6.3 NOISE

6.3.1 INTRODUCTION

This section includes a summary of applicable noise regulations, a description of ambient noise conditions, and an analysis of potential noise impacts of the proposed project. Mitigation measures are recommended, as necessary, to reduce significant noise impacts.

6.3.2 EXISTING SETTING

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound, as described in more detail below, is mechanical energy transmitted in the form of a wave because of a disturbance or vibration.

SOUND PROPERTIES

A sound wave is introduced into a medium (air) by a vibrating object. The vibrating object (e.g., vocal chords, the string, and sound board of a guitar, or the diaphragm of a radio speaker) is the source of the disturbance that moves through the medium. Regardless of the type of source creating the sound wave, the particles of the medium through which the sound moves are vibrating in a back and forth motion at a given frequency (pitch). The frequency of a wave refers to how often the particles vibrate when a wave passes through the medium. The frequency of a wave is measured as the number of complete back-and-forth vibrations of a particle per unit of time. If a particle of air undergoes 1,000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second. A commonly used unit for frequency is hertz (Hz).

Each particle vibrates as a result of the motion of its nearest neighbor. The first particle of the medium begins vibrating at, say, 500 Hz, and sets the second particle of the medium into motion at the same frequency (500 Hz). The second particle begins vibrating at 500 Hz and thus sets the third particle into motion at 500 Hz. The process continues throughout the medium; hence each particle vibrates at the same frequency, which is the frequency of the original source. Subsequently, a guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency (500 Hz), which carries a sound signal to the ear of a listener that is detected as a 500 Hz sound wave.

The back-and-forth vibration motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Because a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from high to low and back to high pressure. As the compression (high-pressure) and rarefaction (low-pressure) disturbances move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Thus, the frequency of a sound wave refers not only to the number of back-and-forth vibrations of the particles per unit of time but also to the number of compression or rarefaction disturbances that pass a given point per unit of time. A detector could be used to detect the frequency of these pressure oscillations over a given period of time. The period of the sound wave can be found by measuring the time between successive high-pressure points (corresponding to the compressions) or the time between successive low-pressure points (corresponding to the rarefactions). The frequency is simply the reciprocal of the period; thus an inverse relationship exists so that as frequency increases, the period decreases, and vice versa.

A wave is an energy transport phenomenon that transports energy along a medium. The amount of energy carried by a wave is related to the amplitude (loudness) of the wave. A high-energy wave is characterized by high amplitude; a low-energy wave is characterized by low amplitude. The amplitude of a wave refers to the maximum amount of displacement of a particle from its rest position. The energy transported by a wave is directly proportional to the square of the amplitude of the wave. This means that a doubling of the amplitude of a wave is indicative of a quadrupling of the energy transported by the wave.

SOUND AND THE HUMAN EAR

Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). Use of this logarithmic scale reveals that the total sound from two individual 65-dBA sources is 68 dBA, not 130 dBA (i.e., doubling the source strength increases the sound pressure by 3 dBA).

Because the human ear is not equally sensitive to all sound frequencies, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. An A-weighted dB (dBA) scale performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. The basis for compensation is the faintest sound audible to the average ear at the frequency of maximum sensitivity. This dBA scale has been chosen by most authorities for the purpose of regulating environmental noise. Typical indoor and outdoor noise levels are presented in Exhibit 6.3-1.

With respect to how humans perceive increases in noise levels, a 1 dBA increase is imperceptible, a 3 dBA increase is barely perceptible, a 6 dBA increase is clearly perceptible, and a 10 dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment.

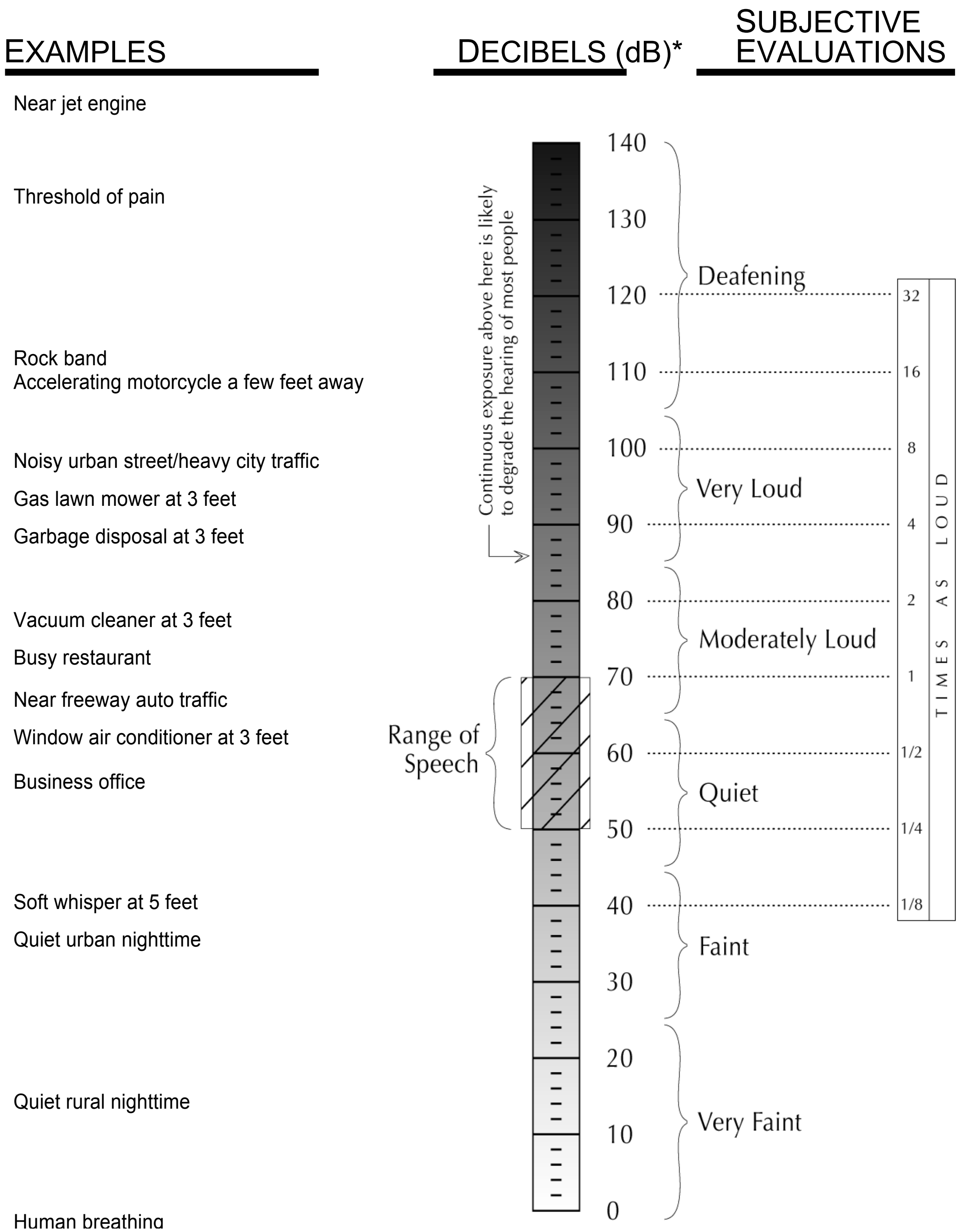
SOUND PROPAGATION

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, is dependent on surface characteristics, atmospheric conditions, and the presence of physical barriers. The inverse-square law describes the attenuation caused by the pattern in which sound travels from the source to receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance (dBA/DD). However, from a line source (e.g., a road), sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. The surface characteristics between the source and the receptor may result in additional sound absorption and/or reflection. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels. Furthermore, the presence of a barrier between the source and the receptor may also attenuate noise levels. The actual amount of attenuation is dependent upon the size of the barrier and the frequency of the noise. A noise barrier may be any natural or human-made feature such as a hill, tree, building, wall, or berm (Caltrans 1998).

All buildings provide some exterior-to-interior noise reduction. A building constructed with a wood frame and a stucco or wood sheathing exterior typically provides a minimum exterior-to-interior noise reduction of 25 dBA with its windows closed, whereas a building constructed of a steel or concrete frame, a curtain wall or masonry exterior wall, and fixed plate glass windows of one-quarter-inch thickness typically provides an exterior-to-interior noise reduction of 30–40 dBA with its windows closed (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002).

NOISE DESCRIPTORS

The selection of a proper noise descriptor for a specific source is dependent upon the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998, Lipscomb and Taylor 1978).



* dB are "average" values as measured on the A-scale of a sound-level meter.
From *Concepts in Architectural Acoustics* (M. David Egan, McGraw Hill, 1988) and *The Noise Guidebook* (U.S. Department of Housing and Urban Development, Office of Community Planning and Development, undated).

Source: EDAW 2006

Typical Noise Levels **Exhibit 6.3-1**

- L_{max} (Maximum Noise Level): The maximum instantaneous noise level during a specific period of time. The L_{max} may also be referred to as the “peak (noise) level.”

- L_{min} (Minimum Noise Level): The minimum instantaneous noise level during a specific period of time.

- L_X (Statistical Descriptor): The noise level exceeded X% of a specific period of time.

- L_{eq} (Equivalent Noise Level): The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}. In noise environments determined by major noise events, such as aircraft overflights, the L_{eq} value is heavily, and usually entirely, influenced by the magnitude and number of single events (SENL, see below) that produce the high work levels.

- L_{dn} (Day-Night Noise Level): The 24-hour L_{eq} with a 10 dBA “penalty” for noise events that occur during the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is “added” to single noise events that occur in the nighttime hours, and this generates a higher reported noise level when determining compliance with noise standards. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

- CNEL (Community Noise Equivalent Level): The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA “penalty” added to single noise events that occur during the noise-sensitive hours between 7:00 p.m. to 10:00 p.m., which are typically reserved for relaxation, conversation, reading, and television. If using the same 24-hour noise data, the reported CNEL is typically approximately 0.5 dBA higher than the L_{dn}.

- SENL (Single Event [Impulsive] Noise Level): The SENL describes a receiver’s cumulative noise exposure from a single impulsive noise event (e.g., an automobile passing by or an air craft flying overhead), which is defined as an acoustical event of short duration and involves a change in sound pressure above some reference value. SENLs typically represent the noise events used to calculate the L_{eq}, L_{dn}, and CNEL.

NEGATIVE EFFECTS OF NOISE ON HUMANS

Negative effects of noise exposure include physical damage to the human auditory system, interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. Gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 1998).

6.3.3 EXISTING NOISE ENVIRONMENT

EXISTING NOISE-SENSITIVE LAND USES

Noise-sensitive land uses generally include those uses where exposure to noise would result in adverse effects, as well as uses where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other noise-sensitive land uses include schools, hospitals, convalescent facilities, parks, hotels, places of worship, libraries, and other uses where low interior noise levels are essential.

The project site currently consists of undeveloped and fallow farmlands with no buildings or sensitive receptors on-site. Two farm houses are located near the northwest corner of the site across from Lone Tree Road, approximately 55 feet west of the project site's western boundary. There are no existing schools, hospitals, convalescent facilities, places of worship, parks, hotels, or libraries on or directly adjacent to the project site. A neighborhood of single family homes is currently being constructed immediately to the north of the location where a wastewater pipeline extension would be built to serve the project. This pipeline extension would approach the project site from the east and extend under State Route (SR 70/99). A water pipeline extension would be constructed under I-5 to connect with the south side of the project site. This extension would not be located near any existing or future planned sensitive receptors.

EXISTING NOISE SOURCES

The existing noise environment within the project area is influenced primarily by surface transportation noise emanating from vehicular traffic on area highways and aircraft operations associated with Sacramento International Airport. Existing noise levels from vehicular traffic and aircraft activity are described in greater detail below.

Vehicular Traffic

One of the dominant noise sources on the project site is vehicular traffic on I-5, which passes along the south side of the project site, and SR 70/99, which passes along the east side of the site. The project site is situated northwest of the intersection formed by I-5 and SR 70/99, and borders their respective right-of-ways. The ambient noise environment in areas surrounding the project site is also dominated by vehicular traffic on area roadways.

Table 6.3-1 presents existing traffic noise levels on area roadways, which were modeled using the FHWA Traffic Noise Model (FHWA 1988) and traffic data obtained from the traffic analysis prepared for this project (TJKM 2005). Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. Table 6.3-1 presents the predicted L_{dn}/CNEL noise levels at 50 feet from the near travel lane centerline and distance from roadway centerline to the 55, 60, 65 and 70 dBA L_{dn}/CNEL contours for existing average daily traffic (ADT) volumes.

Aircraft Activity

Another dominant noise source at the project site is noise generated by aircraft operations associated with Sacramento International Airport, which is located approximately one mile west of the project site. Flight operations, flight patterns, and associated CNEL contours are discussed below.

Flight Operations

Operations at the airport consist of takeoffs and landings by commercial passenger, cargo, military, and general aviation aircraft. The average number of flights in 2005 was 461 daily flights, most of which are domestic commercial passenger flights (Newhouse, pers. comm., 2006; Sacramento County Airport System Planning [SCAS] and Development Department 2004). The models of aircraft used most at the airport include Boeing 737-300s (43.8% of aircraft fleet), Boeing 737-700s (10.4%), Boeing 737-800s (7.6%), Airbus 320s (6.9%), and Boeing 737-200s (6.3%) (SCAS Planning and Development Department 2004). Most flight operations occur between 6:00 a.m. and 11:00 p.m. each day; however, some landings and takeoffs occur during the early morning hours (SCAS Planning and Development Department 2004).

The County has a Memorandum of Understanding with the military that it will only operate flights from 7:00 a.m. to 7:00 p.m. Monday through Friday. However, this restriction is non-binding and the military could fly planes during other times, such as on weekends, if it so decided. For instance, because the Navy conducted training exercises with E6 Mercury aircraft on the afternoon of Saturday, March 5, 2005 (Latourrette, pers. comm., 2005), it is assumed that military aircraft operations occasionally take place on weekend days as well. The aircraft models most used by the military at the Sacramento International Airport are cargo planes (i.e., C5s and C130s), refueling and transport aircraft (i.e., KC10s and KC135s), and jet training aircraft (i.e., T38s) (Newhouse, pers. comm., 2004).

Table 6.3-1
Summary of Modeled Existing Vehicular Traffic Noise Levels

Roadway Segment and Location	Distance (ft) from Roadway Centerline to L_{dn}/CNEL (dBA)				L_{dn}/CNEL (dBA) 50 Feet from Centerline of Near Travel Lane
	70 CNEL	65 CNEL	60 CNEL	55 CNEL	
Power Line Road north of W. Elverta Road	—	—	—	—	53.85
Power Line Road south of W. Elverta Road	—	—	—	—	55.78
W. Elverta Road east of Power Line Road	—	—	—	87.5	57.93
W. Elverta Road west of Power Line Road	—	—	—	70.3	56.50
Power Line Road north of Elkhorn Boulevard	—	—	63.6	136.5	60.84
Power Line Road between Elkhorn Boulevard and Del Paso Road	—	—	60.5	129.9	60.51
Elkhorn Boulevard between Power Line Road and Lone Tree Road	—	—	—	—	53.09
Elkhorn Boulevard between Lone Tree Road and SR 70/99	—	—	—	70.1	56.48
Elkhorn Boulevard between SR 70/99 and E. Commerce Parkway	78.8	169.3	364.5	784.9	72.24
Elkhorn Boulevard east of E. Commerce Parkway	67.5	144.9	311.9	671.7	71.23
E. Commerce Parkway between Elkhorn Boulevard and Del Paso Road	—	—	66.3	142.2	61.11
Power Line Road south of Del Paso Road	—	—	52.3	112.1	59.56
Del Paso Road between Power Line Road and Wyndview Drive	—	—	—	—	45.89
Del Paso Road between Wyndview Drive and El Centro Road	—	—	—	—	40.37
SR 70/99 north of W. Elverta Road	211.4	448.9	964.0	2,075.1	76.16
SR 70/99 between W. Elverta Road and Elkhorn Boulevard	246.2	524.7	1,127.7	2,427.8	77.19
SR 70/99 between Elkhorn Boulevard and the I-5 split	273.1	583.2	1,254.0	2,700.0	77.88
I-5 west of the SR 70/99 split	378.7	798.2	1,711.0	3,681.7	78.10

Note: Traffic noise levels were modeled using the FHWA Traffic Noise Model (FHWA 1988) based on traffic volumes obtained from the traffic report prepared for this project. Calculated noise levels do not consider any shielding or reflection of noise by existing structures or terrain features or noise contribution from other sources. See modeling results in Appendix G for further detail.
Source: Modeling performed by EDAW in 2005.

