This section describes the existing noise environment in the area of the proposed Project and the potential of the proposed Project to generate noise levels exceeding the applicable City of Elk Grove exterior noise level standards at noise-sensitive receptors in the Project area. This section includes analysis of potential non-transportation and transportation source noise and groundborne vibration impacts at nearby existing as well as proposed land uses.

5.10.1 BACKGROUND INFORMATION ON NOISE

FUNDAMENTALS OF ACOUSTICS

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as airborne sound that is loud, unpleasant, unexpected, or undesired and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent on many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, but are expressed as dB, unless otherwise noted.

The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound and twice as loud as a 60 dBA sound. Typical noise levels associated with common noise sources are depicted in **Figure 5.10-1**.

Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. Human hearing is limited in the range of audible frequencies. In general, people are most sensitive to the frequency range of 1,000 to 8,000 Hz. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies, which is referred to as the A-weighted sound level. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted noise scale. Other weighting networks have been devised to address high noise

levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with environmental noise.

The intensity of environmental noise fluctuates over time. As a result, several descriptors of time-averaged noise levels are typically used for environmental noise assessment. The most commonly used descriptors are L_{eq}, L_{dn}, and CNEL. The energy-equivalent noise level, L_{eq}, is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average noise level, L_{dn}, is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to L_{dn} but adds an additional 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Common noise descriptors are summarized in **Table 5.10-1**.

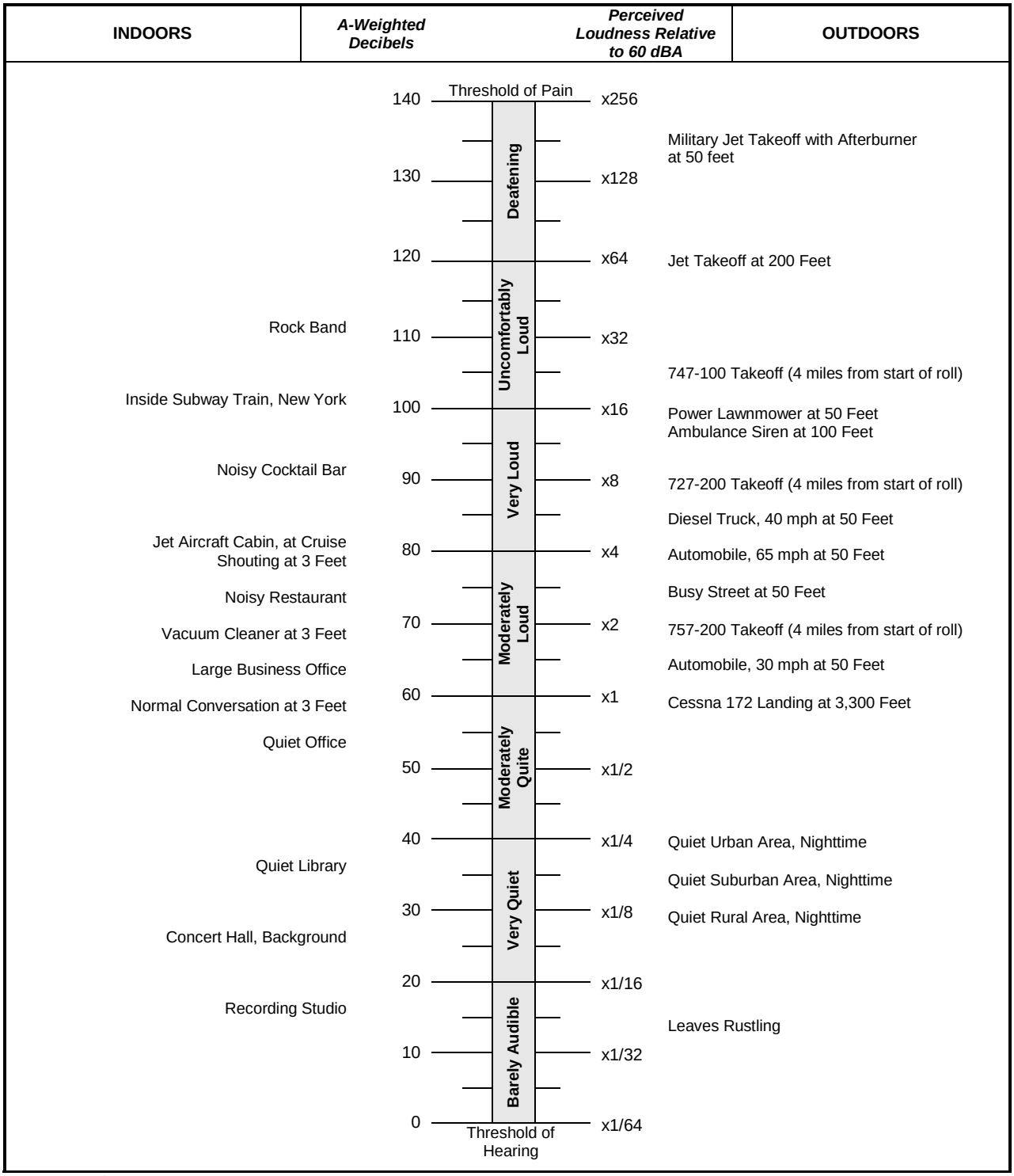
TABLE 5.10-1
COMMON ACOUSTICAL TERMS AND DESCRIPTORS

Descriptor	Definition
Decibel (dB)	A unit-less measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to referenced sound pressure amplitude. The reference pressure is 20 micropascals.
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
Energy Equivalent Noise Level (L_{eq})	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 (in dBA) is calculated.
Maximum Noise Level (L_{max})	The maximum instantaneous noise level during a specific period of time.
Day-Night Average Noise Level (DNL or L_{dn})	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 noise events that occur in the nighttime hours to account for increases sensitivity to noise during these hours.
Community Noise Equivalent Level (CNEL)	The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated L_{dn}.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. The effects of noise typically arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. The acceptability of noise and the threat to public well-being are the basis for land use planning policies preventing exposure to excessive community noise levels.

FIGURE 5.10-1
TYPICAL NOISE LEVELS



Sources: Caltrans 2002a; HUD 1985

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged. Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived by humans.
- Outside of the laboratory, a 3-dB change is considered a just-perceivable difference.
- A change in level of at least 5 dB is required before any noticeable change in community response would be expected. An increase of 5 dB is typically considered substantial.
- A 10-dB change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

A limitation of using a single noise-level increase value to evaluate noise impacts, as discussed above, is that it fails to fully account for pre-project noise conditions. With this in mind, the Federal Interagency Committee on Noise (FICON) developed guidance to be used for the assessment of project-generated increases in noise levels that take into account the ambient noise level. The FICON recommendations are based on studies that relate aircraft noise levels to the percentage of persons highly annoyed by aircraft noise. Although the FICON recommendations were specifically developed to assess aircraft noise impacts, these recommendations are often used in transportation noise impact assessments. FICON-recommended noise evaluation criteria are summarized in **Table 5.10-2**.

