of backup alarms, would reduce the impacts to less than significant.

The staging and parking area would be in close proximity to residences and the school. Although noise calculations, including construction time limits, indicate that noise levels would be less than significant with mitigation, equipment loading and unloading at the staging and parking area could create periodic disturbances for nearby residences and the school. Relocating the staging and parking area north of the Ranger Residence would reduce these impacts on the school and the residences.

Residual noise impacts would be less than significant with mitigation.

Impact #	Impact Description	Phase	Residual Impact
N.2	Drilling activities during the Drilling and Testing Phase would increase noise levels in the area.	Drilling and Testing Phase	Less Than Significant With Mitigation

This study estimated noise impacts with standard noise propagation equations codified into complex computer models that take into account noise reduction and attenuation due to barriers (e.g., man-made walls, hills, and other natural obstructions), weather effects, and ground absorption. The model used was SoundPlan, which is a commonly used high level noise assessment model in the acoustical industry. Results of the calculations are CNEL and peak-hour noise contours that estimate which areas would experience noise levels above a given threshold.

Large diesel engines used for drilling would likely be the noisiest activity associated with the proposed Project. Drilling operations continue during evening and nighttime hours, exacerbating the noise impacts. Regulatory restrictions on noise are stricter during evening and nighttime than during daytime.

Major noise sources associated with drilling activities include metal-on-metal contact, internal combustion engines, electric motors, drawworks brakes, the mud shakers and mixers, warning devices (e.g., equipment backup alarms, H_2S monitors), and personnel communicating instructions and commands.

During drill pipe and casing handling on a drilling rig, common metal-on-metal contact activities include:

- Tongs making up or breaking out drill pipe;
- Elevators clanging against drill pipe that is either being picked up to be lowered into the hole or pulled out of the hole;
- Picking up drill pipe or casing from trailers to be set on racks to be run in the hole;

- Moving the drill pipe or casing from pipe racks adjacent to the rigs pipe walk to the pipe walk and then pulling it up the V-doors (area to catch pipe as it swings to the vertical near the rig floor) to the drilling rig floor;
- Making up the drill pipe or casing; and
- Picking up tools from the pipe walk to the rig floor, such as cementing heads or hydraulic pipe tongs used to make up casing.

Most of the metal-on-metal noise generated on the rig would be at ground level and from the rig floor. The only source of noise above the rig floor would be at the boards, partway up the drilling rig, where the derrick man would use the pipe elevators to engage or disengage stands of drill pipe as it is pulled from or lowered into the hole.

Metal-on-metal noise can be characterized as clanking sounds varying in duration and sound level. Since the clanking noise is loud and short in duration, it may be perceived as more annoying than steady noise from other sources.

Additional noise sources associated with drilling operations include:

- Internal combustion engines, including the drilling rig diesel generators, crane engines, truck engines associated with the slickline unit, well logging, cementing unit, and the coil tubing unit;
- Internal combustion engines associated with the mud pumps and drawworks;
- The mud and cutting shaker and separator that separates drilled cuttings from drilling mud; and
- Drawworks brakes that stop the lowering or raising of pipe.

This equipment, at various locations and different heights within the drilling site, would not be above the drilling rig floor.

Several equipment pieces are truck-mounted (see Section 2.0, Project Description) and therefore would be slightly elevated. Other equipment would be located on the drill floor, at a height of 19 feet for the Kenai Drilling number 14 rig.

The drilling rig and most of the associated drilling equipment would be diesel powered. The proposed diesel engines are those for the drilling rig mud pumps, the drawworks, and the rig generator. Additionally, the cementing equipment, slickline, wireline equipment, crane, and coil-tubing unit are used less frequently and are mounted on trucks and use the truck engines for power.

Miscellaneous small hydraulic-powered equipment (e.g., shakers) would be powered by electricity from diesel-powered generators.

The slickline, well–logging, and cementing unit and the coil tubing units would not be used at the same time the drilling rig is operating since they perform services on the well when pipe is not being drilled. The crane is used only for moving pipe and is assumed to operate 20 percent of the time. All other equipment is assumed to operate 90 percent of the time. The metal-on-metal noise and backup alarms are assumed to have a duration of 1 second and to occur 500 times per day. Back-up alarm noise levels are assumed to be 5 dBA more than the crane's peak noise level.

Noise from the equipment, particularly the equipment at the drilling site ground level, would be partially attenuated by the terrain. This effect is included in the noise model.

Several studies were examined to estimate the noise levels from the drilling equipment, including studies conducted on drilling sites by the Bureau of Land Management and studies in Los Angeles urban areas by Arup Acoustics and Behrens and Associates (BLM 2001). Kenai Drilling also provided some noise monitoring data from the drilling rig (Dubbink 2009) that was gathered to ensure OHSA compliance with worker hearing protection requirements.

Bureau of Land Management drilling noise studies indicate noise levels from drilling of 83 dBA at 50 feet (BLM 2001). A noise study performed for drilling operations in Los Angeles at the Baldwin Hills oilfield indicates equivalent noise levels of 82 dBA from drilling operations (Arup Acoustics 2004). However, information on the specific activities undertaken and details of the equipment arrangements, such noise reduction techniques, were not available for these studies, so a direct comparison is not possible.

The Baldwin Hills Environmental Impact Report (EIR), prepared for an urban oilfield development in Los Angeles County, conducted noise monitoring of ongoing drilling activities and pumping units (Los Angeles County 2009). Noise levels during drilling, casing, and cementing activities were 77, 73, and 80 to 82 dBA at 50 feet, respectively. Additional noise monitoring at the Baldwin Hills by Behrens and Associates indicated that noise levels associated with drilling range up to 80 dBA 50 feet from drilling equipment.

Studies associated with the Matrix Honolulu Terrace facility also indicated an L_{eq} (short period) of 100 dBA from metal-on-metal activities 50 feet from the drilling activities (Arup Acoustics 2006).

A wide range of literature is available for noise emissions from specific equipment pieces, such as diesel engines and backup alarms. These sources include the EPA and the FHWA, as well as noise studies conducted for general plans, various other EIR, and manufacturer information (EPA 1971, FHWA 2006).

As a worst case, this study compiled noise estimates for each piece of equipment and activity and assigned noise levels and associated use factors. Estimating noise levels from each piece of equipment, as opposed to assigning a noise level for the entire drilling process, has the advantage of identifying which pieces of equipment are creating impacts and might require mitigation. Table 4.8-7 lists these noise sources, the noise levels, and use factors. The large diesel engine (the mud pumps, generator, and the drawworks engines) noise levels are based on Kenai Drilling Company noise monitoring within the rig area.

In addition to the noise sources listed in Table 4.5-8, trucks and other vehicles that visit the Processing Facility Area and the Well Area were calculated in the model using the vehicle types and traffic levels from Section 2.0, Project Description. These sources generate noise at the Project Site and along Catalina Road (or the North Access Road depending on the phase of drilling). The noise model takes into account the terrain and grade of the road and it corrects the vehicle noise accordingly; for example, trucks laboring uphill produce more noise than trucks on a level surface.