Flight Patterns

The Sacramento International Airport operates two runways, which are oriented in a north-south direction. The closer of the two runways is located 1.17 miles from the west boundary of the project site. The airport operates in a "south flow" airfield approximately 68% of the time and in a "north flow" airfield approximately 32% of the time (SCAS Planning and Development Department 2004), depending on wind conditions. During "south flow" conditions, all aircraft take off and land into the south wind. After taking off during "south flow" conditions, most aircraft immediately turn southeast and pass near the project site. Planes taking off in south flow conditions that are ultimately headed north turn and fly over or near the southeast portion of the project site. During "north flow" conditions, all aircraft take off and land into the north wind and do not pass over the project site (SCAS 2005).

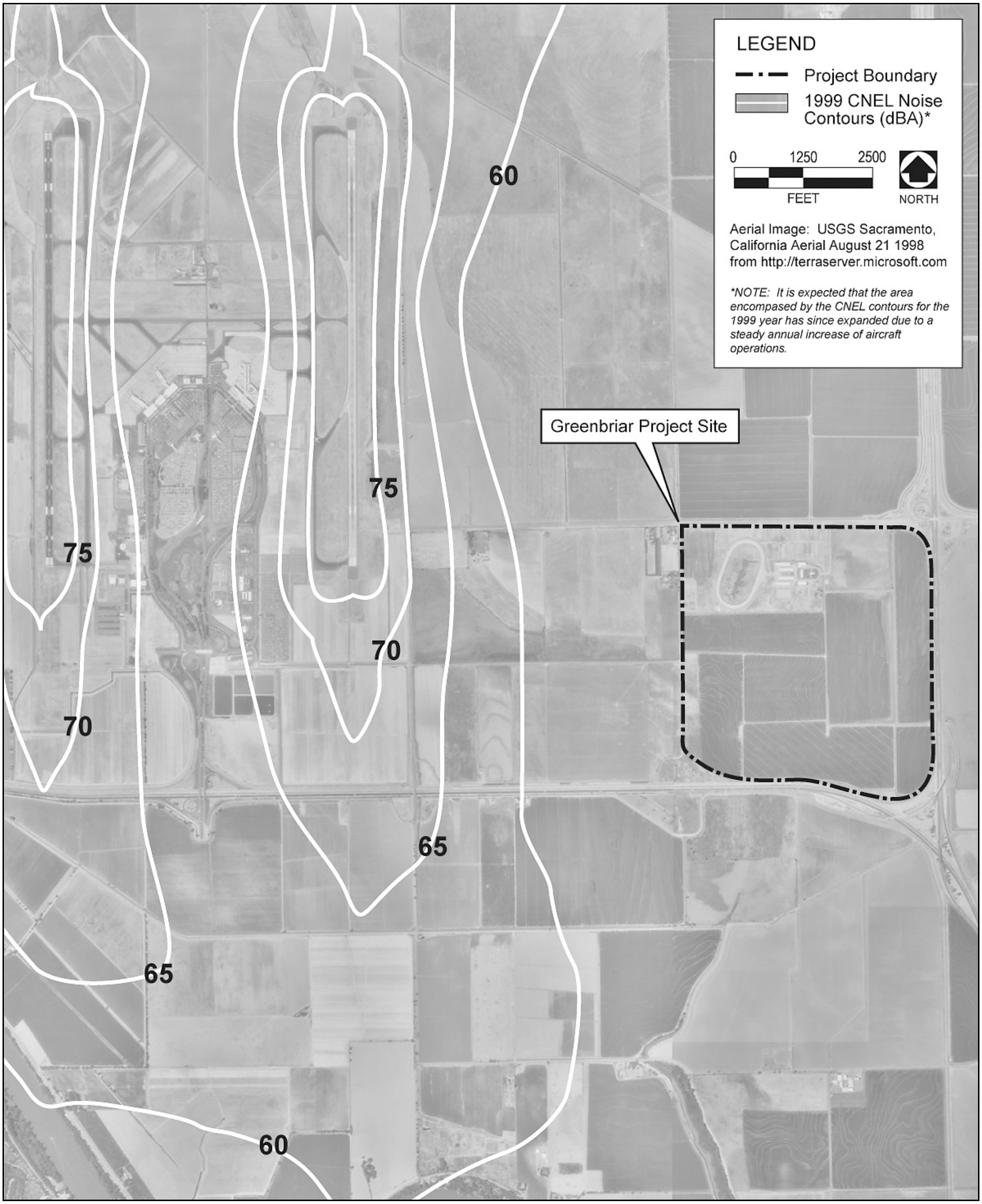
Airport CNEL Contours

The Sacramento International Airport Master Plan includes CNEL noise contours for aircraft activity associated with the airport operations in 1999. (SCAS Planning and Development Department 2004). These contours are shown in Exhibit 6.3-2. As shown in the Exhibit, the 60 dBA CNEL contour does not overlap with the proposed project site; however, it is expected that the area encompassed by the airport's CNEL contours has since expanded because the increased aircraft activity at the airport over the past 6 years. According to the draft Airport Master Plan, the number of annual operations (i.e., takeoffs and landings) at the airport was estimated to increase from approximately 157,000 annual operations in 1999 to a projected approximately 190,000 annual operations in the year 2005 (SCAS Planning and Development Department 2004). Consequently, the 1999 contours are outdated and do not accurately represent noise levels associated with current airport activity.

The SCAS Planning and Development Department has recently developed new draft CNEL contours as part of the new Airport Master Plan (SCAS Planning and Development Department 2004), which is currently undergoing environmental review. These draft contours are shown in Exhibit 6.3-3 and are associated with implementation of the Master Plan in some undetermined future year. They were provided by the SCAS Planning and Development Department in October 2005 and remain subject to approval by the Sacramento County Board of Supervisors (Newhouse, pers. comm., 2006). Nonetheless, these draft CNEL contours represent the most up-to-date estimation of noise levels generated by Sacramento International Airport when operating at full capacity, which has not yet been reached at the airport but could be within approximately the next 20 years. The full-capacity CNEL levels are based on the maximum number of flights that could be accommodated by facilities on the ground, including the number of passenger gates and the area of ramp space and cargo space at the airport. In addition, these noise contours are considered to represent bands of similar noise exposure, rather than absolute lines of demarcation. Actual noise levels would vary from day to day, depending on factors such as local meteorological conditions, weather-induced changes to flight paths, and the types and intensity of aircraft activity.

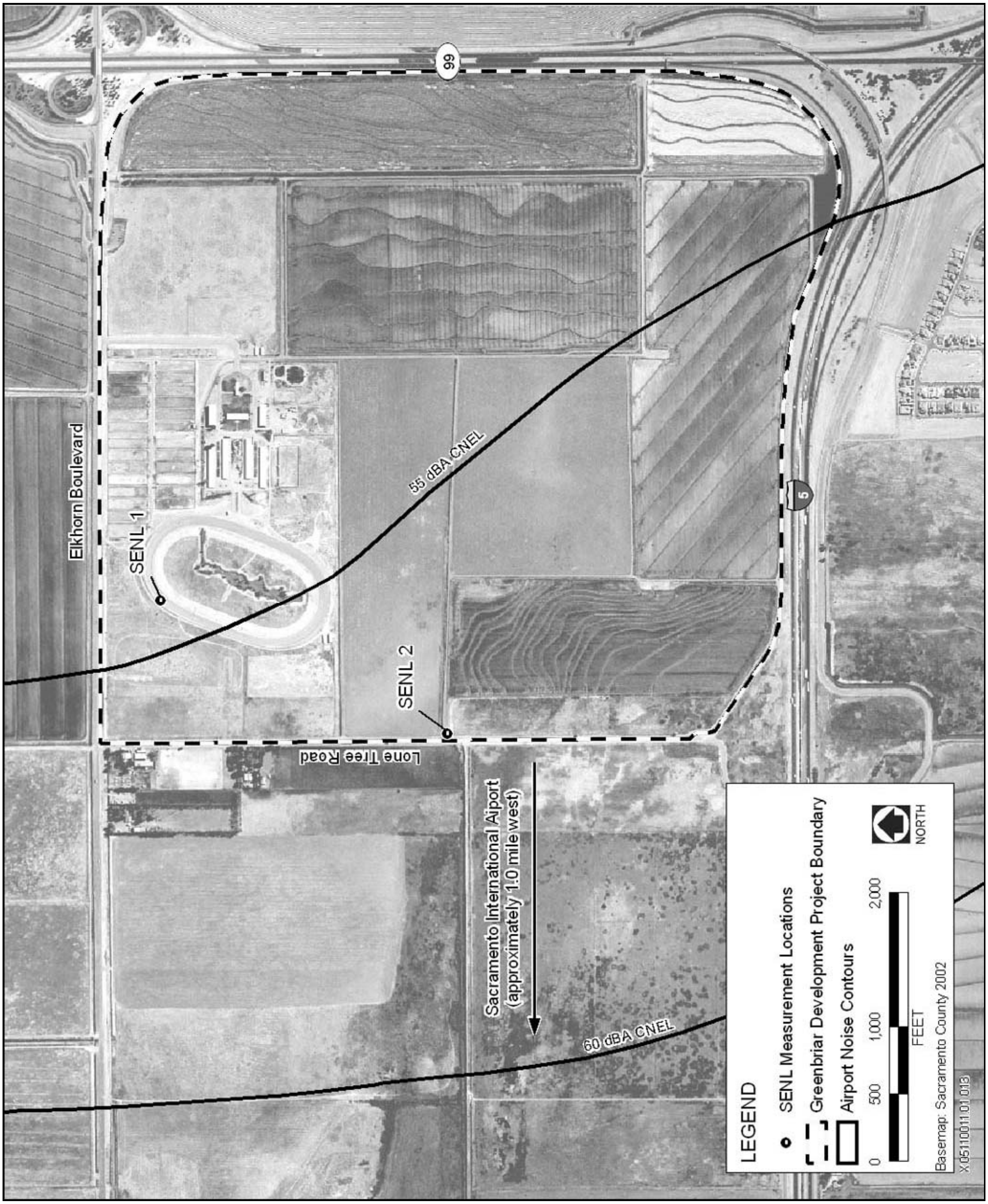
Exhibit 6.3-2 shows that the project site is approximately 2,800 feet from the 60 dBA CNEL contour for the 1999 year and Exhibit 6.3-3 shows that the projected future 60 dBA CNEL contour would be about 2,000 feet from the western boundary of the project site. Exhibit 6.3-3 also shows the airport's future projected 55 dBA CNEL contour, which encompasses more than one third of the project site.

The SCAS Planning and Development Department does not produce SENL contours for aircraft-generated noise (Newhouse, pers. comm., 2004); however, as a 24-hour "average" noise descriptor, the full-capacity CNEL contours account for the frequency and intensity of SENL events.



Source: Sacramento County Airport System Planning and Development Department 2004

1999 CNEL Noise Contours for Sacramento International Airport **Exhibit 6.3-2**



Source: Newhouse, pers. comm., 2005

Sacramento International Airport Noise Contours — Exhibit 6.3-3

Table 6.3-2 Existing Ambient Noise Levels					
Noise Measurement Location	Time of Day on September 27, 2005	Predominant Noise Source(s)	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1. South side of project site. Approximately 300 feet north of near travel lane of I-5 and 1,500 west of SR 70/99.	2:25 pm – 2:40 pm	Traffic on I-5.	59.0	65.6	48.1
2. Southeast portion of project site. Approximately 840 feet north of I-5, 816 feet west of SR 70/99, and 960 feet northwest of interchange connector between I-5 southbound and SR 70/99 northbound.	3:04 pm – 3:19 pm	Traffic on I-5 and, to a lesser degree, traffic on SR 70/99.	58.3	76.0	48.0
3. East side of project site. Approximately 300 feet west of near travel lane of SR 70/99.	3:53 pm – 4:08 pm	Traffic on SR 70/99.	52.1	65.9	40.7
4. Northwest portion of project site. Approximately 750 feet east of western boundary and 1,500 feet south of Elkhorn Boulevard.	4:23 pm – 4:38 pm	Rooster(s) at farm house near western boundary, wild birds.	46.1	59.5	36.0
Source: Data collected by EDAW on September 27, 2005					

EXISTING AMBIENT NOISE SURVEY

An ambient noise survey was conducted by EDAW on Tuesday, September 27, 2005 to document the existing noise environment at various locations within the project area. The dominant noise sources noted during the survey were vehicular traffic on I-5 to the south of the project site and on SR 70/99 to the east of the project site. Short-term noise level measurements were taken in accordance with the American National Standards Institute (ANSI) acoustic standards at four locations within the project area using a Larson Davis model 820 sound level meter. The short-term L_{eq} value along with the L_{max}, and L_{min}, for each ambient noise measurement location is presented in Table 6.3-2. The locations of the ambient sound level measurements are shown in Exhibit 6.3-4. Based on the short-term measurements conducted, average daytime noise levels (L_{eq}) within the project area range from 46.1 to 59.0 dBA L_{eq}, depending primarily on distance from I-5 and/or SR 70/99, while maximum noise levels (L_{max}) range from 59.5 to 76.0 dBA L_{max}. In addition, a series of traffic noise measurements on the project site were conducted on March 27, 2006 specifically to check the accuracy of the modeled on-site traffic noise levels, as contained in Appendix G (Sawyer, pers. comm., 2006).

COMMERCIAL AIRCRAFT SENL EVENT SURVEY

Because the Sacramento County Airport System Planning and Development Department does not produce SENL contours for aircraft-generated noise (Newhouse pers. comm., 2004), additional noise measurements were collected by EDAW to characterize the site's current exposure to SENLs generated by aircraft activity. SENL measurements were collected in accordance with the ANSI acoustic standards for SENL measurements (ANSI S12.9-2000/Part 6) at two locations within the project area using Larson Davis model 820 SLM. SENL measurements of commercial aircraft, collected during "south flow" conditions on Monday, January 9, 2006, are presented in Table 6.3-3. Measurements were collected from two locations on the west side of the project site as shown in Exhibit 6.3-3.

Source: EDAW 2006

Sound Level Measurement Locations **Exhibit 6.3-4**

Table 6.3-3
Noise Level Measurements Commercial Aircraft Activity

Measurement Number	Measurement Location [a]	Time of Day [b,c]	SENL (dBA)	SENL Duration (seconds)	L_{max} (dBA) [d]	Event L_{eq} (dBA) [e]	Commercial Aircraft Model [f]
1	1	15:28:08	74.0	22.5	68.1	60.4	BE58
2	2	15:33:05	77.1	13.5	70.4	65.8	C501
3	2	15:39:40	82.6	27.0	73.3	68.3	B737
4	1	15:39:43	77.6	31.0	68.9	62.7	B737
5	2	15:47:52	79.0	22.0	72.5	65.6	B733
6	1	15:47:57	73.9	26.5	65.5	59.7	B733
7	2	15:51:54	76.2	61.5	66.3	58.3	B733
8	2	15:59:37	83.8	30.5	74.7	69.0	MD82
9	1	15:59:47	84.7	32.5	74.5	69.6	MD82

Notes: SENL measurements were collected in accordance with the American National Standards Institute acoustic standards (ANSI S12.9-2000/Part 6) using Larson Davis model 820 sound level meters on the afternoon of January 9, 2005.

a SENL measurement locations 1 and 2 are shown on Exhibit 6.3-3.

b Weather conditions during measurements on the afternoon of January 9, 2005 were partly cloudy with a temperature of 55 Fº, relative humidity of 67%, atmospheric pressure of 30.27 inches, and winds from the southwest averaging 5.8 mph.

c Time of day is expressed in military time and represents when the instantaneous L_{max} occurred. Sound level meters operated simultaneously during most recorded SENL events. The clocks of both sound meters were synchronized. In some cases an SENL event was recorded at only one of the two sound level meters.

d The L_{max} sound level represents the highest instantaneous sound level during the SENL event.

e The L_{eq} sound level represents the average sound level during the SENL event, during which the aircraft was the dominant noise source.

f Aircraft models were confirmed using the web-based resource, Replay of Sacramento Area Air Traffic (Sacramento County Airport System 2005). Measurements include aircraft takeoffs from both runways 16L and 16R.

Source: Data collected by EDAW on Monday, January 9, 2006.

Table 6.3-3 shows that the SENL events measured on the project site from commercial aircraft ranged from 73.9 dBA SENL to 84.7 dBA SENL. The average duration of the recorded SENL events was 29.7 seconds. For those SENL events recorded simultaneously at both measurement locations, the recorded SENL levels were not consistently higher at one two location or the other. Field observations by EDAW staff indicated that approximately 35% of the aircraft takeoffs observed resulted in recorded SENL events at one or both of the sound level meters.