As depicted in **Table 5.10-2**, a noise level increase of 5.0, or greater, would typically be considered to result in increased levels of annoyance where existing ambient noise levels are less than 60 dB. Within areas where the ambient noise level ranges from 60 to 65 dB, increased levels of annoyance would be anticipated at increases of 3 dB, or greater. Increases of 1.5 dB, or greater, could result in increased levels of annoyance in areas where the ambient noise level exceeds 65 dB. The rationale for the FICON-recommended criteria is that as ambient noise levels increase, a smaller increase in noise resulting from a project is sufficient to cause significant increases in annoyance (FICON 1992; FAA 2000).

TABLE 5.10-2
FEDERAL INTERAGENCY COMMITTEE ON NOISE
RECOMMENDED CRITERIA FOR EVALUATION OF INCREASES IN AMBIENT NOISE LEVELS

Ambient Noise Level Without Project	Increase Required for Significant Impact
< 60 dB	5.0 dB, or greater
60–65 dB	3.0 dB, or greater
> 65 dB	1.5 dB, or greater

Source: FAA 2000; FICON 1992

5.10.2 EXISTING SETTING

EXISTING NOISE RECEPTORS

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential uses are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

The Project area consists predominantly of undeveloped agricultural lands and rural residential dwellings, which are generally located within the Project site boundaries and at varying distances to the west, north, and south of the Project site. Nearby existing land uses also include a single-family residential subdivision and a senior apartment complex, which are generally located along Bruceville Road, north of Bilby Road. The Consumnes River College Elk Grove Center and Elizabeth Pinkerton Middle School are located north of the Project site, along Whitelock Parkway east of Big Horn Boulevard. Nearby land uses are depicted in **Figure 5.10-2**.

EXISTING NOISE ENVIRONMENT

The noise environment in the proposed Project area is defined primarily by vehicular traffic on State Route (SR) 99 and local roadways. To a lesser extent, occasional aircraft overflights, nearby agricultural activities, and landscape maintenance activities at nearby residential and commercial land uses also contribute on an intermittent basis to ambient noise levels in the Project area.

Airports

The nearest airports to the Project site are Franklin Field, approximately 5 miles south of the Project site and Sacramento Executive, approximately 9.5 north of the project site. The Project site is not located within the projected noise contour zones of either of these airports. Kaiser Hospital at 6600 Bruceville Road, approximately 5.5 miles from the Project site, operates a helistop for patient transport and helistops have been approved for Sutter Hospital and Dignity Hospital in Elk Grove; however, flight paths for these helistops do not extend over the project site and noise from these helistops would not affect the project.

Agricultural Activities

Existing land uses in the Project area include agricultural land uses, located south of Kammerer Road; generally west of the Project site, across Bruceville Road and south of Bilby Road; and to the east, between the Project site's eastern boundary and Promenade Parkway.

Noise levels associated with agricultural activities can vary substantially depending on the type of activities being conducted and equipment used. Depending on various factors such as horsepower ratings and equipment age, maximum noise levels generated by farm-related tractors typically range from approximately 75 to 85 dBA at a distance of 50 feet. Due to the seasonal nature of agricultural activities, there are often extended periods of time when no noise is generated on properties that are actively being farmed, followed by short-term periods of more intensive equipment use and associated noise levels. However, such noise levels are typically distributed over a large area and prolonged noise levels at individual nearby receptors

would not be anticipated for most activities. In addition, given that agricultural activities typically occur during the daytime hours, noise generated by nearby agricultural activities are often largely masked by vehicle traffic noise along nearby roadways (i.e., Kammerer Road, Bruceville Road, Promenade Parkway, and SR 99).

Roadway Traffic

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used to determine noise levels associated with existing vehicle traffic on area roadways. The FHWA model used California vehicle reference noise emission factors (CALVENO) for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. Traffic data used in the modeling effort was obtained from the traffic analysis prepared for this Project and the California Department of Transportation (Fehr & Peers 2014).

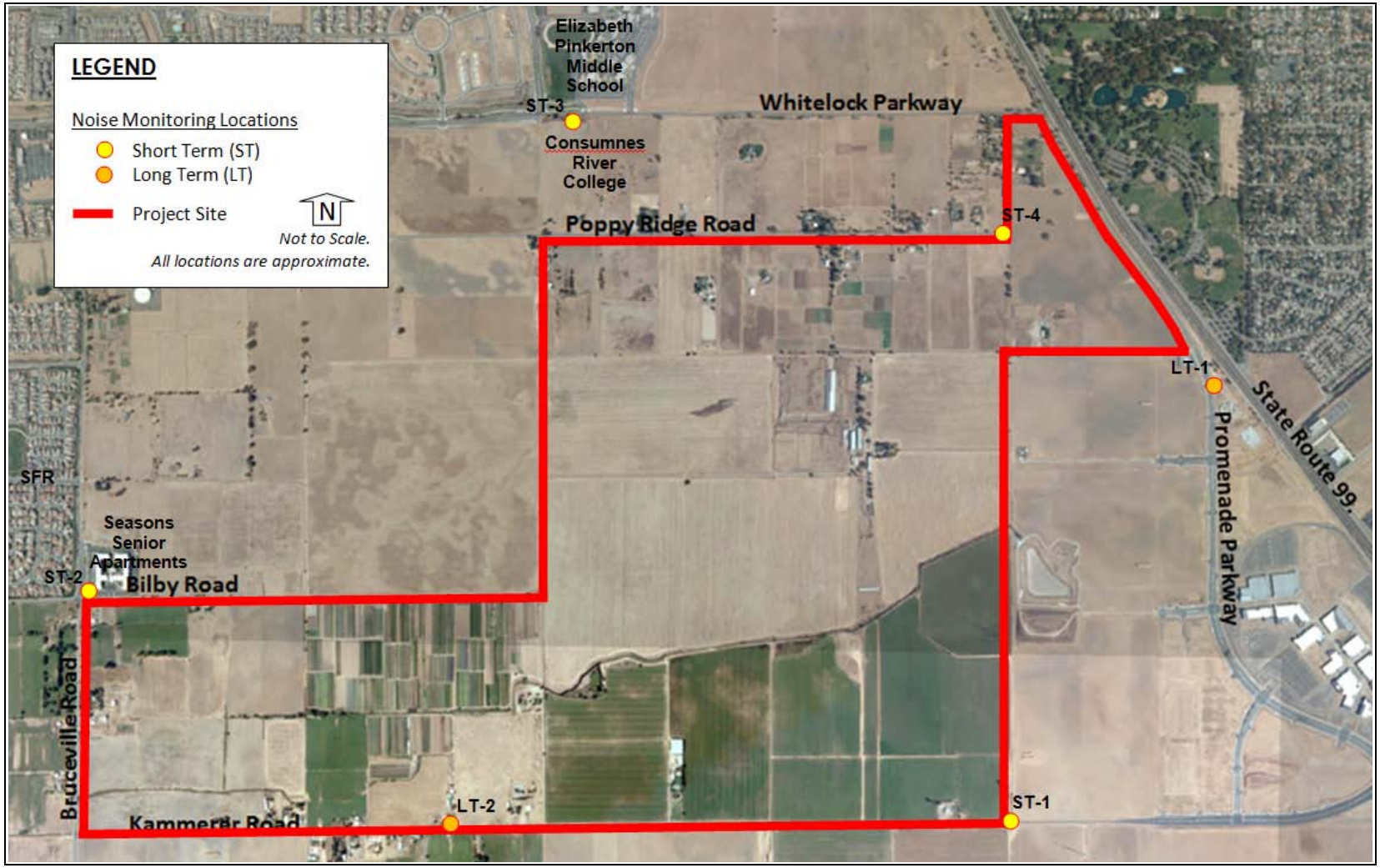
Table 5.10-3 depicts predicted existing average-daily traffic noise levels (in CNEL/L_{dn}) at a distance of 50 feet from the near travel-lane centerline for major roadways within the Project area, as well as distances to the predicted 70, 65, and 60 dBA CNEL/L_{dn} traffic noise contours. The extent to which nearby land uses are affected by existing traffic noise depends on multiple factors, including their respective proximity to the roadways, shielding provided by intervening terrain and structures, and their individual sensitivity to noise.