Table 4.5-8 Drilling Activities Equipment Specific Noise Sources

Equipment	Equipment Quantity	Peak Day, Fraction of Time Used	Sound Level at 50 feet (dBA)	Location	Source
Mud Mixer	1	0.9	76	Ground Level	Kenai Drilling. Measured value from shaker/mixer area
Mud Pumps and Diesel Engines, Caterpillar C-15	2	0.9	69	Ground Level	Kenai Drilling. Measured value from mud pump area
Slickline Engine *	1	0.2	86	Truck-mounted	EPA, 71, Hwy truck, <35 mph
Shakers	2	0.5	69	Ground Level	Kenai Drilling. Measured value from mud pump area
Well-logging Unit Cementing *	1	0.2	86	Truck-mounted	EPA, 71, Hwy truck, <35 mph
60-ton Crane	1	0.2	81	Ground Level	FHWA Construction Equipment Noise
Coil Tubing Unit *	1	0.2	86	Truck-mounted	EPA, 71, Hwy truck, <35 mph
Backup Alarms, Voices, Annunciators	1	0.030	94	Ground Level	OSHA, 5 dBA above crane level
Metal-on-Metal noise	1	0.006	100	Ground Level	Arup Acoustics, Whittier, maximum banging
Metal-on-Metal noise	1	0.006	100	Rig floor	Arup Acoustics, Whittier, maximum banging
Metal-on-Metal noise	1	0.006	100	Boards	Arup Acoustics, Whittier, maximum banging
Cutting Conveyor	1	0.9	69	Rig floor	Kenai Drilling. Measured value from mud pump area
Drill Rig Engines, Caterpillar C-15	1	0.9	84	Ground Level	Kenai Drilling. Measured value from generator house inside (no control)
Drawworks Engines, Caterpillar C-15	1	0.9	74	Rig floor	Kenai Drilling. Measured value from drawworks area
Drawline Brakes	1	0.030	80	Rig floor	Arup Acoustics, pipe handling

Notes: * Equipment used for servicing the well and not included in the peak day noise scenario.
Sources: EPA 1971, FHWA 2006, Arup 2006, Los Angeles County 2009, Dubbink 2009

SoundPlan noise modeling indicated that noise levels 50 feet from the drilling equipment arrangement listed in Table 4.5-7 would be approximately 85 dBA L_{eq}. This noise level is somewhat higher than that measured near drilling operations in Los Angeles. However, this level does not include any mitigation (e.g., noise barriers) and is, therefore, considered a conservative, worst-case unmitigated analysis.

Table 4.5-9 and Figure 4.5-4 show the results of the noise modeling. The highest noise levels would be encountered at the Ranger Residence and the recreational sensitive receptors within the Preserve along the Loop Trail. The greatest impact on residential sensitive receptors would be at the Romero Drive, Lodosa Drive, and Catalina Avenue receptors.

Figure 4.5-4 shows the peak hour noise contours.

Table 4.5-9 Noise Level at Receptors – Proposed Project Test Drilling Well Pad - No Mitigation

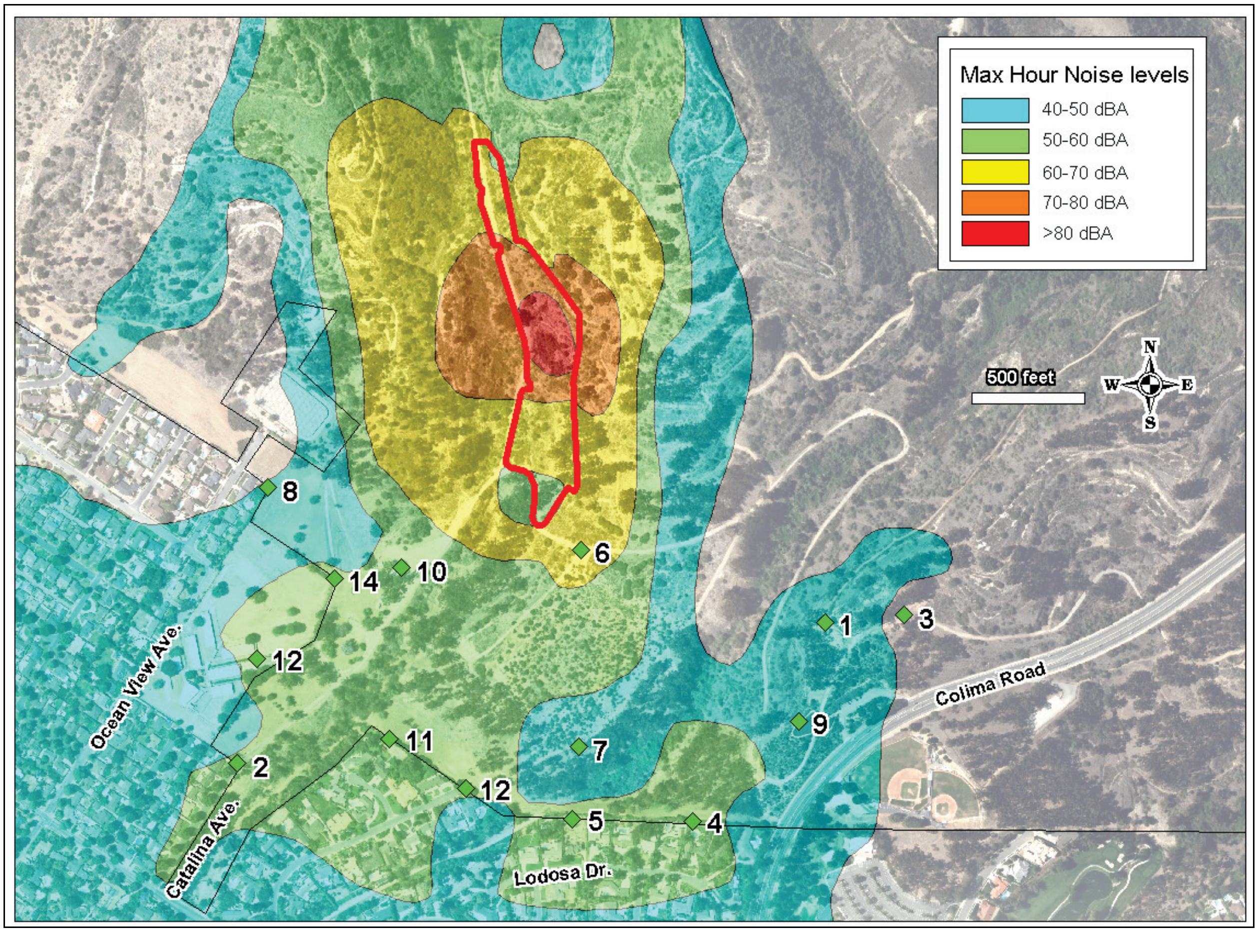
#	Receptor	CNEL (dBA)	L_{eq}, Peak Hour (dBA)	Exceed General Plan Limit? (Limit)	Peak Hour Increase over Baseline (dBA) (Sig ?)
1	Amphitheater	57.5	48.0	No (70)	0.3 (No)
2	Catalina Avenue	58.2	52.7	No (60)	5.0 (Yes)
3	Tunnel at Colima	57.4	47.8	No (70)	0.1 (No)
4	Lodosa Drive East	55.7	49.2	No (60)	1.5 (No)
5	Lodosa Drive Mid	58.1	51.9	No (60)	4.2 (Yes)
6	Loop Trail	67.4	61.3	No (70)	14.8 (Yes)
7	Loop Trail South	55.2	48.2	No (70)	1.7 (No)
8	Ocean View Avenue	54.1	47.3	No (60)	0.9 (No)
9	Overlook	57.5	48.1	No (70)	0.4 (No)
10	Ranger Residence	61.6	55.7	Yes (60)	8.0 (Yes)
11	Romero Drive	57.4	51.1	No (60)	3.4 (Yes)
12	San Lucas Drive	53.1	45.1	No (60)	2.0 (No)
13	School Building	55.2	48.6	No (65)	0.9 (No)
14	School Yard	54.5	47.9	No (65)	1.5 (No)

Notes: CNEL and L_{eq} peak hour are combined with the background CNEL and peak hour L_{eq}. The peak hour increase is the increase over the lowest value measured during monitoring. Receptor number correlates with the corresponding noise contours map. Table reflects impacts without mitigation.

The primary contributors to noise levels are large diesel engines (e.g., mud pumps, diesel generators, drawworks engine), the cutting conveyer, and pipe clanging at the boards on the drilling rig.

Drilling traffic contributes to the noise impacts to residences along Catalina Avenue during the test drilling to levels averaging an L_{eq} peak hour of approximately 45 dBA 50 feet from the roadway. Traffic impacts on receptors are included in the noise levels listed in Table 4.5-9.