MILITARY AIRCRAFT SENL EVENTS

In comparison to commercial aircraft, the flight tracks of military aircraft near the Sacramento International Airport are much more variable, consisting primarily of low, circling flyovers and touch-and-go activity (practice takeoffs and landings) at the runways. SENL events were recorded by EDAW staff on a site located approximately 3,000 feet south of the proposed Greenbriar site on March 17, 2005. Measurements were taken on a site known as “West Lakeside”; aircraft were noted to be at a similar height and similar maneuver in flight pattern as they flew over Greenbriar. Thus,these measurements, presented in Table 6.3-4, are considered to be representative of SENL events generated by military aircraft flyovers at the Greenbriar site. Most of military aircraft flyovers were observed approaching from or heading towards the direction of the Greenbriar site. Aside from their more variable flight paths and lower flight patterns, military aircraft generate louder SENL events because they are not subject to the same noise-related design standards as commercial aircraft. Table 6.3-4 shows that the SENL events measured near the project site from military aircraft ranged from 67.4 dBA SENL to 110.8 dBA SENL. It is important to note that noise levels in excess of 70 dBA (interior; roughly equal to 85 to 100 dBA exterior, depending on whether windows are open or closed) are quite likely to elicit noise complaints and interfere with speech, outdoor activities, as well as indoor activities (e.g., watching television, talking on the phone).

Table 6.3-4
Noise Level Measurements of Military Aircraft Activity

Measurement No.	Time of Day [a,b]	SENL (dBA)	SENL Duration (seconds)	L_{max} (dBA) [c]	Event L_{eq} (dBA) [d]	Aircraft Model [e]
1	12:48:53	84.8	14.5	79.2	73.2	C130
2	12:48:56	85.9	12.0	79.7	75.1	C130
3	14:30:21	108.3	8.0	104.6	99.3	C5
4	14:30:28	110.8	7.5	109.4	102.0	C5
5	14:46:02	76.3	31.5	67.2	61.3	KC10
6	14:46:06	67.4	8.0	65.7	58.4	KC10
7	14:46:13	68.0	4.0	65.2	62.0	KC10
8	14:52:26	108.3	15.5	103.9	96.4	C5
9	14:52:33	101.0	19.0	94.8	88.2	C5
10	15:01:38	83.5	13.0	79.4	72.4	C5
11	15:01:45	79.5	16.5	73.4	67.3	C5
12	15:12:06	108.1	13.0	103.5	97.0	C5
13	15:12:10	100.5	14.5	94.3	88.9	C5

Notes: SENL measurements were collected in accordance with the American National Standards Institute acoustic standards (ANSI S12.9-2000/Part 6) using Larson Davis model 820 sound level meters.

[a] Weather conditions during measurements on March 17 were partly cloudy with a temperature of 64 F°, relative humidity of 58%, atmospheric pressure of 29.96 inches, and winds from the south-southwest averaging 8.1 mph. The airport was operating in "south flow" conditions during all measurements.

[b] Time of day is expressed in military time and represents when the instantaneous L_{max} occurred.

[c] The L_{max} sound level represents the highest instantaneous sound level during the SENL event.

[d] The L_{eq} sound level represents the average sound level during the SENL event, during which the aircraft was the dominant noise source.

[e] Aircraft models were confirmed using the web-based resource, *Replay of Sacramento Area Air Traffic* (Sacramento County Airport System 2005). Measurements include aircraft takeoffs from both runways 16L and 16R. Airport staff has confirmed that all aircraft, including military aircraft, were following their typical flight patterns (Miller, pers. comm., 2005).

Source: Data collected by EDAW on March 17, 2005 at the proposed West Lakeside project site.

6.3.4 REGULATORY SETTING

STATE

Title 24 of the California Code of Regulations (CCR) establishes standards governing interior noise levels that apply to all new single family and multi-family residential units in California. These standards require that acoustical studies be performed before construction at building locations where the existing L_{dn} exceeds 60 dBA. Such acoustical studies are required to establish mitigation measures that will limit maximum L_{dn} levels to 45 dBA in any habitable room. Although there are no generally applicable interior noise standards pertinent to all uses, many communities in California have adopted an L_{dn} of 45 as an upper limit on interior noise in all residential units.

In addition, the state has developed land use compatibility guidelines for community noise environments. The State of California General Plan Guidelines (State of California 2003), published by the state Governor's Office of Planning and Research (OPR), provides guidance for the acceptability of projects within specific L_{dn}/CNEL contours. Table 6.3-5 presents acceptable and unacceptable community noise exposure limits for various land use categories. There limits are expressed in terms of L_{dn} and CNEL. There are no compatibility standards for SENL, although it is recognized that the L_{dn}/CNEL account for the cumulative exposure to all SENLs. Generally, residential uses are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA L_{dn}/CNEL. Residential uses are normally unacceptable in areas exceeding 70 dBA L_{dn} and conditionally acceptable within 55 to 70 dBA L_{dn}. Schools are normally acceptable in areas up to 70 dBA CNEL and normally unacceptable in areas exceeding 70 dBA CNEL. Commercial uses are normally acceptable in areas up to 70 dBA CNEL. Between 67.5 and 77.5 dBA CNEL, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements. The guidelines also present adjustment factors that may be used to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

Table 6.3-5
State Land Use Noise Compatibility Guidelines

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dBA)			
	Normally Acceptable[a]	Conditionally Acceptable[b]	Normally Unacceptable[c]	Clearly Unacceptable[d]
Residential-Low-Density Single-Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential-Multi-Family	<65	60–70	70–75	75+
Transient Lodging-Motel, Hotel	<65	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	<70	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters		<70	65+	
Sports Arena, Outdoor Spectator Sports		<75	70+	
Playgrounds, Neighborhood Parks	<70		67.5–75	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<75		70–80	80+
Office Building, Business Commercial and Professional	<70	67.5–77.5	75+	
Industrial, Manufacturing, Utilities, Agriculture	<75	70–80	75+	

a Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
b New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
c New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.
d New construction or development should generally not be undertaken.
Source: State of California Governor's Office of Planning and Research 2003

LOCAL

County of Sacramento General Plan

The County of Sacramento General Plan Noise Element contains several policies for controlling and reducing environmental noise, which are applicable only to the unincorporated areas of Sacramento County. The following policies are applicable to the proposed project:

- **Policy NO-1:** Noise created by new transportation noise sources should be mitigated so as not to exceed 60 dB L_{dn}/CNEL at the outdoor activity areas of any affected residential lands or land use situated in the unincorporated areas. When a practical application of the best available noise-reduction technology cannot achieve the 60 dB L_{dn}/CNEL standard, then an exterior noise level of 65 dB L_{dn}/CNEL may be allowed in outdoor activity areas.

- **Policy NO-2:** Noise created by new nontransportation noise sources shall be mitigated so as not to exceed any of the noise level standards of Table II-1 [Table 6.3-6 of this EIR], as measured immediately within the property line of any affected residentially designated lands or residential land use situated in the unincorporated areas.

For the purposes of the Noise Element, transportation noise sources include traffic on public roadways.

Table 6.3-6
County of Sacramento Noise Level Performance Standards[a] for Residential Areas Affected by Nontransportation Noise[b]

Statistical Noise Level Descriptor	Exterior Noise Level Standards (dBA)	
	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
L_{50}	50	45
L_{max}	70	65

Note: Each of the noise standards in Table 6.3-6 shall be decreased by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).
[a] These standards are for planning purposes and may vary from the standards of the County's Noise Control Standards, which are for enforcement purposes.
[b] These standards apply to new or existing residential areas affected by new or existing nontransportation sources.
Source: County of Sacramento General Plan 1993.

City of Sacramento General Plan

The Noise Element of the City of Sacramento General Plan establishes land use compatibility standards for noise measured at the property line of noise-sensitive land uses. The land use compatibility noise criteria provide the basis for decisions on location of land uses in relation to noise sources, and for determining noise mitigation requirements. The City's noise exposure standards for land use compatibility for residential uses (both single-family and multi-family) and schools are presented in Table 6.3-7.

Table 6.3-7
City of Sacramento General Plan Land Use Compatibility Noise Levels Shown as dBA, L_{dn} or CNEL

Land Use	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential Uses	50 to 60	60 to 70	70 to 75	above 75
Schools, Libraries, Churches	50 to 60	60 to 70	70 to 80	above 80
Office Building, Business, Commercial	50 to 65	65 to 80	above 80	not specified

Normally Acceptable: Specified land use is satisfactory based upon the assumption that any buildings are of normal construction without special noise requirements.
Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features included in the design.
Normally Unacceptable: New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of noise reduction requirements must be made and needed noise insulation features included in this design.
Clearly Unacceptable: New construction or development clearly should not be undertaken.
Source: City of Sacramento General Plan 1988

Table 6.3-8 City of Sacramento Maximum Acceptable Interior and Exterior Noise Level Standards for New Development without Mitigation					
Noise Source	Land Use	Applicable Area		State Requirements [a]	Noise Element Requirements
		Interior	Exterior		
Traffic or fixed source (industrial, plants, etc.)	Single-family	X		None	$L_{dn} \leq 45$ dB [b]
	Single-family		X	None	$L_{dn} \leq 60$ dB in backyards
	Multi-family [c]	X		$L_{dn} \leq 45$ dB	$L_{dn} \leq 45$ dB
	Multi-family		X	None	$L_{dn} \leq 60$ dB in common outdoor use areas
	Schools	X		None	Noisiest hourly $L_{eq} \leq 40$ dB during school day
	Schools		X	None	$L_{dn} \leq 60$ dB
Aircraft	Single-family	X		None	$L_{dn} \leq 45$ dB and maximum instantaneous levels of ≤ 50 dB in bedrooms and ≤ 55 in other habitable rooms [b]
	Single-family		X	CNEL ≤ 65 dB (State Aeronautics Noise Standards) requirement does not apply to Mather and McClellan AFB	CNEL ≤ 60 dB for Sacramento International Airport CNEL ≤ 65 dB for all other areas
	Multi-family	X		$L_{dn} \leq 45$ dB	$L_{dn} \leq 45$ dB and maximum instantaneous levels of ≤ 50 dB in bedrooms and ≤ 55 in other habitable rooms [b]
	Multi-family		X	CNEL ≤ 65 dB (State Aeronautics Noise Standards) requirement does not apply to Mather and McClellan AFB	CNEL ≤ 60 dB for Sacramento International Airport CNEL ≤ 65 dB for all other areas
	Schools	X		None	Noisiest hourly $L_{eq} \leq 40$ dB during school day
	Schools		X	CNEL ≤ 65 dB (State. Aeronautics Noise Standards) requirement does not apply to Mather and McClellan AFB	CNEL ≤ 60 dB for Metro Airport CNEL ≤ 65 dB for all other areas

[a] Projects for which U.S. Department of Housing and Urban Development (HUD) financing is requested are subject to HUD noise requirements. The noise element requirements listed in this table are at least as stringent as the HUD requirements.

[b] The requirement for interior noise exposure is triggered when the exterior L_{dn} exceeds 60 dB.

[c] Multi-family includes hotels, motels, apartment houses, and dwellings other than detached single-family dwellings as defined by Title 24, Part 2, California Administrative Code.

Source: City of Sacramento General Plan 1988

The City of Sacramento General Plan's Noise Element also contains several goals and policies for controlling and reducing environmental noise. The following goals and policies are applicable to the proposed project:

- **Goal A:** Future development shall be compatible with the projected year 2016 noise environment.
  - **Policy 1:** Require an acoustical report for any project which would be exposed to noise levels in excess of those shown as normally acceptable in Figure 3 (Table 6.3-8 of this EIR). The contents of the acoustical report shall be as described in the Noise Assessment Report Guidelines. No acoustical report shall be required where City staff has an existing residential report on file which is applicable.
  - **Policy 2:** Require mitigation measures to reduce noise exposure to the "Normally Acceptable Levels" in Figure 3 (Table 6.3-8 of this EIR), except where such measures are not feasible.
  - **Policy 3:** Land uses proposed where the exterior noise level would be below the "Normally Acceptable Levels" may be approved without any requirement for interior or exterior mitigation measures.
- **Goal C:** Eliminate or minimize the noise impacts of future development on existing land uses in [the City of] Sacramento.
  - **Policy 1:** Review projects that may have noise generation potential to determine what impact they may have on existing uses. Additional acoustical analysis may be necessary to mitigate identified impacts.
  - **Policy 2:** Enforce the Sacramento Noise Ordinance [i.e., Noise Control Standards] as the method to control noise from sources other than transportation sources.

In addition, the City Noise Element also includes guidelines for conducting noise assessment. The Noise Element states that mitigation measures should be considered if the proposed development would increase the average daily noise levels at a noise-sensitive land use by more than 4 dBA or cause the overall level to exceed the "normally acceptable" standard for land use compatibility, or be expected to generate significant adverse community response.

The City Noise Element also includes maximum acceptable interior and exterior noise level standards for assessing whether new development should occur at a particular location. These standards are presented in Table 6.3-8. New development is considered "conditionally acceptable" provided adequate noise insulation features have been incorporated into the design of the project.

The project's consistency with these policies is evaluated in Chapter 5.0, "Project Consistency with Plans and Policies."

LAFCo Policies

The LAFCo Policies, Procedures, and Guidelines document does not contain any adopted policies related to exterior and interior noise levels.

City of Sacramento Noise Control Code and County of Sacramento Noise Control Code

The noise control standards of the City of Sacramento Municipal Code (Title 8, Health and Safety, Chapter 8.68 Noise Control) and the County of Sacramento Code (Title 6, Health and Sanitation, Chapter 6.68, Noise Control) are essentially identical, with a few exceptions. They have the same limits for exterior noise levels measured at residential land and agricultural land uses, which are presented in Table 6.3-9. Both codes state that it shall be unlawful for any person at any location to create any noise which causes the noise levels when measured on agricultural or residential property to exceed the standards shown in Table 6.3-9. The standards generally limit exterior noise levels (measured at residential land and agricultural land uses) to a maximum of 55 dBA during any cumulative 30-minute period during the daytime hours (7 a.m. to 10 p.m.), and 50 dBA during any cumulative 30-minute period during the nighttime hours (10 p.m. to 7 a.m.). The codes set somewhat higher noise limits for noise of shorter duration; however, noise shall never exceed 75 dBA in the day and 70 dBA at night.

Table 6.3-9 Noise Control Standards of the City of Sacramento Municipal Code and County of Sacramento Code		
Cumulative Period of Time	Exterior Noise Standards (dBA) [a,b]	
	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
1. 30 minutes in an hour	55	50
2. 15 minutes in an hour	60	55
3. 5 minutes in an hour	65	60
4. 1 minute in an hour	70	65
5. Never to exceed	75	70

[a] This table presents of summary of the noise control standards that are considered to be most applicable to the proposed project. Refer to the City of Sacramento Municipal Code, Title 8, Health and Safety, Chapter 8.68, Noise Control, or Sacramento County Code, Title 6, Health and Sanitation, Chapter 6.68, Noise Control, for additional noise control standards and limitations pertaining to noise-generating activities.

[b] The above standards shall be reduced by 5 dBA for noise consisting of speech, music, or simple tones. If the ambient noise level exceeds that permitted by any of the first four noise limit categories specified in Table 6.3-9, the allowable noise limit shall be increased in 5-dBA increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth noise level category, the maximum ambient noise level shall be the noise limit for that category.

Source: County of Sacramento, 2005; City of Sacramento, 2005

The codes also establish interior noise standards for multiple dwelling units (two or more units); however, these standards are applicable only to noise created inside one of the residential units that disturbs a neighboring unit.

The City Noise Control Code and the County Noise Control Code conditionally exempt noise generated by certain activities. For instance, both codes exempt noise sources associated with agricultural operations provided such operations take place between the hours of 6:00 a.m. and 8:00 p.m. The City Noise Control Code, however, grants this exemption only if the internal combustion engines on agricultural equipment includes suitable exhaust and intake silencers that are in good working order.

Both the City Noise Control Code and the County Noise Control also exempt construction activity but during different times of the day and week. The City Noise Control Code exempts noise generated by construction activity that occurs during the hours of 7 a.m. to 6 p.m., Monday through Saturday, and from 9 a.m. to 6 p.m. on Sunday. The County Noise Control Code exempts noise generated by construction activity that occurs during the hours of 6 a.m. to 8 p.m., Monday through Friday, and 7 a.m. to 8 p.m. on Saturday and Sunday.

Also, residential use heating, ventilation and air conditioning (HVAC) system equipment, such as pumps, fans, and air conditioners, shall not exceed 60 dBA at any point at least 1 foot inside the property line of the affected residential or agricultural property, 55 dBA when measured in the center of a neighboring patio or at the nearest exterior window of the affected residential unit.