TABLE 5.10-3
EXISTING TRAFFIC NOISE LEVELS

Segment	Existing ADT	CNEL/L_{dn} at 50 Feet from Near-Travel-Lane Centerline	Distance (feet) to Noise Level Contours (dBA CNEL/L_{dn}) from Roadway Centerline		
			70	65	60
Whitelock Pkwy., West of Bruceville Road	12,060	64.7	WR	70.7	145.2
Whitelock Pkwy., East of Bruceville Road	6,560	60.6	WR	WR	80.4
Whitelock Pkwy., West of Big Horn Blvd.	5,860	60.1	WR	WR	75.1
Whitelock Pkwy., East of Big Horn Blvd.	4,450	60.4	WR	WR	59.7
Whitelock Pkwy., West of W. Stockton Blvd.	2,880	58.8	WR	WR	WR
Bruceville Rd., North of Whitelock Pkwy.	13,910	65.8	WR	95.8	194.6
Bruceville Rd., South of Whitelock Pkwy.	7,670	65.5	WR	60.2	129.1
Bruceville Rd., North of Kammerer Rd.	5,640	64.1	WR	WR	105.3
Bruceville Rd., South of Kammerer Rd.	1,240	57.6	WR	WR	WR
Kammerer Rd., East of Bruceville Rd.	5,600	66.3	WR	68.4	146.8
Kammerer Rd., West of Promenade Pkwy.	5,620	64.3	WR	75.7	150.3
Promenade Pkwy., North of Kammerer Rd.	2,440	59.0	WR	WR	64.6
W. Stockton Blvd., South of Whitelock Pkwy.	3,490	62.1	WR	WR	76.6
Big Horn Blvd., North of Whitelock Pkwy.	5,370	62.4	WR	WR	104.3
SR 99, North of Grant Line Road	43,200	76.0	215	464	1,001

Source: Ambient 2014
Notes:
Traffic noise levels were calculated using the FHWA roadway noise prediction model and do not include shielding from existing structures, sound barriers, or intervening terrain.
WR = Within roadway right-of-way
Refer to Appendix 5.10-B for modeling assumptions and results.

FIGURE 5.10-2
NOISE MONITORING LOCATIONS AND EXISTING CONDITIONS



Refer to Table 5.10-4 and Table 5.10-5 for noise measurement data.
Image Source: USGS 2014

MEASURED AMBIENT NOISE LEVELS

To document existing ambient noise levels in the Project area, ambient noise measurements were conducted on October 9, 10 and 11, 2014. Noise measurements were conducted using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter positioned at a height of approximately 5 feet above ground level. The meter was calibrated before use and is certified to be in compliance with ANSI specifications.

Short-term (i.e., 10-minute) noise measurement surveys were conducted at four locations, near the boundaries of the Project site (see **Figure 5.10-2**.) Short-term noise measurement data corresponding to these measurement locations are summarized in **Table 5.10-4**. Based on the measurements conducted, ambient noise levels at the measurement locations generally range from approximately 55 to 64 dBA L_{eq}. Maximum intermittent noise levels were primarily associated with vehicle passbys near area roadways and ranged from approximately 72 to 84 dBA L_{max}.

TABLE 5.10-4
SUMMARY OF SHORT-TERM AMBIENT NOISE MEASUREMENT DATA

Site	Location	Date	Time Period	Measured Noise Levels (dBA)	
				L_{eq}	L_{max}
ST-1	Southeastern SEPA boundary, approximately 10 feet from Kammerer Road	October 9, 2013	16:50–17:00	64.2	76.2
		October 10, 2013	11:50–12:00	59.2	71.8
ST-2	Western SEPA boundary , approximately 50 feet from Bruceville Road	October 9, 2013	16:20–16:30	63.7	83.9
		October 10, 2013	12:10–12:20	61.7	71.8
ST-3	Whitelock Parkway east of Big Horn Boulevard, approximately 70 feet from roadway centerline	October 9, 2013	16:00–16:10	60.1	78.3
		October 9, 2013	17:20–17:30	59.8	72.9
		October 10, 2013	12:30–12:40	58.7	71.6
ST-4	Northern SEPA boundary at Poppy Ridge Rd.	October 9, 2013	15:20–15:30	54.8	66.3

Source: Ambient 2014
*Refer to **Figure 5.10-2** for noise monitoring locations.*

Two long-term noise measurements were also conducted for the purposes of documenting average-daily noise levels in the Project area. Long-term monitoring site 1 (LT-1) was located near the eastern boundary of the Project site, approximately 190 feet from SR 99. Monitoring site 2 (LT-2) was located near the southern boundary of the Project site, approximately 14 feet from Kammerer Road. Noise monitoring locations are depicted in **Figure 5.10-2**. Long-term noise measurement data for LT-1 and LT-2 is summarized in **Table 5.10-5** and depicted in **Figure 5.10-3** and **Figure 5.10-4**, respectively.

Based on the monitoring conducted, measured ambient noise levels range from approximately 68 to 72 dBA L_{eq} during daytime hours. Nighttime noise levels were roughly 10 to 15 dB lower than daytime noise levels, ranging from approximately 57 to 58 dBA L_{eq}. Maximum intermittent noise levels ranged from approximately 72 to 84 dBA L_{max}. Average-daily noise levels ranged from approximately 69 to 72 dBA CNEL and were generally consistent with peak-hour noise levels (measured in L_{eq}). Ambient noise levels are dependent primarily on distance from major roadways.