Figure 4.5-4 Maximum Hour Noise Contours – Proposed Project Test Drilling – No Mitigation



Note: Figure reflects impacts without mitigation.

In combination with the existing baseline levels, peak hour noise levels at only the residential receptors would increase by an average of almost 3 dBA (not including the Ranger Residence or trail receptors) with the range from less than 1 dBA along Ocean View Avenue to 5 dBA along Catalina Ave.

Noise levels at the Loop Trail location closest to the drilling activities would increase by more than 14 dBA over the minimum baseline peak hour.

Noise increases over baseline would exceed the General Plan levels at the Ranger Residence and the 3 to 5 dBA increase, listed in Table 4.5-9, would be exceeded at multiple locations. This would be a significant impact.

Extensive noise control measures could be implemented to reduce noise levels. These measures, used at other oilfields, such as Baldwin Hills, are proven to substantially reduce noise levels.

Mitigation Measures

N-2a The Applicant shall develop and implement a Noise Reduction Plan for all drilling (testing, development, and re-drills and workovers) to ensure that the L_{eq} *noise levels from activities, measured as a 1-hour* L_{eq}*, is less than a 3-dBA increase at the closest sensitive residential receptor and less than a 5-dBA increase at the closest sensitive recreational receptor. The Plan shall be prepared by an acoustic consultant approved by the City and the Plan shall be subject to City review and concurrence. The measures in the Plan shall include but not be limited to the following: (1) enclose the drill rig area in soundproof barriers 30 feet high on the south and west sides; (2) utilize a central generator type drilling rig, with the generators the only diesel engines onsite and enclosed in a soundproofed generator house with appropriate grade muffler systems, or install sound enclosures around all diesel engines with appropriate grade muffler systems; (3)install noise barriers around the drill rig floor, mud mixers, cleaners, conveyers, and shakers; (4) enclose drawworks brake area with soundproofing shroud; (5) install pads on V-door and other appropriate areas, timbers and pads on drill deck, pads between drill and casing pipe while in storage, and pad and timbers at the boards on the mast to reduce metal-on-metal noise (for both drilling and workover operations); (6) enclose the drilling mast boards area (on drilling and workover rigs) with barriers 2 inches thick and 2 pounds per square foot in density at least 5 feet above and below any noise sources; and (7) install ambient sensitive backup indicators on all equipment requiring backup indicators.*

N-2b The Applicant shall institute a quiet-mode for all drilling activities between 7 p.m. and 7 a.m. Quiet-mode operation would apply to both drilling and operations and would involve: (1) using signalers for all backup operations instead of backup alarms and turning off backup alarms; (2) using radios instead of voice communication; (3) minimizing crane use and pipe handling operations, pipe offloading from trucks and board loading during daytime to the maximum extent feasible and nighttime loading only for safety reasons; (4) prohibiting material and supply deliveries to the Project Site between the hours of 7 p.m. and 7 a.m., with exceptions only for safety; and (5) limiting process alarms and communications over the broadcast system to the maximum extent feasible during all operations and use only for safety reasons.

N-2c Provide a comprehensive noise abatement study, including noise and vibration monitoring at nearby sensitive receptors, under contract and supervision of the City, to monitor noise and vibration from the drilling and operations in the community, which shall have the authority to shut-down operations and require additional mitigation if the noise criteria are exceeded.

Residual Impacts

The noise reduction methods in the mitigation measures are established practices in the drilling industry that reduce noise levels in urban drilling situations. Figure 4.5-5 provides photographs of several mitigation measures in place on various drilling rigs.

The barrier blankets range in size from 1 to 2 inches thick and density from 1 to 2.5 pounds per square feet. The thicker, denser material achieves greater sound reduction. A sound enclosure differs from a sound barrier because a sound enclosure surrounds the entire piece of equipment, can be made from wood and various thicknesses of sound absorbing material, and is effectively a container in which the equipment is placed (i.e., similar to a generator house). A sound barrier is a wall erected out of sound barrier blanket material (as seen in Figure 4.5-5) or solid material.

Several companies produce exhaust systems that reduce noise from heavy-duty diesel engines; these systems could be used to reduce the noise from diesel engines used during drilling operations. These systems have a range of noise reduction levels and they can attenuate the exhaust noise by 23 to 35 dBA.

Generally, noise reduction levels associated with barriers are approximately 8 to15 dBA, depending on proximity to the equipment (Arup 2004, Soundseal 2009). Measurements at Baldwin Hills oil field indicate that a 30-foot high noise barrier wall and a steel support structure with noise barrier blankets can reduce noise levels by at least 8 dBA. Noise blankets immediately adjacent to and around noise sources, such as the mud pit area, can reduce noise levels by more than 15 dBA.

A variety of companies produce enclosures that can reduce noise levels by as much as 23 dBA. If the enclosures are insulated with additional foam, noise reduction could increase by 6 to 8 dBA (up to 31 to 33 dBA). Measurements taken at Kenai rigs by Kenai Drilling indicate that a generator house can reduce noise levels by at least 13 to 15 dBA.

The following assumptions were made related to noise mitigation levels:

- Installing a 30-foot barrier wall with blankets on the west and south sides of the drilling site would attenuate noise levels by 8 dBA (the east and north sides of the drilling site are encompassed by retaining walls ranging in height from 20 to 40 feet) ;
- Installing barrier blankets immediately adjacent to a noise source would attenuate noise levels by 10 dBA;
- Installing an enclosure with barrier blankets or other equivalent sound absorption material would attenuate noise levels by 15 dBA for all diesel engines and 20 dBA for generators within a generator house with appropriate sound insulation;
- Using ambient-sensitive backup alarms and reducing use of backup alarms and annunciators would decrease noise levels by 5 dBA; and
- Using pads and boards to reduce metal-on-metal noise levels would reduce noise levels by 15 dBA.

Table 4.5-10 and Figure 4.5-6 show impacts at the receptors after the applied mitigations.

Figure 4.5-5 Example Photographs of Noise Mitigation Measures

Pads on the Pipe Storage Area and the V-door

Pads on the Drill Floor

Sound Barrier Around Mast Boards

Pads and Boards Between Pipe

Figure 4.5-5 Example Photographs of Noise Mitigation Measures (continued)

Sound Barrier Wall Around Equipment

Sound Cover on Drawworks Brakes

Sound Barriers Around Mud Works and Pumps

30-Foot Sound Barrier Wall Around Drilling Area

Table 4.5-10 Noise Level at Receptors – Proposed Project Drilling Mitigated

#	Receptor	CNEL (dBA)	L_{eq}, Maximum Hour (dBA)	Exceed General Plan Limit? (Limit)	Peak Hour Increase (dBA) (Sig ?)
1	Amphitheater	57.4	47.7	No (70)	0.0 (No)
2	Catalina Avenue	54.8	49.5	No (60)	1.8 (No)
3	Tunnel at Colima	57.4	47.7	No (70)	0.0 (No)
4	Lodosa Drive East	54.6	47.8	No (60)	0.1 (No)
5	Lodosa Drive Mid	54.7	47.9	No (60)	0.2 (No)
6	Loop Trail	55.5	48.4	No (70)	1.9 (No)
7	Loop Trail South	54.1	46.6	No (70)	0.1 (No)
8	Ocean View Avenue	53.5	46.4	No (60)	0.0 (No)
9	Overlook	57.4	47.7	No (70)	0.0 (No)
10	Ranger Residence	54.9	48.4	No (60)	0.7 (No)
11	Romero Drive	54.6	47.8	No (60)	0.1 (No)
12	San Lucas Drive	52.1	43.2	No (60)	0.1 (No)
13	School Building	54.5	47.7	No (65)	0.0 (No)
14	School Yard	53.5	46.5	No (65)	0.1 (No)

Note: Receptor number correlates with the corresponding noise contours map.