In other words, like most city or county noise ordinances, the noise control standards of the City of Sacramento Municipal Code and County of Sacramento Code were created to regulate noise generated by stationary sources and to provide criteria for the handling of noise disputes. The City of Sacramento General Plan Land Use Compatibility Noise Levels shown in Table 6.3-7 and the City of Sacramento Maximum Acceptable Interior and Exterior Noise Level Standards for New Development shown in Table 6.3-8 were developed for the purpose of assisting the City in making land use planning decisions.

6.3.5 IMPACTS AND MITIGATION MEASURES

METHOD OF ANALYSIS

To assess potential construction, area, and stationary source noise impacts, sensitive receptors and their relative exposure were identified. Noise levels of specific equipment expected to be used in project construction or operation were determined and resultant noise levels at sensitive receptors were calculated assuming a noise attenuation rate of 6 dBA/DD. Because the project site would be annexed by the City of Sacramento, this analysis examines the effects of noise generated by construction on the site pursuant to the Noise Control Standards of the City of Sacramento Municipal Code (Table 6.3-9) and accounts for the hours exempted by the City (7 a.m. to 6 p.m., Monday through Saturday, and from 9 a.m. to 6 p.m. on Sunday).

The FHWA Traffic Noise Model (FHWA 1988) was used to model traffic noise levels along affected roadways, based on the trip distribution estimates obtained from the traffic analysis prepared for this project (TJKM 2005). The project's contribution to the baseline traffic noise levels along area roadways was determined by comparing the predicted noise levels at 50 feet from the centerline of the near travel lane with and without project-generated traffic. Predicted traffic noise levels at particular sensitive receptors were calculated assuming a noise reduction of 4.5 dBA/DD from the roadway (i.e., the centerline of the near traffic lane). Separate thresholds of significance are applied based on whether the noise-sensitive receptor is located within Sacramento's city limits or in the unincorporated area of Sacramento County.

The land use compatibility analysis with respect to on-site noise levels from aircraft activity is based on CNEL contours provided by the SCAS Planning and Development Department, though aircraft SENL events, which make up the CNEL, and their potential to result in daytime annoyance and sleep disturbance are also discussed.

The thresholds of significance applied in this analysis primarily address the exterior noise standards established by the City of Sacramento and the Sacramento County. Unless otherwise stated, an exceedance of interior noise level standards would not occur if exterior noise standards are achieved because of sufficient exterior-to-interior noise reduction of common buildings.

THRESHOLDS OF SIGNIFICANCE

The following thresholds of significance, as identified in the Appendix G of the State CEQA Guidelines, were used to determine whether implementing the project would result in a significant noise impact. The project would result in a significant noise impact if it would:

- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project,

  - **Short-Term Construction Noise Impacts.** Short-term construction noise impacts would be significant if construction-generated noise levels exceed the City of Sacramento Noise Code standards (Table 6.3-9) or result in a noticeable increase (i.e., 3 dBA or greater, according to Caltrans 1998) in ambient noise levels at existing nearby noise-sensitive land uses during the more noise-sensitive early morning, evening and nighttime periods of the day [i.e., outside the hours considered exempt (i.e., 7 a.m. to 6 p.m., Monday through Saturday, and 9 a.m. to 6 p.m. on Sunday)]

- Expose persons to or generation of noise levels in excess of standards establish in the local general plan or noise ordinance, or applicable standards of other agencies,

- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project,

- Expose people residing or working in the project area to excessive noise levels

  - **Traffic Noise Impacts.** For the analysis of long-term traffic noise, separate thresholds of significance were applied based on whether the noise-sensitive receptor is located in the City of Sacramento or in the unincorporated area of Sacramento County. Long-term traffic noise impacts would be significant if traffic generated by operation of the proposed project would increase the average daily noise levels by more than 4 dBA or cause the overall exterior noise level to exceed the “normally acceptable” standard for land use compatibility established by the City of Sacramento General Plan (Table 6.3-7) (e.g., 60 dBA L_{dn}/CNEL for residential land uses) at noise-sensitive receptors located in the City of Sacramento. Long-term traffic noise impacts would be significant if traffic noise generated by implementation of the proposed project would increase the average daily noise levels by more than 4 dBA where baseline levels already exceed 60 dBA L_{dn}/CNEL or cause the exterior (i.e., outdoor activity area) noise level to exceed 60 dBA L_{dn}/CNEL at noise sensitive receptors located in the unincorporated area of Sacramento County. When a practical application of the best available noise-reduction technology cannot achieve the 60 dBA L_{dn}/CNEL standard, then an exterior noise level of 65 dBA L_{dn}/CNEL may be allowed in outdoor activity areas (Sacramento County General Plan Policy NO-1). For all affected residential land uses, regardless of location, long-term traffic noise impacts would be significant if traffic noise generated by implementation of the proposed project would exceed 45 dBA L_{dn}/CNEL in any habitable rooms (pursuant to Title 24 of the CCR).

  - **Stationary- and Area-Source Noise Impacts.** Long-term stationary source noise impacts would be significant if the proposed project would result in noise levels that exceed the City of Sacramento and Sacramento County Noise Control Standards at existing nearby noise-sensitive land uses. As shown in Table 6.3-9, the noise control standards limit exterior noise levels (measured at single-family residential land uses) to a maximum of 55 dBA during any cumulative 30-minute period during the daytime hours (7 a.m. to 10 p.m.) and 50 dBA during any cumulative 30-minute period during the nighttime hours (10 p.m. to 7 a.m.).

  - **Land Use Compatibility with On-site Noise Levels.** Development of the proposed land uses would have a significant impact if predicted on-site ambient noise levels under existing or future cumulative conditions would exceed applicable noise criteria of the City of Sacramento General Plan Land Use Compatibility Noise Levels (Table 6.3-7) or the City of Sacramento Maximum Acceptable Interior and Exterior Noise Level Standards for New Development (Table 6.3-8). With regard to exterior noise levels generated by aircraft, the development of residential land uses and schools would be considered a significant impact if they are located within the 60 dBA CNEL exterior noise contour of Sacramento International Airport. Development of the proposed land uses would also have a significant impact if predicted interior noise levels would exceed 45 dBA L_{dn}/CNEL in residential buildings (pursuant to Title 24 of the CCR) or 40 for the nosiest hourly L_{eq} dBA in school buildings. Furthermore, development of the project would result in a significant impact if it would develop residential land uses in locations where people would be exposed to noise levels that result in substantial frequency of speech and/or sleep disturbance.

- Expose persons to or generation of excessive groundborne vibration or groundborne noise levels.

  - **Exposure of Sensitive Receptors or Generation of Excessive Vibration Levels.** Short- and long-term vibration impacts would be significant if construction or operation of the proposed project would result in the exposure of sensitive receptors to or generate vibration levels that exceed Caltrans recommended standard of 0.2 in/sec peak particle velocity (ppv) with respect to the prevention of structural damage for normal buildings (Caltrans 2002) or the Federal Transit Administration’s (FTA) maximum acceptable vibration standard of 80 velocity decibels (VdB) with respect to human response for residential uses (i.e., annoyance) (FTA 1995) at any nearby existing sensitive land uses.

IMPACTS AND MITIGATION MEASURES

IMPACT 6.3-1

Short-term Construction Noise. *Short-term construction-generated noise levels could exceed City of Sacramento Noise Code standards (Table 6.3-9) or result in a noticeable increase in ambient noise levels at existing nearby off-site sensitive land uses as well as on-site residences that are constructed and inhabited before other portions of the project are complete. This would be a* ***potentially significant*** *impact.*

Construction activities at the project site would include site preparation (e.g., excavation, grading, and clearing), trenching, laying of concrete foundations, paving, frame erection, equipment installation, finishing, cleanup, and other miscellaneous activities. No pile driving or rock blasting would occur as part of project construction.

The on-site equipment required is not known at this time but, based on similar projects, would be anticipated to include excavators, graders, loaders, haul trucks, and cranes. According to the EPA, the noise levels of primary concern are typically associated with the site preparation phase because of the on-site equipment associated with clearing, grading, and excavation. Depending on the operations conducted, individual equipment noise levels can range from 79 to 91 dBA at 50 feet, as indicated in Table 6.3-10. The simultaneous operation of the on-site heavy-duty equipment associated with the project, as identified above, could result in combined intermittent noise levels of approximately 94 dBA at 50 feet from the project site. Based on these equipment noise levels and assuming a noise attenuation rate of 6 dBA per doubling of distance from the source and no intervening barriers, exterior noise levels at sensitive receptors located within approximately 4,500 feet of the project site could exceed 55 dBA without feasible noise controls.

Table 6.3-10
Typical Construction Equipment Noise Levels

Type of Equipment	Noise Level in dBA at 50 feet	
	Without Feasible Noise Control	With Feasible Noise Control [1]
Dozer or Tractor	80	75
Excavator	88	80
Compactor	82	75
Front-end Loader	79	75
Backhoe	85	75
Grader	85	75
Crane	83	75
Generator	78	75
Truck	91	75

[1] Feasible noise control includes the use of intake mufflers, exhaust mufflers, and engine shrouds in accordance with manufacturer's specifications.

Sources: U.S. Environmental Protection Agency 1971; Federal Transit Administration 1995

Noise from construction activities between the hours of 7 a.m. to 6 p.m., Monday through Saturday, and 9 a.m. to 6 p.m. on Sunday are exempt from the provisions of the City of Sacramento Noise Code. However, if construction operations were to occur during the noise-sensitive hours outside of these hours, the applicable noise standards could be exceeded at residential land uses near the proposed project. There are three off-site locations where such impacts could occur. One location includes the farm houses located near the northwest corner of the project site near Lone Tree Road. Even if no construction activity occurs within the 200-foot-wide habitat preservation corridor along the west side of the project site, construction activity could be as close as 250 feet to the nearest farm house. The other two locations consist of the future planned residences that would be located in close proximity to the proposed water supply and wastewater pipeline connections. The water supply and wastewater pipeline connection would cross SR 70/99 to connect to a water and wastewater pipelines east of the project site, passing near residences that are part of the approved Natomas Creek development. These residences are currently being built and would be complete and likely occupied before the time of construction. Similarly, the water pipeline connection would cross I-5 to connect to a pipeline system south of the project site, passing near residences that are part of the approved and planned Westbourough development. These residences also may be occupied before the time of construction. In addition, because the project's construction period would be completed in two phases and span 10 years, some residences may be built and inhabited while construction of other residences and facilities continue to be developed. Thus, if construction activities are not limited to the hours exempt from the standards set forth by the City of Sacramento Noise Control Code, the temporary construction noise associated with on-site equipment could expose off-site and on-site sensitive receptors to or generate noise levels in excess of the applicable noise standards and/or result in a noticeable increase in ambient noise levels at noise-sensitive receptors. This would be a ***potentially significant*** impact.

Mitigation Measure 6.3-1. (City of Sacramento and LAFCo)

Construction operations shall be limited to the hours between 7 a.m. to 6 p.m. Monday through Saturday, and 9 a.m. to 6 p.m. on Sunday.

Significance After Mitigation

This measure would ensure that construction operations are consistent with the exemption provided by the City of Sacramento Noise Control Code and that construction would not result in a noticeable increase in ambient noise levels at noise-sensitive receptors during the more noise-sensitive hours of the day, thereby reducing potential impacts to a ***less-than-significant*** level.

IMPACT 6.3-2

Long-Term Operational Traffic Noise. *Implementation of the proposed project would result in increases in traffic noise levels greater than 4 dBA and cause traffic noise levels to exceed the County's 60 dBA L_{dn}/CNEL exterior noise standard at sensitive receptors in unincorporated Sacramento County. This would be a* significant *impact.*

The increase in daily traffic volumes resulting from implementation of the proposed project would generate increased noise levels along nearby roadway segments. The FHWA Traffic Noise Model (FHWA 1988) was used to predict traffic noise levels along affected roadways for baseline traffic conditions, with and without implementation of the proposed project, based on the trip distribution estimates obtained from the traffic analysis prepared for this project (TJKM 2005). Baseline traffic conditions include existing traffic levels as well as traffic that would be generated by all approved projects in the project area, as listed in Exhibit 6.1-1 of Section 6.1, "Traffic and Circulation." The project's contribution to the baseline traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic under baseline conditions. The traffic volumes used to estimate the traffic noise levels account for completion of the Meister Way overpass over SR 70/99, which would be completed before full buildout of the project. This analysis examines only those nearby roadway segments on which sensitive receptors are currently located and/or on which development of future sensitive receptors is already approved.

This traffic noise analysis examines exposure of sensitive receptors located within the City of Sacramento separately from residences in unincorporated areas of Sacramento County because different standards of significance apply for these two areas.

Sensitive Receptors in the City of Sacramento

Table 6.3-11 summarizes the modeling results for road segments that pass by residential dwellings located in the City of Sacramento that would be affected by project-generated traffic. Table 6.3-11 displays the L_{dn}/CNEL at a distance 50 feet from the centerline of the near travel lane for the baseline year with and without the proposed project traffic. Note that most of the noise levels presented in Table 6.3-11 would be lower at the property line of the nearest sensitive receptors assuming they are located further than 50 feet from the modeled road segments. Table 6.3-11 also shows the net increase in roadside noise levels as compared to baseline conditions. The roadway noise levels presented in the table represent worst-case potential noise exposures, which assume no natural or artificial shielding between the roadway and a noise receptor located 50 feet from the centerline of the near travel lane. Sound barriers may already be planned to protect some of the future planned receptors. For instance a sound wall is currently being constructed along the east side of SR 70/99 between Elkhorn Boulevard and the I-5 split, which would provide some protection for receptors in the Natomas Creek Development.

As shown by Table 6.3-11, baseline traffic noise levels along all four of the modeled road segments exceed the “normally acceptable” standard of 60 dBA L_{dn}/CNEL for residential land uses established by the City of Sacramento General Plan (Table 6.3-7) and the noise increases generated by project traffic along all four modeled segments would be less than 4 dBA . Because project-generated traffic would not cause the city’s threshold to be exceeded (it already is), and all the increases are less than 4.0 dBA, the traffic noise impact at sensitive receptors located along these four road segments would be ***less than significant***.

Table 6.3-11
Summary of Modeled Traffic Noise Levels Along Area Roads Affecting Residences in the City of Sacramento

Roadway Segment	Nearby Receptors	L_{dn}/CNEL (dBA) 50 ft from Centerline of Near Travel Lane		
		Baseline	Baseline + PP with Overpass	Increase
Elkhorn Boulevard between SR 70/99 and E. Commerce Parkway	Residential dwellings approved at Natomas Creek	73.0	74.0	0.9
Elkhorn Boulevard east of E. Commerce Parkway	Residential dwellings approved at Natomas Town Center	71.8	72.9	1.2
E. Commerce Parkway between Elkhorn Boulevard and Del Paso Road	Residential dwellings approved at Natomas Town Center and Natomas Creek	66.9	70.2	3.3
SR 70/99 between Elkhorn Boulevard and the I-5 Split	Residential dwellings approved at Natomas Creek	80.5	81.1	0.6

Notes: Traffic noise levels were predicted using the FHWA Traffic Noise Model based on traffic information (e.g., average daily traffic, vehicle speeds, roadway width) obtained from the data generated by TJKM Transportation Consultants used to prepare the traffic section for this DEIR. Modeled estimates assume no natural or human-made shielding (e.g., vegetation, berms, walls, buildings). Refer to Appendix G for modeling input assumptions and output results.
Source: Modeling performed by EDAW in 2005

Sensitive Receptors in Unincorporated Sacramento County

Project-generated traffic would also result in traffic noise increases at residential dwellings located in unincorporated areas of Sacramento County. Table 6.3-12 summarizes the modeling results for road segments that pass by residential land uses located in unincorporated Sacramento County that would be affected by project-generated traffic. The values in Table 6.3-12 indicate the daily level of traffic noise at the nearest sensitive receptors under baseline conditions with and without the proposed project.