TABLE 5.10-5
SUMMARY OF LONG-TERM AMBIENT NOISE MEASUREMENT DATA

Site	Location	Date	Measured 24-Hour Noise Levels (dBA)		
			Lowest L_{eq}	Highest L_{eq}	CNEL/L_{dn}
LT-1	Eastern SEPA boundary approximately 190 feet from State Route 99	October 10–11, 2013	57.9	67.6	69
LT-2	Southern SEPA boundary approximately 14 feet from Kammerer Road	October 9–10, 2013	56.6	72.3	72

Source: Ambient 2014
*Refer to **Figure 5.10-2** for noise monitoring locations.*

FIGURE 5.10-3
24-HOUR NOISE MONITORING – SITE LT-1

*LT-1 was located approximately 190 feet from SR 99. Refer to **Table 5.10-5** for noise monitoring data and **Figure 5.10-1** for noise monitoring locations.*

Source: Ambient 2014

FIGURE 5.10-4
24-HOUR NOISE MONITORING – SITE LT-2

*LT-2 was located approximately 14 feet from Kammerer Road. Refer to **Table 5.10-5** for noise monitoring data and **Figure 5.10-1** for noise monitoring locations.*

Source: Ambient 2014

GROUNDBORNE VIBRATION

No major existing sources of groundborne vibration have been identified in the proposed Project area. Roadway vehicle traffic on area roadways are generally not considered to result in significant levels of groundborne vibration that would adversely impact nearby land uses (Caltrans 1976).

5.10.3 REGULATORY FRAMEWORK

STATE

California Building Code

Title 24 of the California Code of Regulations contains standards for allowable interior noise levels associated with exterior noise sources (California Building Code, 2013 edition, Volume 1, Chapter 12). The standards apply to new hotels, motels, dormitories, apartment houses, and dwellings other than detached single-family residences. The standards state that the interior noise level attributable to exterior sources may not exceed 45 dBA CNEL in any habitable room. Proposed residential structures to be located where the CNEL exceeds 60 dBA shall require an acoustical analysis showing that the proposed building design would achieve the prescribed allowable interior noise standard. Worst-case noise levels, either existing or future, are to be used as the basis for determining compliance with these standards.

LOCAL

City of Elk Grove General Plan Noise Element

The City of Elk Grove General Plan Noise Element establishes policies and noise level criteria both for transportation noise sources and for non-transportation (stationary) noise sources. The Project does not include any actions or components that conflict with these General Plan policies. However, it should be noted that the final authority for interpretation of a policy statement, determination of the Project's consistency, ultimately rests with the Elk Grove City Council. The General Plan policies most applicable to the proposed Project are included below.

"Policy NO-1: New development of the uses listed in Tables NO-C shall conform with the noise levels contained in that Table. All indoor and outdoor areas shall be located, constructed, and/or shielded from noise sources in order to achieve compliance with the City's noise standards."

"Policy NO-2: Where noise-sensitive land uses are proposed in areas exposed to existing or projected exterior noise levels exceeding the levels specified in Table NO-C or the performance standards of Table NO-A, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design."

"Policy NO-3: Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table NO-A as measured immediately within the property line of lands designated for noise-sensitive uses."

- **"NO-3, Action 1:** Limit construction activity to the hours of 7 a.m. to 7 p.m. whenever such activity is adjacent to residential uses."

- **"NO-3, Action 2:** Consider limiting the hours of operation for loading docks, trash compactors, and other noise-producing uses in commercial areas which are adjacent to residential uses."

- **"NO-3, Action 3:** The City shall require that stationary construction equipment and construction staging areas be set back from existing noise-sensitive land uses."

"Policy NO-4: Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table NO-A at existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design. The requirements for the content of an acoustical analysis are shown in Table NO-B."

"Policy NO-5: Noise created by the construction of new transportation noise sources (such as new roadways or new light rail service) shall be mitigated so as not to exceed the levels specified in Table NO-C at outdoor activity areas or interior spaces of existing noise-sensitive land uses. Please see Policy NO-6 for discussion of improvements to existing roadways."

"Policy NO-8: Where noise mitigation measures are required to achieve the standards of Tables NO-A and NO-C, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures—including the use of distance from noise sources—have been integrated into the project."

"Policy NO-9: Where soundwalls or noise barriers are constructed, the City shall strongly encourage and may require the use of a combination of berms and walls to reduce the apparent height of the wall and produce a more aesthetically appealing streetscape."

Transportation Noise Source Criteria

For transportation noise sources, the City's noise criteria for determination of land use compatibility ranges from an exterior noise level of 60 dBA CNEL/L_{dn} for residential uses to 70 dBA CNEL/L_{dn} for parks and playgrounds. The intent of this standard is to provide an acceptable noise environment for outdoor activities. The City has also established an interior noise standard of 45 dBA CNEL/L_{dn} for residential, school, and office uses exposed to transportation noise sources. Interior hourly noise limitation (in dBA L_{eq}) are also established for land uses that are sensitive to daytime noise levels, such as churches, offices, libraries, and schools. The intent of the interior noise standards is to provide a suitable environment for indoor activities and reduced levels of annoyance. The City's noise standards for transportation noise sources are summarized in **Table 5.10-6**.

TABLE 5.10-6
MAXIMUM ALLOWABLE NOISE EXPOSURE –TRANSPORTATION NOISE SOURCES
(ELK GROVE GENERAL PLAN TABLE NO-C)

Land Use	Outdoor Activity Areas [1] CNEL/L_{dn}, dB	Interior Spaces	
		CNEL/L_{dn}, dB	L_{eq}, dB [2]
Residential	60[3]	45	–
Residential subject to noise from railroad tracks, aircraft overflights	60[3]	40[5]	–
Transient Lodging	60[4]	45	–
Hospitals, Nursing Homes	60[3]	45	–
Theaters, Auditoriums, Music Halls	–	–	35
Churches, Meeting Halls	60[3]	–	40
Office Buildings	–	–	45
Schools, Libraries, Museums	–	–	45
Playgrounds, Neighborhood Parks	70	–	–

Source: City of Elk Grove 2003, Table NO-C

Notes:

1. *Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.*

   Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.
2. *As determined for a typical worst-case hour during periods of use.*
3. *Where it is not possible to reduce noise in outdoor activity areas to 60 dB CNEL/Ldn or less using a practical application of the best -available noise reduction measures, an exterior noise level of up to 65 dB CNEL/Ldn may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.*
4. *In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the Project design. In these cases, only the interior noise level criterion will apply.*
5. *The intent of this noise standard is to provide increased protection against sleep disturbance for residences located near railroad tracks.*

Non-Transportation Noise Sources

Table 5.10-7 provides the noise level performance criteria for new projects that are affected by or include non-transportation noise sources, such as those attributed to commercial and industrial land uses. These criteria are applied at the property line of noise-sensitive land uses. The standards shown in **Table 5.10-7** are lowered by 5 dB for noise sources that are tonal in nature, impulsive or repetitive, or consist primarily of speech or music (e.g., humming sounds, outdoor speaker systems). Typical noise sources in this category include pile drivers, drive-through speaker boxes, punch presses, steam valves, and transformer stations. These standards do not apply to residential units established in conjunction with industrial or commercial uses.