Regardless of mitigation, these noise levels would occur during day and night because drilling would occur 24 hours per day. The highest noise levels from drilling would occur at the Loop Trail and the Ranger Residence and along Catalina Avenue due to traffic. The largest contributors to the noise levels after mitigation would be diesel generators, the cutting conveyer, backup alarms, and annunciators.

Noise levels 50 feet from the drilling operation, inside the 30-foot noise wall, would be reduced to 77 dBA max hour Leq with the recommended mitigations.

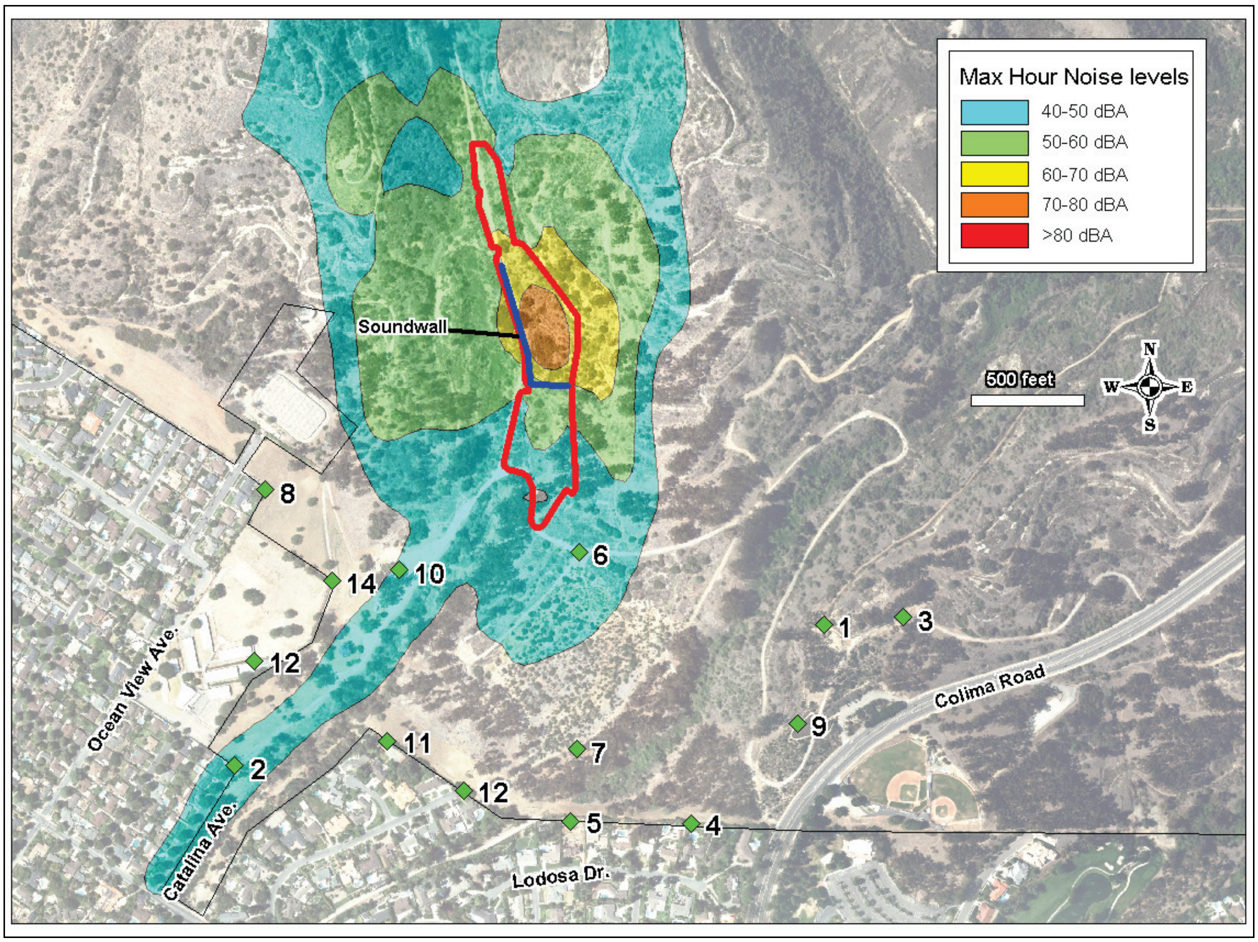
These estimates of noise levels are comparable to actual, measured values at the Baldwin Hills oilfield, which utilizes a similar list of mitigation measures. At residences 750 feet from the mitigated Baldwin Hills drilling operations, noise levels from drilling are less than 40 dBA during the maximum hour drilling operations. The closest residences to the Well Area drilling operations (aside from the Ranger Residence) would be at Ocean View Avenue (approximately 1,460 feet), Romero Road (1,900 feet), and Catalina Avenue (2,400 feet). The Loop Trail receptor is approximately 870 feet from the drilling activities and the noise level from the Project contribution (without the baseline) during the peak hour at the Loop Trail is estimated to be approximately 43 dBA, which is comparable to noise levels estimated at the Baldwin Hills Oilfield with drilling mitigation.

Some of the mitigation measures recommended for the Project have been implemented at the existing, operating Matrix Honolulu Terrance facility. Documented complaints regarding noise from the Honolulu Terrace facility range 100 feet to approximately 1,000 feet from the facility site. Most complaints originate within 500 feet of the site.

The proposed Project equipment arrangement would be similar to Honolulu Terrace operations, except that the Honolulu Terrace facility is in very close proximity to residences; drilling occurs within approximately 100 feet of residences and that facility only utilizes a subset of the extensive range of noise control devices recommended for this Project .

Peak hour mitigated noise level increases at the residential receptors only (not including the Ranger residence or trail receptors) would average 0.4 dBA increase ranging up to a 1.8 dBA increase along Catalina (primarily due to traffic).

Figure 4.5-6 Maximum Hour Noise Contours – Proposed Project Test Drilling – Mitigated



The mitigation measures would reduce the noise levels at the nearest residence and at all sensitive receptors to below levels specified in the General Plan and would prevent noise levels from increasing by more than 3 to 5 dBA at all receptor locations The impacts of drilling would be less than significant with mitigation. Even though hourly average noise levels are less than the significance criterion, periodic noises would still be heard. Annunciators and pipe clangs, even with the mitigation measures, would be heard for short durations.

Impact #	Impact Description	Phase	Residual Impact
N.3	Project activities would increase vibration levels in the area.	Operations and Maintenance	Less than Significant

Project activities could increase ground vibration and create annoyance for humans. Vibration levels from drilling activities could produce the highest vibration levels and were estimated at the closest sensitive receptor. Vibration from drilling was assumed to have point source propagation characteristics, as described by the Federal Transit Administration (FHWA 2006). As drilling activities include equipment delivery, setup, drilling and breakdown, a range of activities could produce vibrations. As a worst case, vibrations data from a pile driver and sheetpiling were used to approximate drilling vibrations. Most likely, the vibration levels due to drilling would be less than this level, as some limited studies of vibration near drilling rigs indicates that drilling produces substantially lower levels of vibration than pile driving. However, due to the uncertainties related to the use of different drilling rigs, the range of different activities during equipment set-up and break-down, and the propagation of vibrations within different soils and the different geologies of the site, pile driving has been used as a worst case analysis. The vibration levels, if experienced at all, would be of very short during and may occur only once during the entire drilling program.

Vibration levels for impact pile drivers are based on studies by the Federal Transportation Administration (FHWA 1995). Under normal propagation in soil conditions, vibration levels at residences 100 feet from the drilling (i.e., the Ranger Residence) would be 0.19 inches per second, which are greater than the County of Los Angeles Code significance criteria of 0.01 inches per second. This would be a potentially significant impact if receptors were within 700 feet of the drilling. However, the Ranger Residence is more than 700 feet from the drilling activities (approximately 1,000 feet). Therefore, this would be a less than significant impact.