Table 6.3-12
Summary of Modeled Traffic Noise Levels Along Area Roads Affecting Residences in Unincorporated Sacramento County

Roadway Segment	Location of Nearby Receptors	L_{dn}/CNEL (dBA) at Receptor		
		Baseline	Baseline + PP with Overpass	Increase
Lone Tree Road south of Elkhorn Boulevard	House located 50 feet west of centerline of Lone Tree Road	61.4	69.1	7.7
W. Elverta Road east of Power Line Road	House located 90 feet south of centerline of W. Elverta Road	55.6	56.3	0.7
Power Line Road between Elkhorn Boulevard and Del Paso Road	House located 80 feet east of centerline of Power Line Road	58.8	64.9	6.1
Elkhorn Boulevard between Power Line Road and Lone Tree Road	House located 575 feet south of centerline of Elkhorn Boulevard	42.8	56.3	13.5
	Two Houses located 175 feet south of centerline of Elkhorn Road	47.9	61.3	13.5

Notes: Traffic noise levels were predicted using the FHWA Traffic Noise Model based on traffic information (e.g., average daily traffic, vehicle speeds, roadway width) obtained from the data generated by TJKM Transportation Consultants used to prepare the traffic section for this DEIR. Modeled estimates assume no natural or human-made shielding (e.g., vegetation, berms, walls, buildings). Refer to Appendix G for modeling input assumptions and output results.
Source: Modeling performed by EDAW in 2005

As shown by Table 6.3-12, project-generated traffic would cause the traffic noise level to exceed the County's 60 dBA L_{dn}/CNEL standard along three of the five road segments and five of the receptors would experience an increase in traffic noise levels that is greater than 4 dBA. For these reasons, exterior noise levels produced by project-generated traffic noise would result in a ***significant*** impact at five existing residences in unincorporated Sacramento County. None of the residences located along the modeled road segments, however, would be exposed to interior noise levels that exceed the Title 24 interior noise threshold of 45 dBA L_{dn}/CNEL. The resultant exterior noise level at each receptor shown in Table 6.3-12 would be less than 70 dBA L_{dn}/CNEL and, assuming a typical exterior-to-interior noise reduction of a minimum of 25 dBA, the interior noise levels at each receptor would be less than 45 dBA L_{dn}/CNEL. Therefore, interior noise levels would be ***less than significant***.

Mitigation Measure 6.3-2: (City of Sacramento and LAFCo)

The project applicant shall implement the following measures to reduce the exposure of existing sensitive receptors to project-generated traffic noise levels.

a. As individual facilities and elements of the proposed project are permitted by the City, the City shall evaluate each for compliance with the County's exterior noise standard and the substantial increase threshold [i.e., relative to existing levels attributed to existing year 2005 traffic volumes (Section 6.1, "Transportation and Circulation")] for transportation noise sources at the existing residences in unincorporated Sacramento County located along Lone Tree Road south of Elkhorn Boulevard (house is 50 feet west of centerline of Lone Tree Road), Power Line Road between Elkhorn Boulevard and Del Paso Road (house is located 80 feet east of centerline of Power Line Road), and Elkhorn Boulevard between Power Line Road and Lone Tree Road (houses are located 575 feet south of centerline of Elkhorn Boulevard and 175 feet south of centerline of Elkhorn Road). Where traffic noise levels generated by individual projects do not clearly comply with the County's exterior noise standards or result in a substantial increase in ambient noise levels at these locations, the City shall offer the owners of the affected residences the installation of solid barriers (e.g., berms, wall, and/or fences) along their affected property line. Actual installation of the barriers/fences would either be funded by, or completed by the project applicant. The barriers/fences must be constructed of solid material (e.g., wood, brick, or adobe) and be of sufficient density and height to minimize exterior noise levels. The barriers/fences shall blend into the overall landscape and have an aesthetically pleasing appearance that agrees with the color and character of nearby residences, and not become the dominant visual element of the community. Where there is a question regarding premitigation or postmitigation noise levels in a particular area, site-specific noise studies/modeling may be conducted to determine compliance or noncompliance with standards. Funding for the installation of this mitigation measure shall be provided by the project applicant.

The County allows for an exterior noise level of up to 65 dBA CNEL/L_{dn} provided that practical exterior noise level reduction measures are implemented. The installation of noise barriers/fences could achieve an approximate 5 dB noise level reduction where the line-of-sight from the nearby roadways to the existing residences would be broken and 1.5 dB of additional noise level reduction for each meter of barrier height beyond the line-of-sight. Thus, a 5 to 10 dB noise reduction could be achieved, resulting in the reduction of traffic-generated noise levels at existing sensitive receptors to levels less than the 65 dBA standard. However, the placement of barriers/fences could be considered infeasible due to their effect on the aesthetic character of these roadways, the spacing between the existing residences and nearby roadways, and the presence of driveways which would prohibit a continuous structure. In addition, even with implementation of the above measure and the reduction of noise levels to below the standard, a substantial increase could still result along Elkhorn Boulevard, where project implementation would result in an approximate 13.5 dB increase. As a result, this impact would remain ***significant and unavoidable***.

Significance After Mitigation

While Mitigation Measure 6.3-2 would substantially lessen exterior noise levels at nearby sensitive receptors, noise levels would still be substantially increased, and the feasibility of the mitigation to reduce all significant noise impacts is unknown. Therefore, this impact would remain ***significant and unavoidable***.

IMPACT 6.3-3

Stationary and Area-Source Noise. *Noise levels generated by stationary- and area-noise sources on the project site would not exceed the Noise Control Standards of the City of Sacramento and County of Sacramento Code at existing nearby noise-sensitive land uses. This would be a* less-than-significant *impact of the proposed project.*

The proposed project would include residential development, an elementary school, neighborhood parks, and retail, office, and commercial space introducing new noise sources to the area. All portions of the project boundary border agricultural lands or freeway corridors. The only noise-sensitive receptors close to the project site are the two farm houses located approximately 55 feet west of the site's western boundary across from Lone Tree Road near the site's northwest corner. These receptors would be buffered from new noise sources on the project site, in part, by Lone Tree Canal and conservation easement that would be established along the west side of the project site. The width of the canal and easement corridor would be approximately 250 feet. In addition, the project would develop three-story residential buildings just east of the buffer area that would act as a sound barrier protecting these off-site receptors from noise generated on the rest of the project site.

Noise typically associated with residential development, such as lawn and garden equipment, voices, amplified music, and HVAC, would not increase ambient noise levels at the off-site receptors located 250 feet away. For instance, HVAC system located on a rooftop typically produces a noise level of 61 dBA L_{eq} at a distance of 50 feet (County of Sacramento 1993). At a distance of 250 feet, this noise level would attenuate to 47 dBA L_{eq}, below the City and County's daytime standards.

Noise generated at the neighborhood parks proposed on the site, such as noise from recreational activities or landscape maintenance equipment, would also not affect these off site receptors as the nearest park would be a minimum of 800 feet away and would not have a direct line of site to the off-site receptors. This would also be the case for the elementary school, which would have similar noise sources and would be located greater than 4,000 feet away, as well as noise generated by office, commercial, and retail land uses (e.g., loading dock activities, parking lot noise), all of which would be located on the eastern half of the project site greater than 3,000 feet away.

The loudest activity near the off-site noise-sensitive receptors would most likely be garbage collection activity. As at most medium- and high-density residential units, trash would be collected from large refuse dumpsters, possibly multiple times each week. The residents of the existing nearby single-family homes are not currently subject to this type of noise because they are located in a low-density area that is not served with large trash dumpsters. Although noise generated by trash collection would likely not increase hourly L_{eq} levels or CNEL levels near the project site, the increased frequency of single-event noise levels generated by trash collection activities could adversely affect the nearby off-site residences. Noise levels generated by garbage collection reach as high as 89 dBA L_{max} from a distance of 50 feet with frequent occurrence of single-event noise levels exceeding 80 dBA (EDAW 2004). These noise levels are sometimes generated high off the ground as a hydraulic lift shakes trash from the dumpster into the truck. At a distance of 305 feet, the loudest maximum noise level generated by garbage collection would attenuate to 73 dBA L_{max}, below the City and County's daytime "not-to-exceed" standard (Table 6.3-9) of 75 dBA L_{max}. Furthermore, the residential buildings located on this side of the project site would often obstruct a direct line of site between the garbage trucks and the off-site receptors, providing additional attenuation. Therefore, noise generated by stationary and areas noise sources on the project site would not exceed any of the noise control standards of the City of Sacramento and County of Sacramento Code (Table 6.3-9), resulting in a ***less-than-significant*** impact.

No mitigation measures are required.

IMPACT 6.3-4

Land Use Compatibility of Proposed Residential and School Uses with On-site Daily and Hourly Average (L_{dn}/CNEL and L_{eq}) Noise Levels. *With implementation of the proposed project, residential land uses (sensitive receptors) proposed on the project site would be exposed to future noise levels generated by area traffic that exceed applicable noise standards. Traffic noise along the bordering segments of I-5, SR 70/99, Elkhorn Boulevard, Lone Tree Road, and on-site Meister Way is estimated to exceed the City's 60 dBA L_{dn}/CNEL exterior noise standard in backyards of single-family homes proposed by the project. Also, the interiors of residential land uses located along these transportation routes would be exposed to interior noise levels that exceed applicable maximum interior noise level standards established by the City of Sacramento General Plan. Therefore, exposure of proposed residential land uses to noise generated by traffic would be a* ***significant*** *impact.*

As previously discussed, noise levels within the project area are influenced by traffic noise associated with vehicle traffic on area roadways, light rail operations, aircraft operations associated with nearby Sacramento International Airport, and agricultural operations on adjacent properties. The levels of noise typically associated with these sources and their compatibility with the proposed sensitive land uses are discussed separately below.

Proposed Residential Uses

Vehicular Traffic

For determination of land use compatibility, predicted traffic noise contours (in dBA CNEL) of area roadways were modeled for future-plus-project conditions (Table 6.3-13 and Exhibit 6.3-5) and calibrated to reflect project specific conditions. Future traffic noise contours were modeled using the FHWA Traffic Noise Prediction Model (FHWA 1988) and are based on the trip distribution estimates obtained from the traffic analysis prepared for this project. Table 6.3-13 summarizes the distances from each roadway centerline to the 55, 60, 65, and 70 dBA L_{dn}/CNEL contours for future plus project conditions. The predicted noise contour distances shown in Table 6.3-13 and Exhibit 6.3-5 do not take into account shielding or reflection of noise from existing or future planned structures or topography. Actual noise levels would vary from day to day, depending on factors such as local traffic volumes, shielding from existing structures, variations in attenuation rates resulting from changes in surface parameters, and meteorological conditions.

Table 6.3-13
Predicted Traffic Noise Contours under Future Plus Project Conditions

Scenario/Roadway Segments	Distance (feet) From Roadway Centerline to Exterior Noise Contour (dBA)			
	70 L_{dn}/CNEL	65 L_{dn}/CNEL	60 L_{dn}/CNEL	55 L_{dn}/CNEL
I-5 west of SR 70/99 Split	219	472	1,003	4,635
SR 70/99 between Elkhorn Boulevard and I-5 Split	216	465	1,000	2,150
Elkhorn Boulevard between Lone Tree Road and SR 70/99	190	404	868	1,868
Lone Tree Road south of Elkhorn Boulevard	97	205	439	944
Meister Way (on the project site) [1]	60	128	275	591

Note: Traffic noise levels were calculated using the FHWA Noise Prediction Model (FHWA 1988) based on traffic information (e.g., average daily traffic, vehicle speeds, roadway width) obtained from the data prepared for this project and calibrated to reflect project specific. Modeling assumes no natural or human-made shielding (e.g., vegetation, berms, walls, buildings). Contour distances of "0" are within roadway right-of-way.

[1] Meister Way currently does not exist and would not be constructed under the No Project Alternative.

Source: Modeling performed by EDAW in 2005 and Calibration by Bollard Acoustical Consultants (Sawyer, pers. comm., 2006).

The City of Sacramento General Plan establishes 60 dBA L_{dn} as the exterior threshold at most sensitive receptors exposed to traffic noise. This threshold applies to the backyards of single-family homes and common outdoor use areas of multi-family residential developments (Table 6.3-8). Therefore, the 60 dBA L_{dn}/CNEL contour of each roadway is closely examined. The City of Sacramento General Plan also establishes an interior noise threshold of 45 dBA L_{dn} for single family homes and multi-family residences. Because the noise reduction from common building construction provides a minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002), the 70 dBA L_{dn}/CNEL contour of each roadway is analyzed to determine whether traffic noise levels would exceed the City's maximum acceptable interior noise level standard of 45 dBA L_{dn} for new residential development.

As shown in Table 6.3-13, and Exhibit 6.3-5 freeway traffic from I-5 and SR 70/99 would be the predominant noise source for much of the project site with their 60 dBA L_{dn}/CNEL contours that extend 1,003 feet and 1,000 feet into the project site, respectively. The proposed noise-sensitive residential land uses are setback various distances from the major freeways and have varying degrees of exposure at the proposed outdoor activity areas. Thus, it is necessary to discuss noise impacts for each discrete location within the project site as shown in Exhibit 6.3-6.

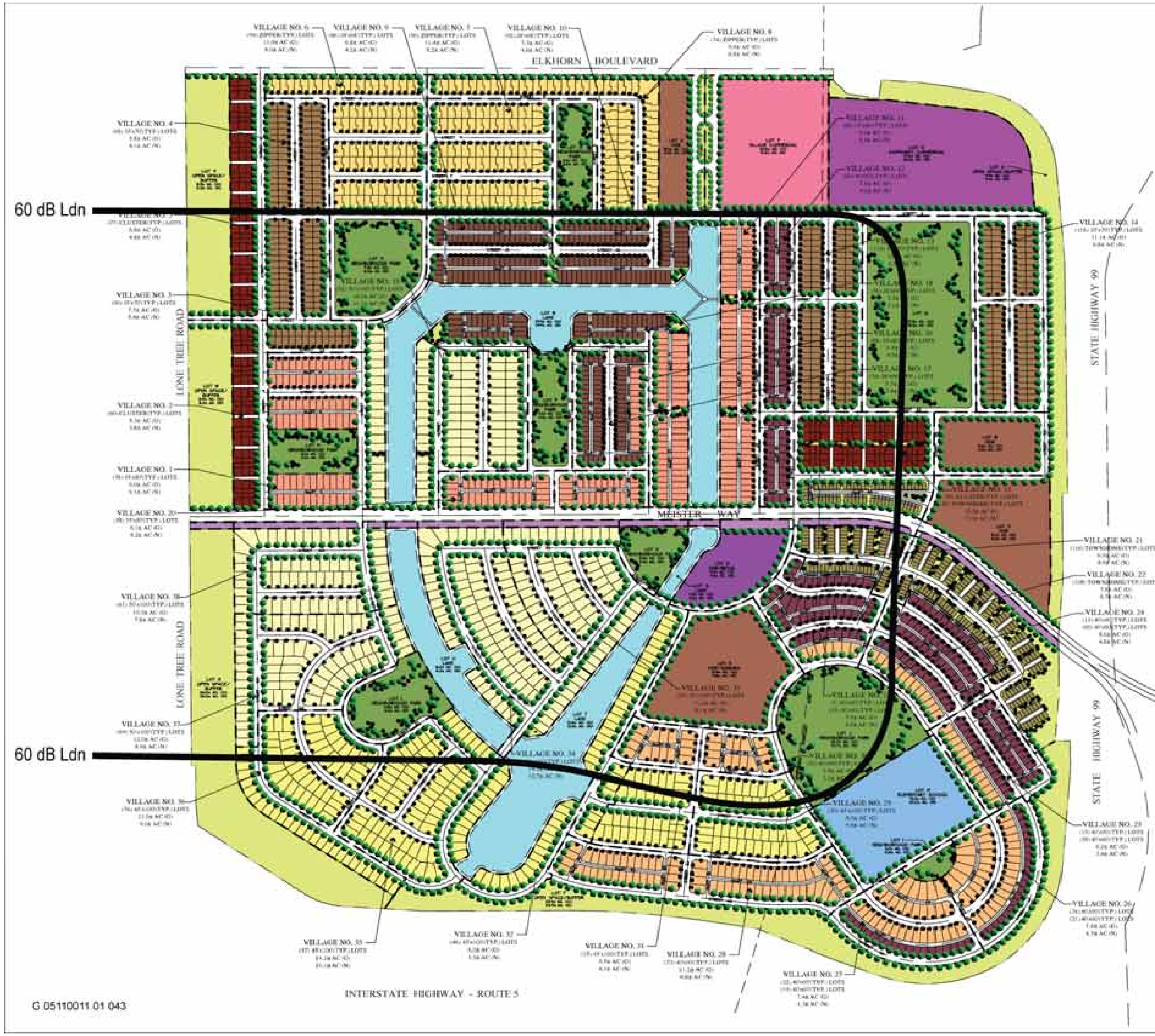
Noise-sensitive residential (low- and medium-density) land uses are proposed in the southeast portion of the project site (see Exhibit 6.3-6 for C1 noise impact study area). The extent of the 60 dBA L_{dn}/CNEL contours of I-5 and SR 70/99 would likely be less than the distances shown in Table 6.3-13 due to attenuation provided by rows of buildings on the outer edge of the project site. For instance, the outer row of medium-density residential units in the southeast corner of the project site (as shown in Exhibit 6.3-6 that may be as much as three stories high, would provide some noise protection for the next row of land uses, low-density homes. However, the amount of noise protection provided by the first row of medium-density residential buildings is unknown, in part, because the interchange between I-5 and SR 70/99 is elevated approximately two stories high.