TABLE 5.10-7
EXTERIOR NOISE LEVEL PERFORMANCE STANDARDS FOR NON-TRANSPORTATION NOISE SOURCES
(ELK GROVE GENERAL PLAN TABLE NO-A)

Noise Level Descriptor	Maximum Acceptable Noise Level, dBA	
	Daytime (7 a.m.–10 p.m.)	Nighttime (10 p.m.–7 a.m.)
Hourly L_{eq}, dB	55	45

Notes:

1. *Noise level standards are applied at the property line of the receiving noise-sensitive land uses.*
2. *Noise level standards apply to new projects affected by or including non-transportation noise sources. Examples include, but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.*
3. *The standards are reduced by 5 dB for noise sources that are tonal, impulsive or repetitive; or, consist primarily of speech or music (e.g., humming sounds, outdoor speaker systems, etc.). Typical noise sources in this category include: pile drivers, drive-through speaker boxes, punch presses, steam valves, and transformer stations.*
4. *Noise level standards do not apply to residential units established in conjunction with industrial or commercial uses.*

Source: City of Elk Grove 2003, Table NO-ACity of Elk Grove Municipal Code

The City's noise control requirements for existing non-transportation noise sources are included in Chapter 6.32 of the Elk Grove Municipal Code. The noise control chapter identifies hourly noise standards that are applicable to existing non-transportation noise sources that are consistent with those identified in the City's General Plan, as depicted in **Table 5.10-7**. In accordance with the City's noise control ordinance, construction activities are generally prohibited between the hours of 7:00 p.m. and 7:00 a.m., excluding emergency work of public service utilities. In addition, the operation of pavement sweeping equipment and associated equipment (e.g., blowers), as well as material loading and unloading activities that would result in a noise disturbance, are typically prohibited between the hours of 10:00 p.m. and 7:00 a.m.

VIBRATION CRITERIA

Sources of earthborne vibrations include natural phenomena (earthquakes, volcanic eruptions, sea waves, landslides, etc.) or manmade causes (explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions).

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves

transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of an amplitude and frequency. A person's perception to the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system that is vibrating. Vibration can be measured in terms of acceleration, velocity, or displacement.

The City of Elk Grove does not have specific policies pertaining to vibration levels. However, various agencies, such as the California Department of Transportation (Caltrans), have developed recommended criteria for the evaluation of groundborne vibration levels with regard to potential human annoyance and building structural damage. Caltrans-recommended criteria for the evaluation of groundborne vibration events are summarized in **Table 5.10-8**. The vibration levels are presented in terms of peak particle velocity (ppv) in inches per second (in/sec) for continuous/frequent sources.

The effects of groundborne vibration levels, with regard to human annoyance and structural damage, are influenced by various factors, including ground type, distance between source and receptor, duration, and the type of vibration events (i.e., continuous or transient). As indicated in **Table 5.10-8,** the threshold at which there is a risk to normal structures is 0.2 ppv in/sec. This same threshold is typically considered the level at which increased levels of annoyance may begin to occur to occupants of nearby buildings. The recommended criteria for transient sources of single isolated events (i.e., blasting or demolition ball drops) is generally twice the level identified for continuous/frequent sources (Caltrans 2002b, 2004).

TABLE 5.10-8
EFFECTS OF VIBRATION ON PEOPLE AND BUILDINGS

Peak Particle Velocity (inches/second)	Human Reaction	Effect on Buildings
0.006–.019	Range of threshold of perception	Vibrations unlikely to cause damage of any type
0.08	Vibrations readily perceptible	Recommended upper level to which ruins and ancient monuments should be subjected
0.1	Level at which continuous vibrations may begin to annoy people, particularly those involved in vibration sensitive activities	Virtually no risk of architectural damage to normal buildings
0.2	Vibrations may begin to annoy people in buildings	Threshold at which there is a risk of architectural damage to normal dwellings
0.4–0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Architectural damage and possibly minor structural damage

Source: Caltrans 2002b, 2004

Notes: Vibration levels based on peak particle velocity in the vertical direction for continuous/frequent intermittent sources. The criteria for transient sources of single isolated events (i.e., blasting or demolition ball drops) is generally twice the level identified for continuous/frequent sources. Where human reactions are concerned, the value is at the point at which the person is situated. For buildings, the value refers to the ground motion. No allowance is included for the amplifying effect, if any, of structural components.5.10.4 Impacts and Mitigation Measures

STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the application of the CEQA Guidelines Appendix G environmental checklist. A noise impact is considered significant if implementation of the Project will result in:

1) Exposure of persons to or generation of noise levels in excess of standards established in the City of Elk Grove General Plan Noise Element or the City of Elk Grove Noise Control Ordinance.

2) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

3) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

4) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

5) For a project located within an airport land use plan or, where such a plan has not be adopted, within 2 miles of a public airport or public use airport, exposure of people residing or working in the area to excessive noise levels.

6) For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

As previously discussed, the nearest airports to the Project site are Franklin Field, approximately 5 miles south of the Project site and Sacramento Executive, approximately 9.5 north of the Project site. The Project site is not located within the projected noise contour zones of either of these airports; therefore, Standards of Significance 5 and 6 would not apply.

METHODOLOGY

Short-Term Construction Activities

Predicted noise levels at nearby noise-sensitive land uses were calculated using typical noise levels and usage rates associated with construction equipment, derived from the FHWA's Roadway Construction Noise Model (version 1.1). Construction noise levels were predicted assuming an average noise attenuation rate of 6 dB per doubling of distance from the source.

Long-Term Operational Activities

Non-Transportation Noise

Non-transportation noise impacts were assessed based on representative noise levels obtained from existing literature, as well as noise measurement data obtained from similar land uses. Noise levels were predicted assuming an average noise attenuation rate of 6 dB per doubling of distance from the source. For determination of impact significance, estimated operational noise levels were compared to the City's noise standards for non-transportation noise sources, as summarized in **Table 5.10-7**.

Traffic Noise and Land Use Compatibility

Traffic noise levels were calculated using the FHWA roadway noise prediction model (FHWA-RD-77-108) based on California vehicle reference noise emission factors and traffic data obtained from the traffic analysis prepared for this Project. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. Predicted noise levels were calculated at a distance of 50 feet from the near-travel-lane centerline, as well as distances to the predicted noise contours. Increases in traffic noise levels attributable to the proposed Project were determined based on a comparison of predicted noise levels, with and without Project implementation. The compatibility of proposed land uses was evaluated based on projected future on-site transportation noise levels with Project implementation. Predicted on-site noise levels were compared with the City's corresponding noise criteria for determination of land use compatibility (**Table 5.10-7**). Modeling assumptions and calculations are included in **Appendix G**.

Groundborne Vibration

Groundborne vibration levels were evaluated using typical groundborne vibration levels associated with construction activities and screening distance criteria for evaluation of transit facilities, obtained from the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment Guidelines* (2006) and the California Department of Transportation (2004). Construction vibration levels and contour distances were calculated based on typical construction equipment vibration levels and assuming a conservative rate of 1.1 for ground attenuation. Groundborne vibration impacts were evaluated based on the typically applied criteria of 0.2 in/sec ppv for structural damage and human annoyance (**Table 5.10-8**). No existing outdoor areas of frequent human exposure or major sources of groundborne vibration have been identified in the proposed Project area.