Large vehicles can also increase ground vibration along streets they travel, although those vibration levels would be substantially less than those from a pile driver. Vibration is a function of vehicle speed and the condition of the pavement. CalTrans indicates that “vehicles traveling on a smooth roadway are rarely, if ever, the source of perceptible ground vibration” and that “vibration from vehicle operations is almost always the result of pavement discontinuities, the solution is to smooth the pavement to eliminate the discontinuities” (CalTrans 2004). Truck travel on area roadways could cause vibrations at nearby residences if roadways are not maintained. Mitigation measures T-1a (ensuring speed limits are posted along Catalina Avenue) and T-1e (implementing a pavement monitoring requirement to ensure that roadway pavement is maintained and free of discontinuities) would mitigate this potentially significant impact.

Vibration levels could exceed the significance criteria for residences within 700 feet of the drilling site. Since no residences are located this close to the facilities, this would be a less than significant impact.

Impact #	Impact Description	Phase	Residual Impact
N.4	Operational activities would increase noise levels in the area.	Operations and Maintenance	Less Than Significant With Mitigation

Operational activities would include pumps and compressors at the Processing Facility Area and at the Well Area, as well as transformers, heaters, air coolers, annunciators, and equipment at the Gas Plant Area. Table 4.5-11 lists the noise-producing stationary equipment at the sites and the estimated un-mitigated noise level and the equipment use factor.

Table 4.5-11 Operational Activities Equipment Specific Noise Sources – Proposed Project Operations

Equipment	Equipment Quantity	Peak Day, Time Used	Sound Level at 50 feet (dBA)	Location	Source
Annunciators	1	0.010	94	Processing Area	OSHA, 5 dBA above crane level
Flare	1	0.042	67	Processing Area	EPA 1971 boilers, assumes 1 hour use per day
Water Injection Pump and Motor, 400 hp	1	1.000	71	Processing Area	EPA 1971 high end of pump range
Booster & IGFC Pump and Motor, 25 hp	2	1.000	71	Processing Area	EPA 1971 high end of pump range
Oil Transfer Pump and Motor, 1 hp	1	1.000	71	Processing Area	EPA 1971 high end of pump range
Reject Oil Pump and Motor, 5 hp	1	1.000	71	Processing Area	EPA 1971 high end of pump range
Crude Shipping Pump and Motor, 500 hp	1	1.000	71	Processing Area	EPA 1971 high end of pump range
Compressors, 400hp	2	1.000	86	Processing Area	EPA 1971 high end of compressor range
Compressor Air Coolers	2	1.000	79	Processing Area	FHWA ventilation fan
Amine & EG Air Cooler/Condenser	3	1.000	79	Processing Area	FHWA ventilation fan
DEA Charge Pump and Motor, 65 hp	1	1.000	71	Processing Area	EPA 1971 high end of pump range
DEA Reboiler	1	1.000	67	Processing Area	EPA 1971, boilers
Reflux & EG Pump and Motor, 5 hp	2	1.000	71	Processing Area	EPA 1971 high end of pump range
Refrigeration Unit (compressor)	1	1.000	86	Processing Area	EPA 1971 high end of compressor range
Office Building Ventilation System	1	1.000	74	Well Area	FHWA ventilation fan, reduce 5dbA for smaller size (trailer unit)
Transfer Pump and Motor, 5 hp	1	1.000	71	Well Area	EPA 1971 high end of pump range
Transformers	1	1.000	60	Well Area	ANSI Standard C89.2 max level for 500 kVA
VRU Compressor, 250 hp	1	1.000	86	Well Area	EPA 1971 high end of compressor range
VRU Air Cooler	1	1.000	79	Well Area	FHWA for a ventilation fan

Sources: EPA 1971, FHWA 2006

The resulting noise levels at the receptors are shown in Table 4.5-12. Traffic to and from the site is assumed to utilize both Catalina Avenue and the North Access Road through Penn Street. Traffic levels are those identified in Section 2.0, Project Description.

Table 4.5-12 Noise Level at Receptors – Proposed Project Operations – No Mitigation

#	Receptor	CNEL (dBA)	L_{eq}, Maximum Hour (dBA)	Exceed General Plan Limit? (Limit)	Peak Hour Increase (dBA)
1	Amphitheater	57.7	48.5	No (70)	0.8 (No)
2	Catalina Avenue	61.2	55.5	Yes (60)	7.8 (Yes)
3	Tunnel at Colima	57.5	48.0	No (70)	0.3 (No)
4	Lodosa Drive East	58.9	52.8	No (60)	5.1 (Yes)
5	Lodosa Drive Mid	61.3	55.0	Yes (60)	7.3 (Yes)
6	Loop Trail	68.7	63.1	No (70)	16.6 (Yes)
7	Loop Trail South	57.3	51.0	No (70)	4.5 (No)
8	Ocean View Avenue	54.7	48.1	No (60)	1.7 (No)
9	Overlook	57.8	48.8	No (70)	1.1 (No)
10	Ranger Residence	62.5	56.9	Yes (60)	9.2 (Yes)
11	Romero Drive	60.2	54.3	Yes (60)	6.6 (Yes)
12	San Lucas Drive	54.9	47.6	No (60)	4.5 (Yes)
13	School Building	55.6	49.3	No (65)	1.6 (No)
14	School Yard	56.0	50.1	No (65)	3.7 (No)

Notes: Receptor number correlates with the corresponding noise contours map. Table reflects impacts without mitigation.

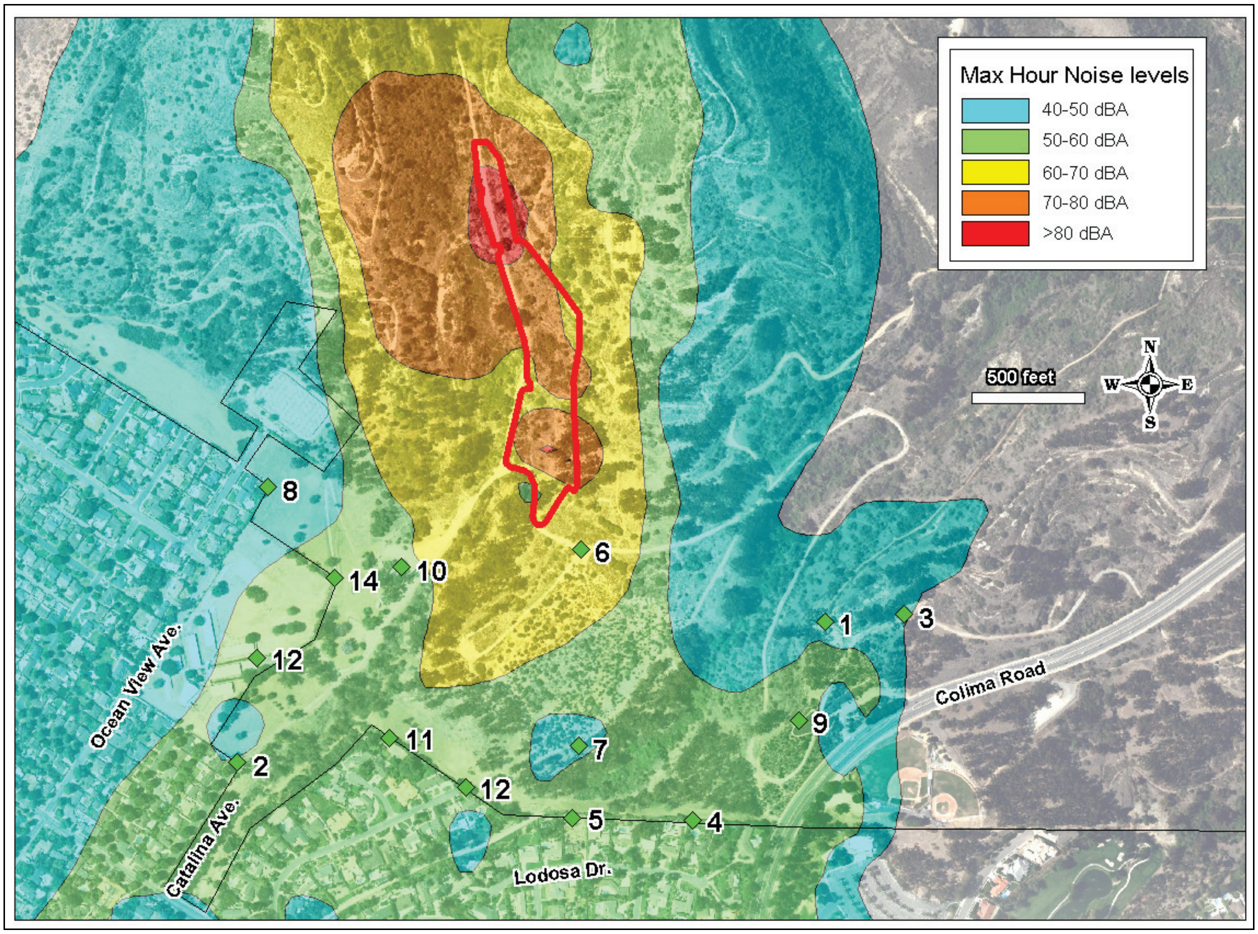
Noise levels would increase at all receptor locations compared to the lowest baseline levels measured. For example, at the overlook near the Preserve parking lot, noise levels would increase over the low nighttime baseline values, but during the daytime baseline noise levels are 9 dBA higher due to traffic on Colima Road and the increase in noise levels would be minimal. Operations would be similar during day and night.