Generally, for an at-grade facility in an average residential area where the first row houses cover at least 40% of total area (i.e. no more than 60% spacing), the reduction provided by the first row is reasonably assumed at 3 dBA, and 1.5 dBA for each additional row (Caltrans 1998). For a facility area where the first row of houses or buildings are "packed" tightly (i.e., cover about 65-90% of total area, with 10-35% open space), the reduction provided by the first row of buildings is reasonably assumed to be 5 dBA, and 1.5 dBA for each additional row (Caltrans 1998). For these assumptions to be true, the first row of houses or buildings must be equal to or higher than the second row, which should be equal to or higher than the third row, etc. (Caltrans 1998). The outer row of medium-density residential land uses in the southwest corner of the site would have a tightly "packed" design; therefore a freeway noise attenuation of 5 dBA for the next row of low-density residential land uses would be provided, as shown in Exhibit 6.3-7, resulting in predicted backyard noise levels of approximately 68 dBA L_{dn}/CNEL (Bollard Acoustical Consulting, Inc. 2006).

Similarly, freeway noise contours may encompass the backyards of single-family homes or the common outdoor use areas of multi-family residential developments proposed near the south and east sides (see Exhibit 6.3-6 for B, C2, D1, and E noise impact study areas), and the southwest corner of the project site (see Exhibit 6.3-6 for A noise impact study area). Even accounting for the reductions in freeway noise resulting from intervening building rows, the 60 dBA L_{dn}/CNEL noise contours of both freeways would encompass one or more rows of residential land uses proposed along the south and east sides of the project site (e.g., predicted backyard noise levels ranging from approximately 60-69 dBA). In addition, because some of the proposed residences would have side-yard exposure to I-5 or SR 70/99 and oriented with backyard areas facing southwest toward I-5 (D1 and A noise impact study areas), they would not be appreciably shielded from traffic noise by the residential structure, as shown in Exhibit 6.3-7. Also, the draining opening identified in area B would create an acoustic opening permitting the transmission of excessive traffic noise from I-5 into the lake area and to nearby back yard spaces abut the lake area (Bollard Acoustical Consulting, Inc. 2006). Thus, some outdoor areas of residential land uses proposed on the site would be exposed to noise levels in exceedance of the "normally acceptable" 60 dBA L_{dn}/CNEL standard of the City of Sacramento General Plan.

In addition, Table 6.3-13 indicates that the 70 dBA L_{dn}/CNEL contour distances of I-5 and SR 70/99 would extend 219 feet and 216 feet, respectively. Because some residential buildings are proposed within one or both of these 70 dBA L_{dn}/CNEL contours and exterior noise levels within this contour would be 70 dBA L_{dn}/CNEL or greater, the City's maximum acceptable interior noise level standard of 45 dBA L_{dn} for new residential development would also be exceeded.

Meister Way would be the primary roadway located on the project site and would carry substantial traffic volume. As shown in Table 6.3-13, Meister Way would have a 60 dBA L_{dn}/CNEL contour that extends approximately 275 feet from the road. The back yards of single family homes would be located on both sides of the road and would fall within this contour (see Exhibit 6.3-6 for C3, D2, and F noise impact study areas). With no intervening structures or

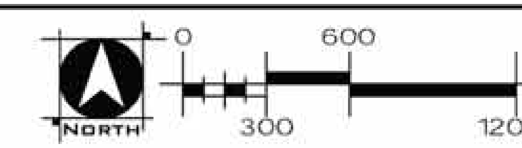


LAND USE SUMMARY

LOT NO./VILLAGE NO.	GENERAL PLAN/ COMM. PLAN/ZONING DESIGNATION	USE	ACRES (G)	ACRES (N)	UNITS	DENSITY
VILLAGES 19, 33, 34, 37 + 38	LDR/LD/R-1(PUD)	LOW DENSITY RESIDENTIAL (50'x100')	62.0	46.6	375	8.1
VILLAGES 29, 31, 32, 35 + 36	LDR/LD/R-1(PUD)	LOW DENSITY RESIDENTIAL (45'x100')	47.6	34.3	296	8.6
SUBTOTAL			109.6	80.9	671	-
VILLAGES 6, 7 + 8	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (ZIPPER)	33.2	23.0	264	11.5
VILLAGES 28 + 30	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x90')	16.7	9.7	103	10.6
VILLAGES 23, 24, 25, 26 + 27	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x90' + 40'x60')	37.5	21.2	291	13.7
VILLAGES 1, 11, 16 + 20	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (35'x80')	30.9	21.6	290	13.4
VILLAGES 3, 4, 13 + 14	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (35'x70')	36.0	23.1	390	16.9
VILLAGE 12	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x60')	7.8	4.2	69	16.4
VILLAGES 9, 10, 17 + 18	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (28'x68')	25.3	15.3	308	20.1
VILLAGES 2 + 5	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (CLUSTER)	12.1	8.6	137	15.9
VILLAGES 21 + 22	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (TOWNHOMES)	14.7	11.2	224	20.0
VILLAGE 15	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (CLUSTER + TOWNHOMES)	10.5	7.3	139	19.0
SUBTOTAL			223.7	145.2	2,215	-
LOTS A, B + C	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL	19.3	15.8	307	22
LOT D	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL (RETAIL)	5.1	4.5	25	22
LOT E	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL (SENIORS)	11.6	9.6	255	30
SUBTOTAL			36.0	29.9	587	-
LOT F	CNCO/CNCO/SC(PUD)	VILLAGE COMMERCIAL	13.6	11.2	-	-
LOT G	CNCO/CNCO/C-2(PUD)	COMMUNITY COMMERCIAL	17.2	16.3	-	-
LOT H	LDR/ES/R-1(PUD)	ELEMENTARY SCHOOL	11.2	10.0	-	-
LOTS I - Q	PROS/P/R-1(PUD)	NEIGHBORHOOD PARK	55.2	48.4	-	-
LOTS R - U	W/OS/A-OS(PUD)	LAKE	39.2	39.2	-	-
LOTS V - Z	PROS/OS/A-OS(PUD)	OPEN SPACE/BUFFER	54.3	54.0	-	-
LOT AA	PROS/OS/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.2	0.2	-	-
LOTS BB, CC, EE + FF	LDR/LD/R-1(PUD)	LIGHT RAIL CORRIDOR	1.8	1.8	-	-
LOTS DD + HH	W/OS/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.4	0.4	-	-
LOT GG	PROS/P/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.4	0.4	-	-
LOT II	HDR/HD/R-2B(PUD)	LIGHT RAIL CORRIDOR	0.6	0.6	-	-
LOTS JJ + KK	MDR/MD/R-1A(PUD)	LIGHT RAIL CORRIDOR	1.6	1.6	-	-
LOTS LL - PP	-	LANDSCAPE CORRIDOR	-	1.8	-	-
LOTS QQ, RR + MMM - RRR	LDR/LD/R-1(PUD)	OPEN SPACE/PEDESTRIAN PASEO	-	0.65	-	-
LOTS SS - LLL + SSS	MDR/MD/R-1A(PUD)	OPEN SPACE/PEDESTRIAN PASEO	-	1.95	-	-
ELKHORN BOULEVARD + MEISTER WAY			12.0	12.0	-	-
LOCAL RESIDENTIAL STREETS			-	120.5	-	-
SUBTOTAL			207.7	321.0	-	-
TOTAL			577.0	577.0	3,473	-

NOTES:

1. LANDSCAPE CORRIDOR AND LANDSCAPE/PEDESTRIAN ACCESS TOTALS ALREADY INCLUDED IN GROSS ACREAGE OF ABOVE VILLAGES.
2. DWELLING UNITS ON HDR - LOT D HAS BEEN CAPPED TO 25 DWELLING UNITS.
3. PER THE NNCP, RESIDENTIAL DWELLING UNITS ON HDR LOTS A, B, C + E WERE CALCULATED USING 0.8AE OF THE NET ACREAGE MULTIPLIED BY THE TARGET DENSITY FOR EACH PARCEL.



Source: Wood Rodgers 2005, Bollard Acoustical Consultants, Inc. 2006, EDAW 2005

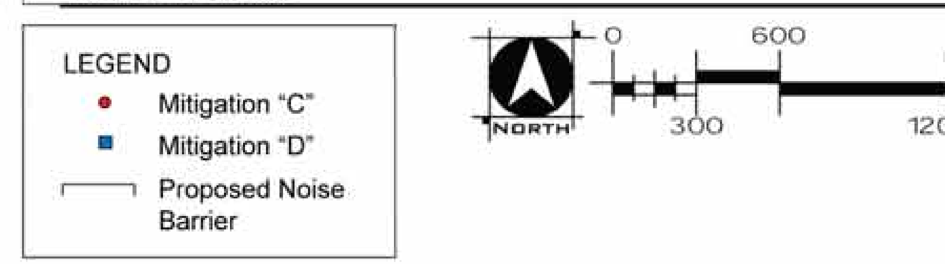
Predicted Interstate 5, Highway 99, and Elkhorn Boulevard 60 dBA L_{dn}/CNEL Noise Contours under Future Plus Project Conditions **Exhibit 6.3-5**

LAND USE SUMMARY

LOT NO./VILLAGE NO.	GENERAL PLAN/ COMM. PLAN/ZONING DESIGNATION	USE	ACRES (G)	ACRES (N)	UNITS	DENSITY
VILLAGES 19, 33, 34, 37 + 38	LDR/LD/R-1(PUD)	LOW DENSITY RESIDENTIAL (50'x100')	62.0	46.6	375	8.1
VILLAGES 29, 31, 32, 35 + 36	LDR/LD/R-1(PUD)	LOW DENSITY RESIDENTIAL (45'x100')	47.6	34.3	296	8.6
SUBTOTAL			109.6	80.9	671	–
VILLAGES 6, 7 + 8	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (ZIPPER)	33.2	23.0	264	11.5
VILLAGES 28 + 30	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x90')	16.7	9.7	103	10.6
VILLAGES 23, 24, 25, 26 + 27	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x90' + 40'x60')	37.5	21.2	291	13.7
VILLAGES 1, 11, 16 + 20	MDR/MD/R-1A(PUD)	MEDIUM DENSITY RESIDENTIAL (35'x80')	30.9	21.6	290	13.4
VILLAGES 3, 4, 13 + 14	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (35'x70')	35.0	23.1	390	16.9
VILLAGE 12	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (40'x60')	7.8	4.2	69	16.4
VILLAGES 9, 10, 17 + 18	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (28'x68')	25.3	15.3	308	20.1
VILLAGES 2 + 5	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (CLUSTER)	12.1	8.6	137	15.9
VILLAGES 21 + 22	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (TOWNHOMES)	14.7	11.2	224	20.0
VILLAGE 15	MDR/MD/R-2B(PUD)	MEDIUM DENSITY RESIDENTIAL (CLUSTER + TOWNHOMES)	10.5	7.3	139	19.0
SUBTOTAL			223.7	145.2	2,215	–
LOTS A, B + C	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL	19.3	15.8	307	22
LOT D	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL (RETAIL)	5.1	4.5	25	22
LOT E	HDR/HD/R-2B(PUD)	HIGH DENSITY RESIDENTIAL (SENIORS)	11.6	9.6	255	30
SUBTOTAL			36.0	29.9	587	–
LOT F	CNCO/CNCO/SC(PUD)	VILLAGE COMMERCIAL	13.6	11.2	–	–
LOT G	CNCO/CNCO/C-2(PUD)	COMMUNITY COMMERCIAL	17.2	16.3	–	–
LOT H	LDR/ES/R-1(PUD)	ELEMENTARY SCHOOL	11.2	10.0	–	–
LOTS I – Q	PROS/P/R-1(PUD)	NEIGHBORHOOD PARK	55.2	48.4	–	–
LOTS R – U	W/OS/A-OS(PUD)	LAKE	39.2	39.2	–	–
LOTS V – Z	PROS/OS/A-OS(PUD)	OPEN SPACE/BUFFER	34.3	34.0	–	–
LOT AA	PROS/OS/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.2	0.2	–	–
LOTS BB, CC, EE + FF	LDR/LD/R-1(PUD)	LIGHT RAIL CORRIDOR	1.8	1.8	–	–
LOTS DD + HH	W/OS/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.4	0.4	–	–
LOT GG	PROS/P/A-OS(PUD)	LIGHT RAIL CORRIDOR	0.4	0.4	–	–
LOT II	MDR/MD/R-2B(PUD)	LIGHT RAIL CORRIDOR	0.6	0.6	–	–
LOTS JJ + KK	MDR/MD/R-1A(PUD)	LIGHT RAIL CORRIDOR	1.6	1.6	–	–
LOTS LL – PP	–	LANDSCAPE CORRIDOR	–	1.8	–	–
LOTS QQ, RR + MMM – RRR	LDR/LD/R-1(PUD)	OPEN SPACE/PEDESTRIAN PASEO	–	0.65	–	–
LOTS SS – LLL + SSS	MDR/MD/R-1A(PUD)	OPEN SPACE/PEDESTRIAN PASEO	–	1.98	–	–
ELKHORN BOULEVARD + MEISTER WAY			12.0	12.0	–	–
LOCAL RESIDENTIAL STREETS			–	120.5	–	–
SUBTOTAL			207.7	321.0	–	–
TOTAL			577.0	577.0	3,473	–

NOTES

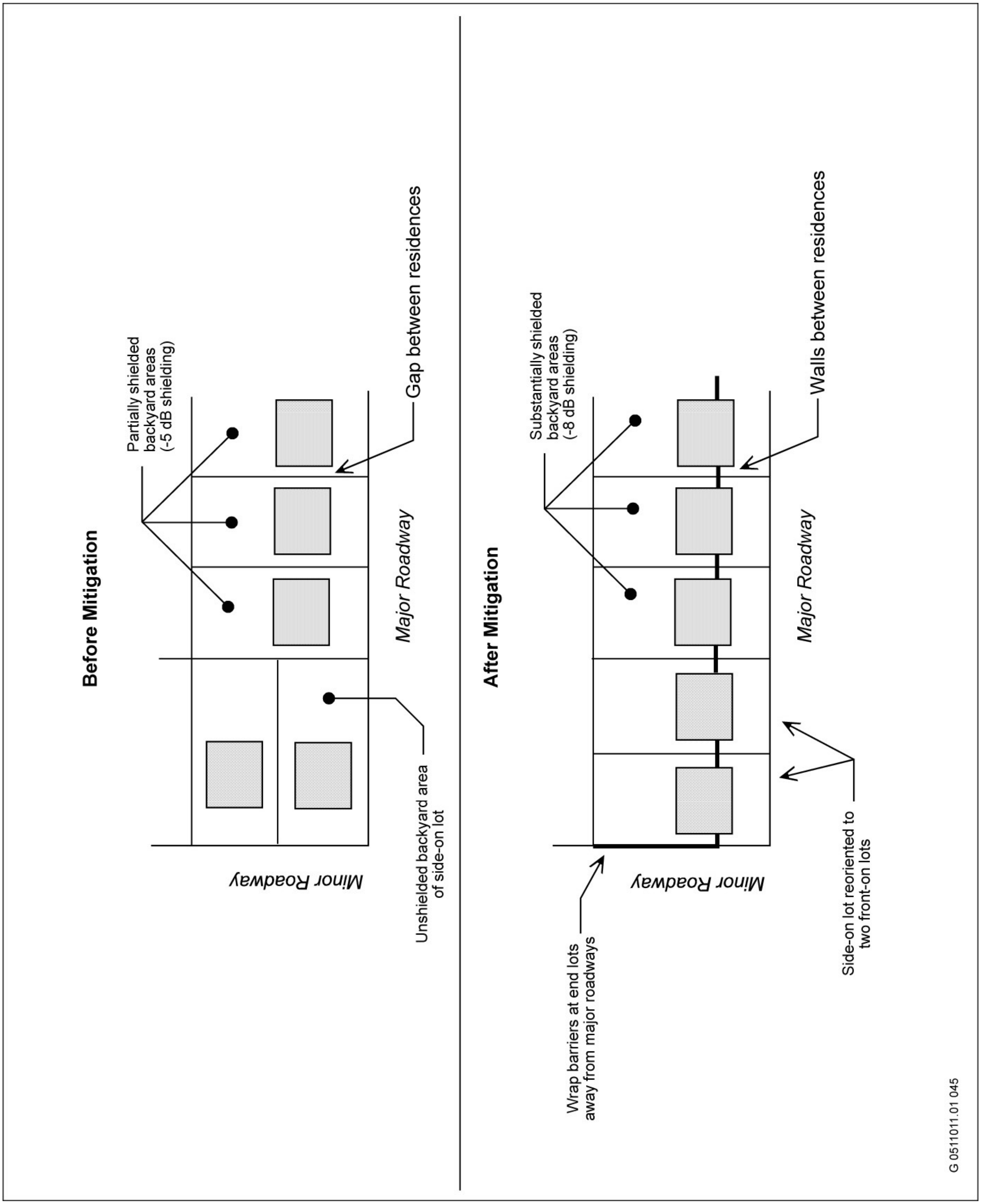
1. LANDSCAPE CORRIDOR AND LANDSCAPE/PEDESTRIAN ACCESS TOTALS ALREADY INCLUDED IN GROSS ACREAGE OF ABOVE VILLAGES.
2. DWELLING UNITS ON HDR – LOT D HAS BEEN CAPPED TO 25 DWELLING UNITS.
3. PER THE NNCP, RESIDENTIAL DWELLING UNITS ON HDR LOTS A, B, C + E WERE CALCULATED USING 0.8% OF THE NET ACREAGE MULTIPLIED BY THE TARGET DENSITY FOR EACH PARCEL.