Substantial Increases in Noise Levels

For purpose of this analysis, a substantial increase in noise levels is defined as an increase of 5.0 dBA, or greater, where noise levels are less than the City's normally acceptable minimum noise level of 60 dBA CNEL/L_{dn}; 3 dBA, or greater, where noise levels range from 60 to 65 dBA CNEL; and 1.5 dBA, or greater, where the noise level exceeds 65 dBA CNEL without the proposed Project. These criteria are based on the FICON criteria (**Table 5.10-2**) and are consistent with the City's commonly applied noise criteria for roadway construction and improvement projects (Elk Grove General Plan Policy NO-6).

Sports Complex Overlay

The proposed Project includes a Sports Complex Overlay, which would provide an opportunity to develop a regional-serving destination use oriented toward sports. The specific location and design of the complex is currently unavailable. However, it is anticipated that the complex would include a sports stadium and tournament components, as well as other sport facilities.

Noise generated by tournament and stadium events held at the proposed complex would have the greatest potential for adverse noise impacts, given the potential to attract larger participant/spectator crowds and the potential for use of amplified sound systems. Based on noise measurement surveys conducted at similar land uses, including those equipped with amplified sound systems, exterior noise levels generally range from the mid-50s to the upper 70s (in dBA L_{eq}) at distance of approximately 500 feet. At this same distance, maximum intermittent noise levels associated with the use of amplified sound systems can reach instantaneous levels

of up to approximately 95 dBA for brief periods of time. Predicted noise levels at sporting events and stadiums are dependent on various factors including facility design and orientation, the activities conducted, spectator crowd size, type of public address (PA) amplification system installed, PA system design, and shielding provided by surrounding structures and terrain. In general, noise from PA systems at stadiums (during recreational events) tends to dominate the noise environment and occurs on a more frequent basis than noise generated by spectators. For audibility purposes, noise levels of PA systems tend to be approximately 3 to 10 dBA greater than spectator noise. Other uses commonly associated with stadium facilities, such as musical performances, can also result in substantial increases in ambient noise levels. Substantial reductions in noise levels can be achieved through the incorporation of various design features (i.e., spectator shielding, elevation changes, PA system design, stadium orientation, and berms), as well as incorporation of operational limitations. Event traffic may also result in intermittent increases in vehicle traffic noise along area roadways.

For the construction of elevated structures and stadiums, pile driving activities may be required. Noise generated by pile driving activities can reach instantaneous levels of approximately 101 dBA L_{max} and 94 dBA L_{eq} at 50 feet.

As noted above, the location and design of the future complex is currently unknown. As a result, a detailed evaluation of associated noise impacts cannot be conducted at this time and is not discussed further in this report. Implementation of mitigation measure **MM 5.10.3** (see discussion of Impact 5.10.3) would require acoustical assessments to be prepared for future development projects within the Project area. Where operational noise levels would be projected to exceed the City's noise standards, noise reduction measures would be required. Refer to Impact 5.10.3 for additional discussion of Project-related non-transportation noise impacts.

PROJECT IMPACTS AND MITIGATION MEASURES

Short-Term Construction Noise Impacts (Standards of Significance 1 and 4)

Impact 5.10.1 Construction activities could result in a substantial temporary increase in ambient noise levels at nearby noise-sensitive land uses, which may result in increased levels of annoyance, activity interference, and sleep disruption. This impact is considered **potentially significant.**

Construction noise associated with future development would be temporary and would vary depending on the nature of the construction activities being performed. Noise generated during construction is typically associated with the operation of off-road equipment, including excavation equipment, material handlers, and portable generators. **Table 5.10-9** lists typical uncontrolled noise levels generated by individual pieces of representative construction equipment likely to be used during construction.

TABLE 5.10-9
TYPICAL CONSTRUCTION EQUIPMENT NOISE LEVELS

Equipment	Typical Noise Level (dBA) at 50 Feet from Source	
	L_{max}	L_{eq}
Air Compressor	80	76
Backhoe/Front End Loader	80	76
Compactor (Ground)	80	73
Concrete Mixer Truck	85	81
Concrete Mixer (Vibratory)	80	73
Concrete Pump Truck	82	75
Concrete Saw	90	83
Crane	85	77
Dozer/Grader/Excavator/Scraper	85	81
Drill Rig Truck	84	77
Generator	82	79
Gradall	85	81
Hydraulic Break Ram	90	80
Jack Hammer	85	78
Impact Hammer/Hoe Ram (Mounted)	90	83
Pavement Scarifier/Roller	85	78
Paver	85	82
Pile Driver (Impact Type)	101	94
Pneumatic Tools	85	82
Pumps	77	74
Truck (Dump/Flat Bed)	84	80

Sources: FHWA 2006

Noise levels associated with individual construction equipment used for typical construction projects can reach levels of up to approximately 90 dBA L_{max} (FTA 2006). Noise from localized point sources, such as construction sites, typically decreases by approximately 6 dBA with each doubling of distance from source to receptor. Given this noise attenuation rate and typical construction equipment noise levels and usage rates, combined noise levels associated with construction activities can reach levels of up to approximately 84 dBA L_{eq} at 50 feet (EPA 1971). For typical construction activities, excluding pile driving, construction-generated noise levels at the nearest existing residential dwellings could reach levels of up to approximately 80 dBA L_{eq} when localized construction activities occur near the Project site boundaries and within roughly 75 feet of a residence.

With regard to residential land uses, noise levels associated with construction activities occurring during the more noise-sensitive evening and nighttime hours (i.e., 7 p.m. to 7 a.m.) are of

increased concern. Because exterior ambient noise levels typically decrease during the nighttime hours as community activities (e.g., commercial activities, vehicle traffic) decrease, construction activities performed during these more noise-sensitive periods of the day could result in increased annoyance and potential sleep disruption for occupants of nearby residential dwellings. It is important to note that construction noise levels are highly variable and would last only as long as construction activities occur. Nonetheless, short-term noise-generating construction activities associated with future development would be considered to have a **potentially significant** impact.

Mitigation Measures

MM 5.10.1 The following mitigation measures shall be implemented and specified on all project implementation plans:

a. Construction activities (excluding emergency work and activities that would result in a safety concern to the public or construction workers) shall be limited to between the hours of 7:00 a.m. and 7:00 p.m. Construction activities shall be prohibited on Sundays and federal holidays.

b. Construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and shrouds, in accordance with manufacturers' recommendations.

c. Construction equipment staging areas shall be centrally located on the Project site or located at the farthest distance possible from nearby residential land uses.

d. All motorized construction equipment and vehicles shall be turned off when not in use.

e. To the extent practical, alternative construction processes that generate lower noise levels should be selected. Examples include the use of drilled piles as opposed to impact piles, and the use of electrified equipment as opposed to combustion engines.