Unmitigated noise levels 50 feet from the gas plant processing equipment would be approximately 90 dBA within the Gas Plant Area wall.

Noise levels along traffic routes would remain below the 45-dBA peak-hour average due to the relatively low traffic levels.

Figure 4.5-7 shows the noise contours for the proposed Project operations.

Figure 4.5-7 Maximum Hour Noise Contours – Proposed Project Operations – No Mitigation



Note: Figure reflects impacts without mitigation.

Peak-hour noise level increases at the residential receptors only (not including the Ranger Residence or trail receptors) would average almost 6 dBA during the nighttime, ranging from a 1.7-dBA peak-hour increase along Ocean View Avenue to a 7.8-dBA peak-hour increase along Catalina Avenue.

Noise levels at the Loop Trail would increase by more than 16 dBA during the peak hour, which would be clearly noticeable.

Project operations would increase CNEL levels at multiple locations and the maximum hour noise levels would increase by more than 3 to 5 dBA at most locations, exceeding the limits defined in the General Plan and the thresholds. This would be a significant impact.

Mitigation Measures

N-4 The Applicant shall develop and implement a Noise Reduction Plan for all operations to ensure that L_{eq} noise levels from operational activities, measured as 1-hour L_{eq}, produce less than a 3 dBA increase over the minimum baseline hourly average level at the closest residential receptor to the facility. The measures in the Plan shall include, but not be limited to: (1) installing sound enclosures or buildings around all compressors; (2) installing noise barriers around all pumps and air coolers; (3) installing ambient-sensitive backup indicators on all equipment requiring backup indicators; (4) installing sound enclosures or buildings around all the oil area pumps (e.g., shipping, IGFC, water injection, water booster, reject pumps); (5) installing sound enclosures or buildings around refrigeration units; (6) installing a secondary, 16-foot tall sound wall on the south, west and north sides of the gas plant; (7) ensuring that all office equipment (i.e., air conditioners, heating, ventilation) produces low noise levels or is surrounded by noise barriers; and (8) limiting traffic on the North Access Road to only from 7 a.m. to 7 p.m., except for emergencies.

Residual Impacts

The noise reduction methods in the mitigation measures are established practices to reduce noise levels in urban situations in the oil and gas industry.

The largest noise sources, the compressors and largest pumps, would be enclosed and insulated with noise barriers or solid noise-attenuation material. This type of structure would reduce noise levels 23 to 33 dBA.

Additional noise sources include various pumps at the Well Area and at the air coolers used to cool process streams. Noise barriers would be installed around these sources to minimize the noise levels. The refrigeration unit would also be enclosed in a noise barrier or building or placed inside the compressor building.

Even with these mitigation measures, noise levels at the public Deer Loop Trail could exceed the significance criteria. Therefore, a 16-foot tall noise wall would be installed on the south, west, and north sides of the Gas Plant equipment. This wall would not only reduce noise levels at the Loop Trail recreational receptor, but it would reduce noise levels within the Preserve and canyon area, which would reduce impacts on biology (see Section 4.2, Biological Resources).

The following assumptions were made related to noise mitigation levels:

- Soundproofed compressors and pump buildings would attenuate noise levels by 20 dBA;
- Soundproofed refrigeration unit buildings would attenuate noise levels by 20 dBA; and
- Sound walls around all pumps and air coolers would attenuate noise levels by 10 dBA.

Impacts at the receptors after the applied mitigations are shown in Table 4.5-13 and corresponding noise contours are shown in Figure 4.5-8. Noise levels 50 feet from the gas plant equipment would be reduced to 77 dBA for the maximum hour within the Gas Plant Area wall.

Peak hour mitigated noise levels at the residential receptors would increase by less than 0.5 dBA (not including the Ranger Residence or trail receptors), and would range up to an increase of 1.3 at Catalina Avenue due primarily to Project traffic.

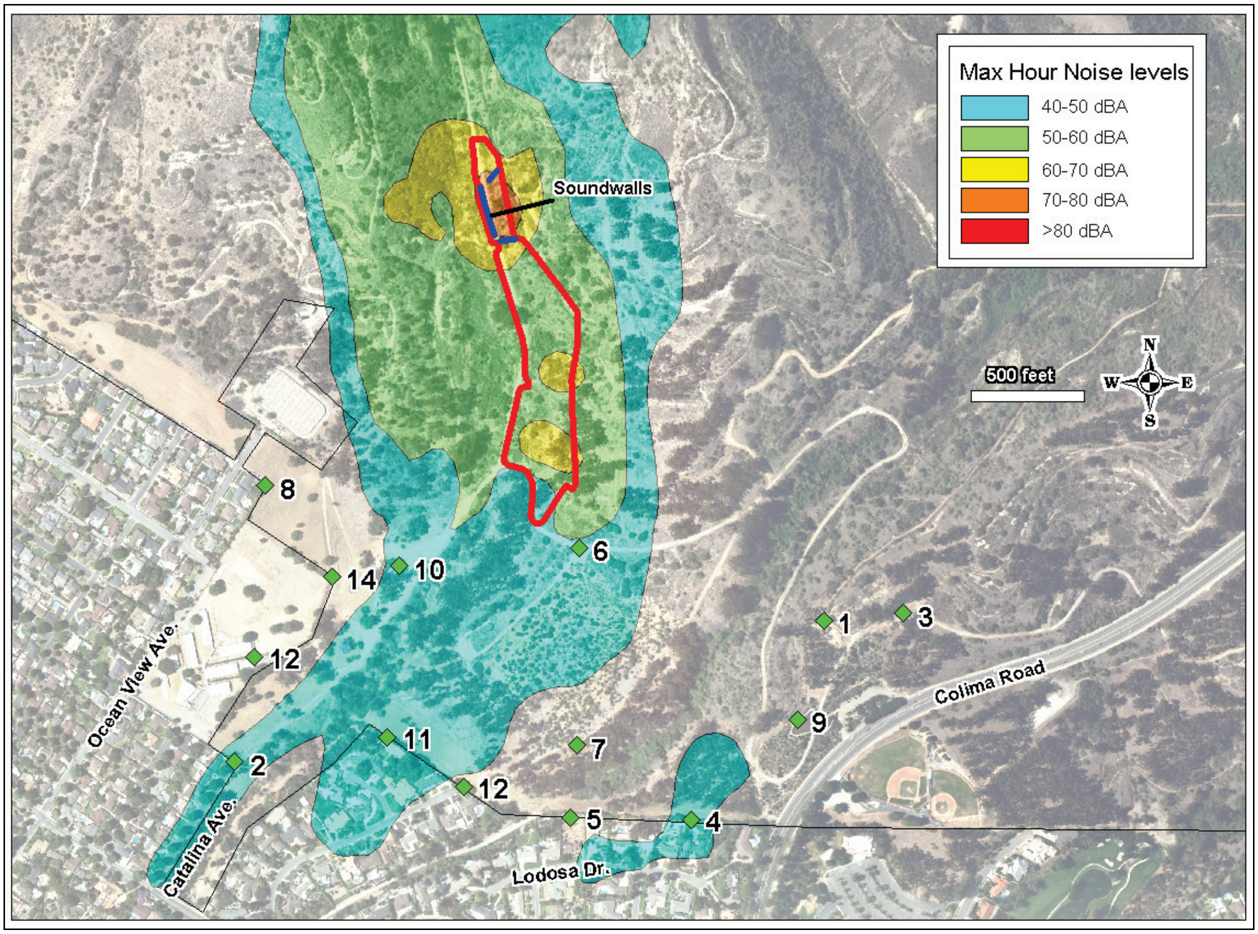
Noise levels at the Loop Trail, the closest area to the Project activities, would increase by less than 5 dBA during the peak hour.