Source: Wood Rodgers 2005, Bollard Acoustical Consultants, Inc. 2006

Noise Impact Study Areas and Mitigation

Exhibit 6.3-6



Source: Bollard Acoustical Consultants, Inc. 2006

Example Noise Mitigation for Lots Adjacent to Major Roadways **Exhibit 6.3-7**

sound barrier, these homes would be exposed to exterior noise levels that exceed the City's maximum acceptable exterior noise level standard of 60 dBA L_{dn} for new residential development (Table 6.3-8). None of these homes, however, would be located within the 70 dBA L_{dn}/CNEL exterior noise contour that extends approximately 60 feet from the centerline of the road, which means that interior noise levels at these residences would not exceed the City's maximum acceptable interior noise level standard of 45 dBA L_{dn}.

Noise-sensitive land uses proposed on the site would also be exposed to traffic noise generated on local roads. As shown in Table 6.3-13 and Exhibit 6.3-5, the segment of Elkhorn Boulevard between Lone Tree Road and SR 70/99 would have a 60 dBA L_{dn}/CNEL contour that extends approximately 868 feet from the road. The back yards of the single-family homes proposed inside this noise contour would be exposed to traffic noise levels that exceed the City's maximum acceptable exterior noise level standard of 60 dBA L_{dn} for new residential development (Table 6.3-8), though noise levels 868 feet from the road may be lower because of attenuation provided by the homes closest to the road (see Exhibit 6.3-6 for H noise impact study area). The 70 dBA L_{dn}/CNEL of this segment of Elkhorn Boulevard would extend approximately 190 feet from the roadway centerline and would encompass all or some of the homes proposed along the north side of the project site. Because the noise reduction from common residential building construction provides a minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002), interior noise levels inside these residences could exceed the City's maximum acceptable interior noise level standard of 45 dBA L_{dn} for new residential development (Table 6.3-8).

The segment of Lone Tree Road along the west side of the project site would have a 60 dBA L_{dn}/CNEL traffic noise contour that extends approximately 439 feet from the centerline of the roadway. Though single-family homes along the west side of the site would be separated by 250 feet from the road (because of Lone Tree Canal and the proposed conservation easement) some of their back yards would abut the conservation easement and be located inside the 60 dBA L_{dn}/CNEL traffic noise contour and therefore exposed to traffic noise levels that exceed the City's maximum acceptable exterior noise level standard of 60 dBA L_{dn} for new residential development (Table 6.3-8) (see Exhibit 6.3-6 for I noise impact study area). The exterior 70 dBA L_{dn}/CNEL traffic noise contour would not extend as far as the residential land uses (i.e., approximately 97 feet) and, therefore, they would not be exposed to noise levels that exceed the City's maximum acceptable interior noise level standard of 45 dBA L_{dn} for new residential development.

With implementation of the project, sensitive receptors (i.e., residences) proposed on the project site would be exposed to future noise levels generated by area traffic that exceed applicable noise standards. This would be a ***significant*** impact.

Light Rail Noise

The City of Sacramento General Plan's exterior noise standard at residential land uses for noise generated by rail activity is 60 dBA CNEL. A Sacramento Regional Transit light rail line is proposed to run along the south side of Meister Way on the project site. The tracks would be located in close proximity to the back yards of single family homes immediately to the south. As part of the light rail line, grade crossings with signal bells would be developed on the project site. Light rail service generally runs from 5:30 a.m. to 12:30 a.m. each day, every 15 minutes during the morning and evening commute hours, and every 30 minutes during the other operating hours.

Based on noise modeling previously conducted for the existing light rail line along the Sacramento Folsom Corridor, wayside noise levels generated by light rail trains average approximately 60 dBA L_{dn}/CNEL at 50 feet (Sacramento Regional Transit 2000). Noise would also be generated by signal crossings. Signal bells used at grade crossings typically operate for periods of approximately 15 to 30 seconds and generate intermittent noise levels (i.e., less than 1 second in duration) of approximately 73 dBA L_{max} at 50 feet (Sacramento Regional Transit 2000). Thus, residential land uses located within 50 feet would be exposed to exterior noise levels generated by light rail trains that exceed the City's maximum acceptable exterior noise standard of 60 dBA L_{dn} for new residential development (Table 6.3-8).

Because the noise reduction from common residential building construction provides a minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002), noise levels generated by light rail noise would not exceed the City's maximum acceptable interior noise level standards inside these residences, including the interior L_{dn} standard of 45 dBA, and the maximum instantaneous standards of 50 dBA in bedrooms and 55 dBA in other habitable rooms (Table 6.3-8). With implementation of the project, sensitive receptors proposed on the project site would be exposed to future exterior noise levels generated by light rail operations that exceed applicable noise standards. This would be a ***significant*** impact.

Aircraft Noise

The City of Sacramento General Plan's exterior noise standard at residential land uses for noise generated by aircraft activity associated with a metropolitan airport is 60 dBA CNEL (Table 6.3-8). As shown in Exhibit 6.3-3, the 60 dBA CNEL aircraft noise contour associated with implementation of the project does not encompass any portion of the project site and is located more than 1,900 feet away to the site's west boundary. Therefore, aircraft noise levels at all of the land uses proposed on the project site would be considered "normally acceptable" with respect to the City of Sacramento General Plan Land Use Compatibility Noise Levels (Table 6.3-7).

However, because CNEL noise levels essentially represent a weighted daily average, there is an argument that CNEL metrics may not adequately identify some aspects of noise exposure effects from individual flights such as speech interference and sleep disturbance (California Division of Aeronautics 2002). For instance, Tables 6.3-3 and 6.3-4 show maximum noise levels (L_{max}) measured on the project site from commercial and military aircraft that exceed the City of Sacramento's instantaneous noise level standards of 50 dBA L_{max} in bedrooms and 55 dBA L_{max} in other habitable rooms of both single-family and multi-family residences (Table 6.3-8). However, according to City of Sacramento General Plan, the interior noise level standards for residential dwellings only apply if the exterior L_{dn} exceeds 60 dBA (as explained by note 'b' to Table 6.3-8).

Because the project site is located more than 1,900 feet from the future projected 60 dBA CNEL contour for Sacramento International Airport, the proposed project is defined as compatible with the overall aircraft noise exposure from the airport, and under this criteria the proposed project is considered to be a ***less-than-significant*** impact. The exposure of residents on the project site to SENL from aircraft overflights and resulting annoyance, due to occasional speech interruption and sleep disturbance is discussed below in Impact 6.3-5.

Agricultural Operations

Agricultural activities near the northern and western boundaries of the project area include the use of various types of heavy equipment. Operation of heavy agricultural equipment typically generates noise levels of approximately 75 dBA L_{eq} at 50 feet (EPA 1971). The project has been designed with an open space buffer/conservation easement along the west side of the project site. The combined width of the conservation easement, Lone Tree Road, and the irrigation canal west of the project site provide a buffer that measures at least 300 feet between the nearest proposed residences and agricultural land uses to the west. At this distance, noise generated by the operation of heavy agricultural equipment would attenuate to 59.4 dBA L_{eq}. The closest residences would not be exposed to this noise level for extended periods, given the mobile nature of agricultural operations (e.g., disking, plowing, haying). If, for instance, residences were exposed to for one full daytime hour in a day and ambient noise levels were 50 dBA L_{eq} during the rest of the day, then the 24-hour noise level would be 57.0 dBA CNEL, which is below the City of Sacramento's "normally acceptable" land use compatibility standard for residential land uses (Table 6.3-7).

The single-family homes that would be located along the north boundary of the project site would be separated from agricultural operations by the Elkhorn Boulevard, which would be widened to 125 feet with six traffic lanes, a median, bike lane, sidewalk, and landscaping, as recommended in Mitigation Measure 6.1-26 in Section 6.1, "Transportation and Circulation." At this distance, noise levels generated by agricultural operations would attenuate to 67.0 dBA L_{eq}. Just one hour of daytime exposure to this noise level would result in a 24-hour noise level of 58.3 dBA CNEL, which is below the City of Sacramento's "normally acceptable" land use compatibility standard for residential land uses (Table 6.3-7). As a result, the exposure of residential land uses located along the western and northern boundaries of the project site to noise generated by off-site agricultural operations would be a ***less-than-significant*** impact.

Proposed School

Agricultural activities would occur near the northern and western boundaries of the project area and not by the proposed school site in the southeast corner, and thus, are not included in the discussion below.

The City of Sacramento General Plan establishes 60 dBA L_{dn} as the exterior threshold at school grounds (Table 6.3-8). The City of Sacramento General Plan also establishes an interior noise threshold of 40 dBA L_{eq} for schools during the noisiest hour of the school day. Though compliance is only voluntary unless specified by a code, ordinance or regulation, the American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools (ANSI Standard 12.60-2002) also recommends a maximum 1-hour unsteady (e.g., transportation source noise) background noise level of 40 dBA L_{eq} (Acoustical Society of American 2002).

Predicted traffic noise levels, not attenuated by intervening structures, at the proposed elementary school site (see Exhibit 6.3-6 for G noise impact study area), which is located 545 feet from I-5 and 548 feet from SR 70/99, would range from approximately 60 dBA to 65 dBA L_{dn}/CNEL (Table 6.3-13 and Exhibit 6.3-5). However, the school would be protected by a minimum of two rows of residential buildings. The amount of noise protection provided by these intervening structures would include a 5 dBA reduction from the outer row of medium-density residential dwellings, and an additional 1.5 dBA from the second row of low-density residences. In addition, the school site would be protected by as many as four rows of residential buildings, which would provide a combined 9.5 dBA attenuation. These reductions would essentially reduce noise levels to below the "normally acceptable" 60 dBA L_{dn}/CNEL standard of the City of Sacramento General Plan. Because the noise reduction from common building construction provides a minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002) and that the peak L_{eq} is typically 2-4 dBA lower than the L_{dn}/CNEL for high-traffic freeways, 67 dBA L_{dn}/CNEL is used to evaluate whether traffic noise levels would exceed the City's maximum acceptable interior noise level standard of 40 dBA L_{eq} for schools during their noisiest hour (Table 6.3-8). Thus, because traffic noise levels would be reduced to at least 58.5 dBA CNEL (~ 31.5 dBA L_{eq}) when considering the intervening buildings, an exceedance of the City of Sacramento's noisiest-hour interior standard of 40 dBA L_{eq} would not anticipated in any school buildings proposed on the elementary school site.

With respect to aircraft noise, as shown in Exhibit 6.3-3, the 55 dBA CNEL aircraft noise contour would be located just to the west of the proposed school site and would not exceed the 60 dBA L_{dn} as the exterior threshold at school grounds (Table 6.3-8). Because the noise reduction from common building construction provides a minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002) and that the peak L_{eq} is typically 3-4 dBA higher than the L_{dn}/CNEL for operations where activities occur primarily during the daytime hours, 61 dBA L_{dn}/CNEL is used to evaluate whether aircraft noise levels would exceed the City's maximum acceptable interior noise level standard of 40 dBA L_{eq} for schools during their noisiest hour (Table 6.3-8). Thus, because aircraft noise levels would not exceed 55 dBA CNEL (~ 34.0 dBA L_{eq}) an exceedance of the City of Sacramento's noisiest-hour interior standard of 40 dBA L_{eq} would not be anticipated in any school buildings proposed on the elementary school site. The exposure of students on the project site to SENL from aircraft overflights and resulting annoyance, due to occasional speech interruption is discussed below in Impact 6.3-5.

Predicted rail noise levels at the proposed school site, which is located 900 feet from the proposed Sacramento Regional Transit would be less than 40 dBA L_{dn}/CNEL, based the reference noise level of 60 dBA at 50 feet mentioned above, and would not exceed the 60 dBA L_{dn} as the exterior threshold at school grounds (Table 6.3-8). In addition, the school site would be protected by as many as four rows of residential buildings, which would provide a combined 9.5 dBA attenuation resulting in noise levels well below the 40 dBA mentioned above. In addition, based on the typical minimum exterior-to-interior reduction of 25 dBA (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002), noise from the proposed rail line would not exceed the applicable interior standard.

Though compliance is only voluntary unless specified by a code, ordinance or regulation, the ANSI Standard which recommends a maximum 1-hour unsteady (e.g., transportation source noise) background interior noise level of 40 dBA L_{eq} (Acoustical Society of American 2002) would also not be exceeded at the proposed school site based on the combination of all the hourly maximum noise levels (~36 dBA L_{eq}) discussed above from transportation sources. Likewise, the FAA standard which recommends a 45 L_{eq} (8-hour) interior standard for schools would also not be exceeded based on the peak hourly L_{eq} discussed above combined with the fact that this level would not occur for 8 hours of any given day. This would be a ***less-than-significant*** impact.

Mitigation Measure 6.3-4: (City of Sacramento and LAFCo)

The project shall implement the following measures before the occupancy of any proposed uses in the related impact areas, to reduce the exposure of sensitive receptors to significant noise associated with surface transportation (Bollard Acoustical Consultants, Inc. 2006):

a. For noise impact/mitigation area A (see Exhibit 6.3-6), a solid (e.g., earth, concrete, masonry, wood, and other materials) noise barrier shall be constructed of 10 feet in height relative to backyard elevation at the residences located nearest to the southern boundary, stepping down linearly to 6 feet at its northwestern terminus. The wrapped portion of the barrier along the southeast corner shall also step down to 6 feet in height at its terminus.

b. For noise impact/mitigation area B (see Exhibit 6.3-6), the drainage opening shall be shifted to the north by two lots to close the acoustic opening.

c. For noise impact/mitigation area C (see Exhibit 6.3-6), the spaces between the residences shall be bridged with solid noise barriers (e.g., earth, concrete, masonry, wood, and other materials) of 6 feet in height, rather than conventional wood privacy fences. Gates constructed for access into the rear yard spaces shall be constructed so as not to create appreciable acoustic leaks (e.g., constructed of solid wood, sealed to prevent sound and be continuous in length and height with minimal gap at the ground).

d. For noise impact/mitigation area D (see Exhibit 6.3-6), all identified side-on residences shall be reoriented so that they face the roadways and the backyard spaces would be shielded by the residences. Following the reorienting of the side-on residences, the side space adjacent to the residences shall be bridged in same manner as specified above under c. Furthermore, the side yard privacy fences at end lots shall be replaced with solid noise barriers (e.g., earth, concrete, masonry, wood, and other materials) 7 feet in height to adequately shield backyard spaces.

e. For noise impact/mitigation area E (see Exhibit 6.3-6), it would not be feasible to utilize the types of noise mitigation described above (e.g., walls between individual units), to achieve satisfaction with City noise standards due to the orientation and shape of the residences. As a result, a solid barrier (e.g., earth, concrete, masonry, wood, and other materials) consisting of a berm, a wall, or combination thereof, shall be constructed at the approximate location shown in Exhibit 6.3-6. The barrier shall be 10 feet in height relative to pad elevations of the residences behind the barrier.

f. For noise impact/mitigation area F (see Exhibit 6.3-6), a solid noise barrier of 8 feet in height shall be constructed to adequately shield Meister Way traffic noise. In addition, because no discrete outdoor activity areas are identified with the higher density residential developments on the north and south sides of Meister Way near the eastern portion of the site, a solid barrier shall be constructed along both sides of Meister Way at these locations (see exhibit 6.3-6). Where Meister Way becomes elevated at the portion heading east over Highway 99, the barrier shall extend along the top of the cut (at the roadway elevation), to provide efficient shielding to the residences below.

g. For noise impact/mitigation area H (see Exhibit 6.3-6), a solid noise barrier or berm/wall combination of 12 feet in height shall be constructed along Elkhorn Boulevard to adequately shield residences which back up to this roadway. In addition, because no discrete outdoor activity areas are identified with the higher density residential developments on the south side of Elkhorn at the northeast corner of the project site, a solid noise barrier or berm/wall combination of 12 feet in height shall be constructed along Elkhorn boulevard at these locations (see Exhibit 6.3-6). The barriers shall be extended inward along the project site access roads.

h. For noise impact/mitigation area I (see Exhibit 6.3-6), a solid noise barrier of 6 feet in height shall be constructed along Lone Tree Road to adequately shield residences which back up to the canal east of and adjacent to this roadway.

i. Prior to issuance of any building permits, site-specific acoustical analyses shall be conducted once construction plans are available for residential developments located with the 60 dBA L_{dn} contours (see Exhibit 6.3-5) to ensure satisfaction with the City of Sacramento interior noise level standards. The acoustical analyses shall evaluate exposure of proposed noise-sensitive receptors to noise generated by surface transportation sources, in accordance with adopted City of Sacramento interior noise standards (Table 6.3-8). These site-specific acoustical analyses shall also include site-specific design requirements to reduce noise exposure of proposed on-site receptors and all feasible design requirements shall be implemented into the final site design. Noise reduction measures and design features may include, but are not limited to the use of increased noise-attenuation measures in building construction (e.g., dual-pane, sound-rated windows; mechanical air systems; and exterior wall insulation). Given the predicted future traffic noise environment at the exterior facades of the residences nearest to Highway 99 and Interstate5, upgrades to windows will likely be required at many residences, as well as the use of stucco siding or the acoustic equivalent. Implementation of these design measures would ensure interior noise levels meet the City's noise standards.