Timing/Implementation: *Prior to and during construction*

Enforcement/Monitoring: *City of Elk Grove Planning Department*

Implementation of the above mitigation measures would substantially reduce construction noise levels. For instance, the use of mufflers and engine shrouds would reduce equipment noise levels by approximately 10 dB or more. In addition, hourly limitations for construction activities would significant reduce the potential for annoyance and sleep disruption for occupants of nearby land uses. However, while implementation of the above mitigation measures would minimize the construction-related noise impacts, the impact would remain **significant and unavoidable**.

Long-Term Operational Noise Impacts (Standards of Significance 1 and 3)

Impact 5.10.2 Implementation of the proposed Project would result in a significant increase in traffic noise levels along some area roadways. However, predicted traffic noise levels at existing land uses would not be projected to exceed

applicable City noise standards. As a result, this impact is considered **less than significant**.

Implementation of the proposed Project would result in increased traffic volumes on nearby area roadways. Predicted increases would primarily occur on nearby segments of Whitelock Parkway, Bruceville Road, Kammerer Road, West Stockton Boulevard, Promenade Parkway, and Big Horn Boulevard. The predicted increase in traffic volumes resulting from implementation of the proposed Project would therefore contribute to predicted increases in traffic noise levels. The Project's contribution to traffic noise levels along these roadways was determined by comparing the predicted noise levels with and without Project-generated traffic. Predicted traffic noise levels for existing conditions, with and without development of the proposed Project, are summarized in **Table 5.10-10**.

TABLE 5.10-10
PREDICTED INCREASES IN TRAFFIC NOISE LEVELS
EXISTING AND EXISTING PLUS PROJECT CONDITIONS

Roadway	CNEL/Ldn at 50 Feet from Near-Travel-Lane Centerline[1]		Predicted Noise Level Increase	Substantial Noise Level Increase?[2]
	Without Project	With Project		
Whitelock Pkwy., West of Bruceville Rd.	64.7	65.4	0.8	*No*
Whitelock Pkwy., East of Bruceville Rd.	60.6	61.5	0.9	*No*
Whitelock Pkwy., West of Big Horn Blvd.	60.1	62.7	2.6	*No*
Whitelock Pkwy., East of Big Horn Blvd.	60.4	61.4	1.0	*No*
Whitelock Pkwy., West of W. Stockton Blvd.	58.8	61.1	2.3	*No*
Bruceville Rd., North of Whitelock Pkwy.	65.8	66.6	0.8	*No*
Bruceville Rd., South of Whitelock Pkwy.	65.5	65.8	0.3	*No*
Bruceville Rd., North of Kammerer Rd.	64.1	65.0	0.9	*No*
Bruceville Rd., South of Kammerer Rd.	57.6	59.3	1.7	*No*
Kammerer Rd., East of Bruceville Rd.	66.3	67.7	1.4	*No*
Kammerer Rd., West of Promenade Pkwy.	64.3	70.2	5.9	***Yes***
Promenade Pkwy., North of Kammerer Rd.	59.0	64.9	5.9	***Yes***
W. Stockton Blvd., South of Whitelock Pkwy.	62.1	60.8	-1.3	*No*
Big Horn Blvd., North of Whitelock Pkwy.	62.4	68.4	6.1	***Yes***

Source: Ambient 2014

1. *Traffic noise levels were calculated using the FHWA roadway noise prediction model and do not include shielding from existing structures, including sound barriers, or intervening terrain.*
2. *Substantial increases defined as an increase of 5.0, or greater, where noise levels are less than the City's normally acceptable minimum noise level of 60 dBA CNEL/Ldn; 3 dBA, or greater, where noise levels range from 60 to 65 dBA CNEL; and 1.5 dB, or greater, where the noise level exceeds 65 dBA CNE,L without the proposed Project.*

Refer to **Appendix 5.10-B** for modeling assumptions and results.As depicted in **Table 5.10-10**, the proposed Project would result in significant increases in traffic noise levels along nearby segments of Kammerer Road, west of Promenade Parkway; Promenade Parkway, north of Kammerer Road; and Big Horn Boulevard, north of Whitelock Parkway. No noise-sensitive land uses were identified along Kammerer Road, west of Promenade Parkway, or along Promenade

Parkway, north of Kammerer Road. It is important to note that significant increases in traffic noise levels at existing rural residential land uses located along Kammerer Road, east of Bruceville Road, and along Bruceville Road, north of Kammerer Road, would not be projected to occur.

Existing noise-sensitive land uses located along the segments of Big Horn Boulevard, north of Whitelock Parkway, include an existing residential subdivision, which is located adjacent to and west of Big Horn Boulevard, as well as Elizabeth Pinkerton Middle School. The existing residential subdivision is shielded from direct line-of-sight by an approximate 8-foot-tall masonry soundwall, which would provide estimated noise reductions of approximately 6 to 8 dB. Assuming a minimum reduction of 6 dB for the existing barrier, predicted traffic noise levels at the nearest residence would be approximately 62 dBA CNEL/L_{dn} with Project implementation. Based on this noise level and assuming an average exterior-to-interior noise reduction of 25 dB, which is typical for newer construction, predicted interior noise levels at these nearest residential dwellings would be approximately 37 dBA CNEL/L_{dn}. Predicted traffic noise levels would not exceed the City's conditionally acceptable exterior noise level of 65 dBA CNEL/L_{dn} nor would projected interior noise levels exceed the City's interior noise standard of 45 dBA CNEL/L_{dn}. The nearest occupied structures at Elizabeth Pinkerton Middle School are located approximately 400 feet east of Big Horn Boulevard. Based on this distance and assuming an average exterior-to-interior noise reduction of 25 dB, predicted peak-hour traffic noise levels in the nearest occupied structure would be approximately 30 dBA L_{eq}, which would not exceed the City's noise standard of 45 dBA L_{eq}.

As a result, significant increases in traffic noise along the segment of Big Horn Boulevard north of Whitelock Parkway would not contribute to increased traffic noise levels at nearby noise-sensitive land uses that would exceed the City's noise standards. As a result, increases in traffic noise levels attributable to the proposed Project would be considered **less than significant**.

Mitigation Measures

None required.

Exposure to Non-Transportation Source Noise (Standard of Significance 3)

Impact 5.10.3 Implementation of the proposed Project may result in non-transportation noise levels that could exceed applicable noise standards at nearby noise-sensitive land uses. This impact would be considered **potentially significant.**

Proposed On-Site Noise Sources

The proposed Project includes a mix of land uses, including commercial, office, industrial, residential, open space/recreational, and elementary school uses. Utility infrastructure facilities (e.g., pump stations and electrical substations) may also be required. These land uses would result in new non-transportation noise sources that could potentially exceed the City's applicable noise standards at nearby noise-sensitive land uses. Noise levels typically associated with these land uses and associated noise impacts are discussed separately below.