Impacts would be less than the CNEL specified by the General Plan for all receptors, and all receptors would experience less than a 3- to 5-dBA noise level increase. Mitigation measures N-2b and N-2c would also apply to operations. With mitigation, the impacts would be less than significant.

Table 4.5-13 Noise Level at Receptors – Proposed Project Operations Mitigated

#	Name	CNEL (dBA)	L_{eq}, Maximum Hour (dBA)	Exceed General Plan Limit? (Limit)	Peak Hour Increase (dBA)
1	Amphitheater	57.4	47.7	No (70)	0.0 (No)
2	Catalina Avenue	54.8	49.0	No (60)	1.3 (No)
3	Tunnel at Colima	57.4	47.7	No (70)	0.0 (No)
4	Lodosa Drive East	54.6	47.9	No (60)	0.2 (No)
5	Lodosa Drive Mid	54.8	48.1	No (60)	0.4 (No)
6	Loop Trail	57.2	50.8	No (70)	4.3 (No)
7	Loop Trail South	54.2	46.7	No (70)	0.2 (No)
8	Ocean View Avenue	53.5	46.5	No (60)	0.1 (No)
9	Overlook	57.4	47.7	No (70)	0.0 (No)
10	Ranger Residence	55.2	48.6	No (60)	0.9 (No)
11	Romero Drive	54.7	48.0	No (60)	0.3 (No)
12	San Lucas Drive	52.2	43.3	No (60)	0.2 (No)
13	School Building	54.6	47.8	No (65)	0.1 (No)
14	School Yard	53.6	46.6	No (65)	0.2 (No)

Figure 4.5-8 Maximum Hour Noise Contours –Proposed Project Operations Mitigated



Impact #	Impact Description	Phase	Residual Impact
N.5	Concurrent operational activities and drilling activities during periods of the Project would increase noise levels in the area.	Drilling and Testing, Operations and Maintenance	Less than Significant with Mitigation

During the test phase drilling of the proposed Project, drilling would occur at the Well Area; however, the Processing Facility Area and Gas Plant Area would not yet be constructed and would not be operating. This is the scenario addressed under impact N.2.

If the test wells prove to be viable, the Processing Plant Area and Gas Plant Area would be constructed and drilling would thereafter commence at the Well Area. This drilling would last for at least an estimated 5 years and during this time, both drilling and processing noise would occur simultaneously. After 5 years, or until the Applicant drills all the initial wells, drilling would occur periodically (up to 3 months per year) to re-drill wells.

In addition, well workovers would use a smaller, truck mounted portable drilling rig. The truck engines would power this rig to service the wells. Noise levels from workover rigs would be substantially less than from the full-sized rig, but they could introduce some increase in noise levels similar in magnitude to a truck engine. Workovers would not occur at the same time as drilling.

During the drilling period and re-drills, both operations and drilling would affect noise levels, which have been discussed independently. Table 4.5-14 and Figure 4.5-9 present the results of modeling for concurrent drilling and operations. Modeling indicates that drilling would increase noise levels at the Deer Loop Trail receptor, at Catalina Avenue (primarily due to traffic), and at all other receptors by less than the significance criteria. Impacts would therefore be less than significant with mitigation.

Mitigation Measures

Implement mitigation measures N-1a and N-1b, N-2a through N-2c, and N-4.

Residual Impacts

With implementation of the recommended mitigation measures, impacts would be less than the significance criteria of a 3- to 5-dBA increase at sensitive receptors, either the Deer Loop Trail or residences. This would be a less than significant impact with mitigation.

Table 4.5-14 Noise Level at Receptors – Concurrent Operations and Drilling Mitigated

#	Name	CNEL (dBA)	L_{eq}, Maximum Hour (dBA)	Exceed General Plan Limit? (Limit)	Peak Hour Increase (dBA)
1	Amphitheater	57.4	47.8	No (70)	0.1 (No)
2	Catalina Avenue	54.9	49.1	No (60)	1.4 (No)
3	Tunnel at Colima	57.4	47.7	No (70)	0.0 (No)
4	Lodosa Drive East	54.7	47.9	No (60)	0.2 (No)
5	Lodosa Drive Mid	54.8	48.1	No (60)	0.4 (No)
6	Loop Trail	57.2	50.9	No (70)	4.4 (No)
7	Loop Trail South	54.2	46.7	No (70)	0.2 (No)
8	Ocean View Avenue	53.5	46.5	No (60)	0.1 (No)
9	Overlook	57.4	47.8	No (70)	0.1 (No)
10	Ranger Residence	55.4	48.9	No (60)	1.2 (No)
11	Romero Drive	54.8	48.0	No (60)	0.3 (No)
12	San Lucas Drive	52.1	43.3	No (60)	0.2 (No)
13	School Building	54.6	47.8	No (65)	0.1 (No)
14	School Yard	53.6	46.7	No (65)	0.3 (No)