Significance After Mitigation

Noise barriers, as well any of the other above measures, would achieve an approximate 5 dB noise level reduction where the line-of-sight from the nearby roadways to the proposed residences would be broken and 1.5 dB of additional noise level reduction for each meter of barrier height beyond the line-of-sight. In addition, as shown in Exhibit 6.3-7, the partial shielding of backyards would result in an approximate 5 dB reduction; walls between residences an additional 3 dB, and the reorientation of side-on lots to front-on lots an 8 dB reduction.

Implementation of the above mitigation measures of items a through it would be effective in reducing interior and exterior noise levels of new development to ***less-than-significant*** levels (Bollard Acoustical Consultants, Inc. 2006).

IMPACT 6.3-5

Land Use Compatibility of Proposed Residences and School with On-site Aircraft SENL Noise Levels. *Exposure of the project site to SENLs generated by aircraft overflights could result in substantial annoyance to on-site sensitive receptors in the forms of speech interference and sleep disruption. Sleep disruption would be infrequent, and an overflight easement disclosing that the project would be subject to sleep and speech disruption would be required. This is a* ***less-than-significant*** *impact. However, students could be exposed to noise generated by aircraft overflights that would result in speech and classroom disruption; this would be a* ***significant*** *impact.*

As previously discussed, there is currently an on-going nationwide debate regarding the appropriateness of SENL criteria as a supplement or replacement for cumulative noise level metrics such as CNEL, a 24-hour noise descriptor. Because SENL describes a receiver’s total noise exposure from a single impulsive event, SENLs are often used to characterize noise from aircraft takeoffs and flyovers. As shown in Tables 6.3-3, SENLs measurements from commercial aircraft on the project site ranged from 74.0 to 84.7 dBA SENL, and as shown in Table 6.3-4, multiple SENL measurements of military aircraft overflights exceeded 100 dBA SENL at a comparable location.

The City of Sacramento and County of Sacramento have not established any SENL standards and no definitive, widely-recognized, SENL guidelines currently exist nationwide. To the extent that there is any guidance regarding acceptable SENLs, the emphasis has been on physiological effects, not on land use planning (California Division of Aeronautics 2002). For example, the Federal Aviation Administration (FAA) has suggested that the threshold of speech interference is 60 dBA. Exposure to high SENLs, including those shown in Tables 6.3-3 and 6.3-4, would result in speech interference at proposed residential dwellings and school facilities. Similarly, the Federal Interagency Committee on Aviation Noise (FICAN) has provided estimates of the percentage of people expected to be awakened when exposed to specific SENLs inside a home (FICAN 1997). However, FICAN did not recommend a threshold of significance based on the percent of people awakened. One agency, the City of Los Angeles, adopted a significance threshold of 10 percent of the population being awakened once every 10 days (i.e., 1 percent of the population was awakened on any one day) for use in the LAX Master Plan EIR/EIS (City of Los Angeles 2004). However, the document specifically cautioned that the threshold was for use in the LAX EIR/EIS only and that the specific environment of LAX was used in the establishment of the thresholds. No other guidance or explanation of the rationale for this highly conservative threshold was provided.

According to the FICAN study, 10% of the population is estimated to be awakened when the SENL interior noise level of 81 dBA. An estimated 5 to 10 percent of the population is affected when the SENL interior noise level is between 64.8 and 81 dBA, and few sleep awakenings (less than 5 percent) are predicted if the interior SENL is less than 64.8 dBA.

Table 6.3-14 shows the percentage of sleep disturbance caused by aircraft type, represented as "awakenings." The percentage of awakenings represents the maximum percent of the exposed sleeping population expected to be awakened, which is estimated using a formula devised by the Federal Interagency Committee on Aviation Noise (FICAN 1997). The number of awakenings is positively correlated with the SENL value. The analysis assumed that windows would be open. According to the City of Los Angeles EIR/EIS, interior noise levels with windows open are an estimated 13 dB less than outdoor noise levels (City of Los Angeles 2004); this same exterior-interior attenuation rate is assumed herein.

Table 6.3-14
Awakenings Associated with Measured Single Event Noise Levels

	SENL (dBA) a		Awakenings (%) b		
Aircraft Model a	Exterior	Interior c	<10%	5-10%	0-5%
Commercial Aircraft					
BE58	74.0	61.0			X
C501	77.1	64.1			X
B737	82.6	69.6		X	
B737	77.6	64.6			X
B733	79.0	66.0		X	
B733	73.9	60.9			X
B733	76.2	63.2			X
MD82	83.8	70.8		X	
MD82	84.7	71.7		X	
Military Aircraft (by agreement, military aircraft generally restrict their flights to 7:00am to 7:00 pm, so sleep disrupting events would be uncommon)					
C130	84.8	71.8		X	
C130	85.9	72.9		X	
C5	108.3	95.3	X		
C5	110.8	97.8	X		
KC10	76.3	63.3		X	
KC10	67.4	54.3			X
KC10	68.0	55.0			X
C5	108.3	95.3	X		
C5	101.0	88.0	X		
C5	83.5	70.5		X	
C5	79.5	66.5			X
C5	108.1	95.1	X		
C5	100.5	87.5	X		

Notes: SENL measurements were collected in accordance with the American National Standards Institute acoustic standards (ANSI S12.9-2000/Part 6) using Larson Davis model 820 sound level meters.

[a] The aircraft models and SENLs are the same as those in Table 6.3-3 (commercial) and Table 6.3-4 (military).

[b] Awakenings represent the "maximum percent of the exposed population expected to be behaviorally awakened" while sleeping (FICAN 1997). EDAW calculated awakenings based on a mathematical curve established by the Federal Interagency Committee on Aviation Noise (FICAN 1997), which represents the upper limit of observed field data.

[c] Assumes open windows.

Source: SENL Data collected by EDAW on March 17, 2005 and January 9, 2006.

According to the data shown in Table 6.3-14, awakenings would be experienced by some occupants of residences proposed on the project site from aircraft activity, particularly during late evening and early morning hours. Furthermore, the number of average daily flights at Sacramento International Airport is projected to increase to 676 average daily flights in 2010 and 824 average daily flights in 2020 (Sacramento County Airport System Planning and Development Department 2004). Overflights are expected to increase in perpetuity over the project site (Newhouse, pers. comm., 2006).

As described in Table 6.3-14, military overflights would likely occur during the non-sleeping hours of 7:00 am to 7:00 pm, although they are not restricted from flying during nighttime hours.

Currently most flights occur between the hours of 6:00 a.m. and 11:00 p.m. each day, but some occur during late night and early morning hours and a similar distribution of flight activity throughout the 24-hour day is expected to continue in the future. Further, one aircraft not recorded during field visits is a Boeing 727 that flies each morning (delivery service) between 5:00 am and 6:00 am; according to airport staff, this aircraft is louder than any of the commercial aircraft recorded during field visits. (Newhouse, pers. comm., 2006)

While the data suggest that both awakenings and speech interference would be experienced by occupants of the proposed project, no government agency has suggested what frequencies of awakenings or speech disruption are acceptable (California Division of Aeronautics 2002). Furthermore, the threshold for sleep disturbance is less absolute because there is a high degree of variability from one person to another. Thus, the means of applying such research to land use decisions is not yet clear.

For these reasons, the Federal Interagency Committee on Noise (FICON) and the California Airport and Land Use Planning Handbook continue to use CNEL as the primary tool for the purpose of land use compatibility planning (California Division of Aeronautics 2002). In fact, the CNEL represents the cumulative exposure to all aircraft overflights; that is, the exposure of all SENLs taken together, weighed to add penalties for evening and nighttime occurrences, and averaged over a 24-hour period. Thus, it can be argued that the CNEL standards already account for the individual impacts associated with the SENLs. Even if the criteria used at LAX was applied here, it likely would suggest that significant impacts from overflights, as they relate to sleep disruption, would not occur because (with the exception of military overflights) aircraft operating at the project site does not appear to be producing sound levels that would awaken more than 10 percent of the population. Military overflights would be few to none during the nighttime period, so would not result in sleep disruption with any regularity.

Further, the applicant is proposing to dedicate an overflight easement over the entire project site. The exact wording of the easement is proposed to be agreed to by the applicant and SCAS. At a minimum, the overflight easement will grant a right-of-way for free and unobstructed passage of aircraft through the airspace over the property at any altitude above an imaginary surface specified in the easement (usually set in accordance with Federal Aviation Regulation Part 77 criteria). The overflight easement will also grant a right to subject the property to noise and vibration associated with normal airport activity.

In addition, recorded deed notices are proposed to be required to ensure that initial and subsequent prospective buyers, lessees, and renters of property on the project site, particularly residential property, are informed that the project site is subject to routine overflights and associated noise by aircraft from Sacramento International Airport, that the frequency of aircraft overflights is routine and expected to increase through the year 2020 and beyond in accordance with the Sacramento International Airport Master Plan, and that such overflights could cause occasional speech interference, sleep disruption that could affect more than 10 percent of all residents at any one time, and other annoyances associated with exposure to aircraft noise. The wording of the easement will also be agreed upon by the applicant and the SCAS. Furthermore, the applicant is proposing to require the posting of signs on all on-site real estate sales office and/or at key locations on the project site that alert the initial purchases about the overflight easement and the required deed notices.

The overflight easement and recorded deed notices would not change the noise environment; however, they would notify people with above-average sensitivity to aircraft overflights (as well as all other prospective residents)—people who are highly annoyed by overflights—that they are choosing to live in a location where frequent overflights occur. This strategy involves making people more aware of an airport's proximity and its current and future potential aircraft noise exposure before prospective buyers, lessees, and tenants move to the project site. The recorded deed notices (item b) also comply with California state real estate law, which requires that sellers of real property disclose "any fact materially affecting the value and desirability of the property" (California Civil Code, Section 1102.1(a)).

Thus, although residents on the project site will be exposed to annoyance from aircraft overflights, due to occasional speech interruption and sleep disturbance the relative low magnitude of these occurrences coupled with the proposed disclosure to future residents that they are subject to overflights would render this a ***less-than-significant impact.***

Exposure of students to occasional overflights could result in speech disruption and classroom disturbance. Speech disturbance begins when the SENL exceeds 60 dBA. Given the typical exterior-interior noise reduction 25 dBA, any noise events above 85 SENL could result in speech disturbance at the site. As shown in Table 6.3-14, the site would be subject to several types of military aircraft that operate on occasion from the airport, and produce overflights during daytime hours where the noise would exceed 85 dBA SENL. Some overflights would be expected to generate noise as loud as 110 dBA SENL. This could adversely affect the learning environment. This is a ***significant impact.***

Mitigation Measure 6.3-5: (City of Sacramento and LAFCo)

a. Prior to issuance of any building permits, site-specific acoustical analyses shall be conducted once construction plans are available for the proposed school to ensure satisfaction with the City of Sacramento interior noise level standards. This site-specific acoustical analyses shall include site-specific design requirements to reduce noise exposure of proposed on-site receptors and all feasible design requirements shall be implemented into the final site design. Noise reduction measures and design features may include, but are not limited to the use of increased noise-attenuation measures in building construction (e.g., dual-pane, sound-rated windows; mechanical air systems; and exterior wall insulation). Implementation of these design measures would ensure interior noise levels meet the City's noise standards and ANSI standard.

Significance After Mitigation

Although outdoor areas at proposed residential land uses and the proposed school would be exposed to occasional annoying noise events, the disclosure ensures that residents of the site are knowingly choosing to accept this annoyance. Further, noise standards would not be exceeded, including at schools. As a result, this impact would be mitigated to a ***less-than-significant*** level.

IMPACT 6.3-6

***Exposure of sensitive receptors or generation of excessive vibration levels.** Short-term construction-generated vibration levels would exceed Caltrans recommended standard of 0.2 in/sec peak particle velocity (PPV) with respect to the prevention of structural damage for normal buildings and could exceed the federal transit administration's (FTA) maximum acceptable vibration standard of 80 velocity decibels (VdB) with respect to human response for residential uses (i.e., annoyance) at on-site residential dwellings that are developed and inhabited before nearby construction is completed. This would be a **potentially significant** impact.*

The long-term operation of the proposed project would not include any major sources of vibration. Construction activities, however, have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and operations involved. Vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. Table 6.3-15 displays vibration levels for typical construction equipment.

Table 6.3-15
Typical Construction Equipment Vibration Levels

Equipment		PPV at 25 feet (in/sec)[1]	Approximate L_v at 25 feet[2]
Pile Driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile Driver (sonic)	Upper range	0.734	105
	Typical	0.170	93
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Trucks		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

1 Where PPV is the peak particle velocity
2 Where L_v is the velocity level in decibels (VdB) and based on the root mean square (RMS) velocity amplitude.
Source: Federal Transit Administration 1995

As discussed above, construction activities at the proposed site would include site preparation (e.g., excavation, grading, and clearing), trenching, laying of concrete foundations, paving, frame erection, equipment installation, finishing, cleanup, and other miscellaneous activities. No pile driving or rock blasting would occur as part of project construction. The on-site equipment required is not known at this time but, based on similar projects, would be anticipated to include dozers, excavators, graders, loaders, haul trucks, and cranes.

According to the FTA, vibration levels associated with the use of such equipment would be approximately 0.089 PPV and 87 VdB at 25 feet, as shown in Table 6.3-13. Vibration levels would generally be lower for equipment not associated with heavy earth movement. Using FTA's recommended procedure for applying a propagation adjustment to these reference levels, the structural-damage threshold of 0.2 in/sec PPV would be exceeded by the operation of any construction equipment that occurs within 15 feet of a vibration-sensitive structure and, similarly, the human-response threshold would be exceeded by equipment operations that take place within 60 feet of a vibration-sensitive structure.

Therefore, the nearest off-site vibration-sensitive land uses, the farm houses located across Lone Tree Road 250 feet away, would not be exposed to vibration levels that exceed the structural-damage threshold or the human-response threshold. However, because project construction would be completed in two phases over 5–10 years, some on-site residences may be built and inhabited while construction of other nearby residences and facilities continue to be developed. This means that some on-site receptors that are developed and/or inhabited on the project site could be exposed to groundborne vibrations generated by remaining construction activity. While it is unlikely that any heavy construction equipment would be operated within 15 feet of an on-site residence, resulting in an exceedence of the structural-damage threshold, it is possible that equipment operation would occur within 60 feet of such structures, resulting in an exceedence of the human-response threshold. This would be a ***potentially significant*** impact.

Mitigation Measure 6.3-6: (City of Sacramento and LAFCo)

Operation of heavy construction equipment (i.e., with engines greater than 50 horsepower) shall not be operated within 60 feet of inhabited residences or within 15 feet of uninhabited structures.

Significance After Mitigation

This mitigation measure is considered feasible because the order in which facilities are constructed and/or inhabited on the project site could be arranged such that operation of heavy construction equipment does not occur within the setbacks prescribed above. For instance, activities that require heavy construction equipment such as grubbing, grading, dozing, and excavation, could be performed before any nearby structures are erected and/or inhabited. Thus, this measure would ensure that construction operations are consistent with the both the structural-damage standards established by Caltrans and the human-response standards of the FTA, thereby reducing potential impacts to a ***less-than-significant*** level.