4.5.3.1 Other Issue Area Mitigation Measure Impacts

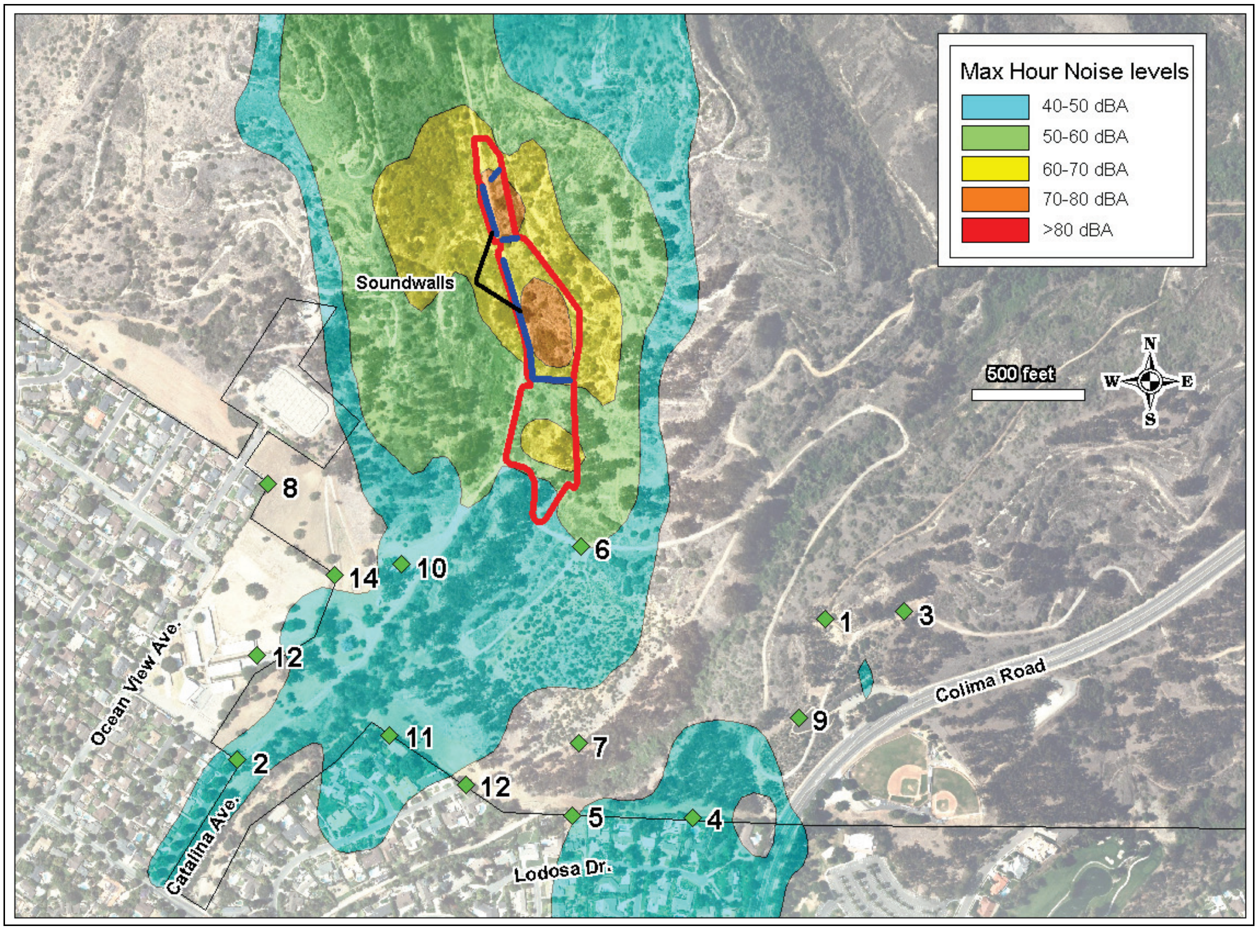
Mitigation measures proposed for other issues areas could increase impacts to noise and vibration if they are implemented. This section discusses those potential mitigation measure impacts.

None of the mitigation measures proposed for impacts related to other issue areas would increase noise impacts. Mitigation measures related to visual, such as the installation of a bermed area to the east of the Project Site, could reduce noise levels at the Deer Loop Trail if implemented. Therefore, the mitigation measures would not result in additional significant impacts, and additional analysis or mitigation is not required.

4.5.4 Cumulative Impacts and Mitigation Measures

None of the cumulative projects discussed in Section 3.0, Cumulative Projects Description, would contribute noise to the same areas that the Proposed Project would. Therefore, there are no cumulative project noise impacts.

Figure 4.5-9 Maximum Hour Noise Contours – Concurrent Operations and Drilling – Mitigated



4.5.5 Mitigation Monitoring Plan

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
N-1a Ensure that all construction activities at the site (including deliveries and arriving and departing workers) is limited to between 7:00 a.m. and 6:00 p.m, Monday through Friday, between 8:00 a.m. and 5:00 p.m. on Saturdays and no activities on Sundays or federal holidays. In addition, for construction work undertaken within the County of Los Angeles unincorporated areas, the Applicant shall ensure that noise levels do not exceed County municipal code levels through the implementation of a noise study and monitoring and measures including high grade mufflers, engine tuning and management of backup alarms. All contracts with construction personnel specify the allowable work hours and study/monitoring requirements.	Construction hours limits	Site inspection	During construction	City of Whittier
N-1b Maintain all construction machinery as per the manufacturers' specifications and ensure that mufflers and silencers are maintained properly. Back-up OSHA noise indicators shall be ambient sensitive, self-adjusting to minimize backup indicator noise or flaggers shall be used in the place of backup alarms (as allowed by OSHA).	Construction machinery maintenance	Site inspection	During construction	City of Whittier
N-1c Relocate the construction parking and staging area farther from the school and residences on Catalina Avenue to an area north of the Ranger Residence or equivalent.	Construction staging and parking area designation	Construction drawings and site inspection	Before construction	City of Whittier

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
N-2a The Applicant shall develop and implement a Noise Reduction Plan for all drilling (testing, development, and re-drills and workovers) to ensure that the Leq noise levels from activities, measured as a 1-hour Leq, is below a 3-5 dBA increase at the closest sensitive receptor (residential (3dBA) or recreational(5dBA)) to the facility. The Plan shall be prepared by an acoustic consultant approved by the City and the Plan shall be subject to City review and concurrence. The measures in the Plan shall include but not be limited to the following: (1) enclose the drill rig area in soundproof barriers 30 feet high on the south and west sides; (2) utilize a central generator type drilling rig, with the generators the only diesel engines onsite and enclosed in a soundproofed generator house with appropriate grade muffler systems, or install sound enclosures around all diesel engines with appropriate grade muffler systems; (3)install noise barriers around the drill rig floor, mud mixers, cleaners, conveyers, and shakers; (4) enclose drawworks brake area with soundproofing shroud; (5) install pads on V-door and other appropriate areas, timbers and pads on drill deck, pads between drill and casing pipe while in storage, and pad and timbers at the boards on the mast to reduce metal-on-metal noise (for both drilling and workover operations); (6) enclose the drilling mast boards area (on drilling and workover rigs) with barriers 2 inches thick and 2 pounds per square feet in density at least 5 feet above and below any noise sources; and (7) install ambient sensitive backup indicators on all equipment requiring backup indicators.	Drilling Noise Reduction Plan	Plan inspection and monitoring	Prior to and during drilling	City of Whittier Habitat Authority
N-2b The Applicant shall institute a quiet-mode for all drilling activities between 7 p.m. and 7 a.m. Quiet-mode operation would apply to both drilling and operations and would involve: (1) using signalers for all backup operations instead of backup alarms and turning off backup alarms; (2) using radios instead of voice	Quiet mode operations	Plan inspection and monitoring	Prior to and during drilling and operations	City of Whittier

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
communication; (3) minimizing crane use and pipe handling operations, pipe offloading from trucks and board loading during daytime to the maximum extent feasible and nighttime loading only for safety reasons; (4) prohibiting material and supply deliveries to the Project Site between the hours of 7 p.m. and 7 a.m., with exceptions only for safety; and (5) limiting process alarms and communications over the broadcast system to the maximum extent feasible during all operations and use only for safety reasons				
N-2c Provide a comprehensive noise and vibration abatement study, including noise monitoring at nearby sensitive receptors, under contract and supervision of the City, to monitor noise and vibration from the drilling and operations in the community, which shall have the authority to shut-down operations and require additional mitigation if the noise criteria are exceeded.	Noise abatement study	Monitoring	During drilling and operations	City of Whittier
N-4 The Applicant shall develop and implement a Noise Reduction Plan for all operations to ensure that Leq noise levels from operational activities, measured as 1-hour Leq, produce less than a 3 dBA increase over the minimum baseline hourly average level at the closest residential receptor to the facility. The measures in the Plan shall include, but not be limited to: (1) installing sound enclosures or buildings around all compressors; (2) installing noise barriers around all pumps and air coolers; (3) installing ambient-sensitive backup indicators on all equipment requiring backup indicators; (4) installing sound enclosures or buildings around all the oil area pumps (e.g., shipping, IGFC, water injection, water booster, reject pumps); (5) installing sound enclosures or buildings around refrigeration units; (6) installing a secondary, 16-foot tall sound wall on the south, west and north sides of the gas plant; (7) ensuring that all office equipment (i.e., air conditioners, heating, ventilation) produces low noise levels or	Operations Noise Reduction Plan	Plan inspection and monitoring	Prior to and during operations	City of Whittier

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
is surrounded by noise barriers; and (8) limiting traffic on the North Access Road to only between 7 a.m. and 7 p.m. except for emergencies.				