Residential Land Uses

The proposed Project includes development of various residential land uses including low-, medium-, and high-density residential development. The proposed Project also includes mixed use land uses, which could incorporate residential development. Noise from proposed residential dwellings would expose other nearby residences (both existing and Project-related)

to minor increases in ambient noise levels. Noise typically associated with such development includes lawn and garden equipment, voices, and amplified music. Activities associated with these land uses would result in only minor increases in ambient noise levels, primarily during the day and evening hours and less frequently at night, as perceived at the closest residential receptors. As a result, increased noise levels associated with proposed residential land uses would be less than significant.

Parks, Trails, and Open Space Land Uses

The proposed Project includes development of open space and park-related land uses distributed throughout the Project site. The specific uses to be included in these areas have not yet been identified; however, these land uses could potentially include children's play areas and vehicle parking areas. Noise typically associated with play areas and vehicle parking areas include the voices of adults and children and the occasional opening and closing of vehicle doors.

Noise levels generated by park-related uses, such as children's play areas and vehicle parking lots, typically average less than 60 dBA L_{eq} at approximately 50 feet. Noise events are typically sporadic and limited primarily to the daytime hours of operation. Parks are typically considered to be an accepted land use within residential developments and generally do not result in noise events that are uncharacteristic of typical residential noise environments, which is reflected in Southeast Policy Area Community Plan Policy MP-18. As such, the policy states that Table NO-A of the General Plan does not apply to the potential noise from these facilities. For these reasons, noise generated by planned park, trails, and open space land uses would be considered to have a less than significant impact.

Commercial and Industrial Land Uses

The proposed Project includes development of various nonresidential land uses, including commercial land uses, office, industrial/flex space, and mixed use. However, the specific types of land uses to be developed have not yet been determined. Potential sources of noise commonly associated with these types of land uses can vary substantially. Noise sources often associated with commercial uses can include parking lot activities (e.g., opening and closing of vehicle doors, people talking) and noise generated by mechanical building equipment (e.g., heating, ventilation, and air conditioning [HVAC] systems). Some commercial and industrial uses may also result in noise associated with on-site truck operations, vehicle/equipment backup alarms, decompression of trailer truck brakes, the operation of stationary and portable equipment (e.g., generators, chillers, air compressors, and trash compactors, pneumatic tools, etc.), and loading dock operations (e.g., use of forklifts, hydraulic lifts, and material handling activities).

Operational noise levels for commercial and industrial land uses can vary and may include operations during the more noise-sensitive nighttime hours. For commercial and industrial uses involving loading dock activities, average-hourly noise levels can range from less than 50 to approximately 60 dBA L_{eq} at 50 feet. Noise levels associated with exterior landscape and parking lot maintenance activities, as well as solid waste collection activities, can generate average-hourly noise levels of approximately 60 dBA L_{eq} at 50 feet; stationary and portable equipment can generate levels of up to 90 dBA L_{eq} at 50 feet. Intermittent noise levels, such as those generated by landscape and parking lot maintenance equipment (i.e., leaf blowers) and vehicle backup alarms, can generate intermittent noise levels of approximately 80 to 120 dBA L_{max} at roughly 3 feet. Actual noise levels will vary depending on the operational characteristics of the Project and site design.

The Project has been designed so that nearby residential development would be largely buffered from the more noise-intensive proposed industrial uses. It is also important to note that the City's Noise Control Ordinance prohibits material loading and unloading activities, as well as pavement sweeping activities that would result in a noise nuisance to nearby noise-sensitive land uses during the more noise-sensitive nighttime hours (i.e., 10:00 p.m. to 7:00 a.m.). Nonetheless, depending on the specific uses proposed, site design, and hours of operation, predicted noise levels associated with proposed commercial and industrial land uses could potentially exceed the City's noise standards at nearby noise-sensitive land uses (refer to **Table 5.10-7**). Areas where commercial and residential development would occur in close proximity, such as planned mixed-use development, would be of particular concern. As a result, noise generated by planned commercial and industrial land uses would be considered potentially significant.

Elementary School Land Uses

The proposed Project includes approximately 30 acres for elementary school land uses. Noise sources typical of schools include the sound of children's voices during recess periods and play area activities, mechanical building equipment (e.g., HVAC systems and boilers), landscape maintenance equipment, and exterior intercom/speaker systems. Noise generated by landscape maintenance activities conducted at proposed elementary schools, particularly if activities occur during the more noise-sensitive evening or early morning hours, may also result in significant increases in ambient noise levels that could adversely impact occupants of nearby residences. Operational noise levels for school-related land uses are typically limited to the daytime hours.

Mechanical building equipment often associated with schools is often enclosed or located in areas that would limit direct exposure, such as within building mechanical rooms or on building rooftops. Noise generated by exterior HVAC systems typically average approximately 90 dBA L_{eq}, or less, at approximately 3 feet (EPA 1971). Noise levels associated with vehicle parking areas, exterior recreational uses, and landscape maintenance activities can generate average-hourly noise levels of up to approximately 60 dBA L_{eq} at 50 feet.

Noise generated during use of exterior play areas is typically of limited duration, would predominantly occur during the daytime hours, and would not be uncharacteristic of typical residential noise environments, which is reflected in Southeast Policy Area Community Plan Policy MP-18. As such, the policy states that Table NO-A of the General Plan does not apply to the potential noise from these facilities. In addition, it is important to note that noise generated by school bands and school athletic and entertainment events are exempt from the City's noise control chapter of the Municipal Code. However, depending on site design and hours of operation, predicted noise levels associated with the operation of building mechanical equipment, vehicle parking areas, and landscape maintenance activities could result in increases in ambient noise levels and increased levels of annoyance to occupants of nearby residential dwellings. For these reasons, noise generated by the proposed elementary school land uses would be potentially significant.

Utility Infrastructure Facilities

The proposed Project would also require the installation of utility infrastructure facilities (e.g., electrical substations and pump stations) to serve proposed on-site development, including future on-site light-rail transit. Operational noise levels associated with these facilities can vary substantially depending on the equipment installed, site design, and noise-reduction features included (e.g., equipment enclosures and soundwalls). Without proper noise control and

depending on the equipment installed and site design, operational noise levels associated with such facilities can reach levels of up to approximately 100 dBA at 3 feet (EPA 1971).

Depending on the specific infrastructure required, facility design, and hours of operation, predicted noise levels could result in significant increases in ambient noise levels in excess of the City's noise standards at nearby noise-sensitive land uses (refer to **Table 5.10-7**). As a result, noise associated with utility infrastructure facilities would be potentially significant.

Off-Site Agricultural Uses

As noted earlier in this section, existing agricultural uses are located south of the Project site, across Kammerer Road. Agricultural land uses are also generally located west of the Project site, across Bruceville Road and south of Bilby Road, and to the east, between the Project site's eastern boundary and Promenade Parkway.

Agricultural activities on parcels located adjacent to the Project area include the use of various types of heavy equipment. Operation of heavy agricultural equipment typically generates noise levels of up to approximately 75 dBA L_{eq} at 50 feet (FHWA 2006). However, agricultural activities (e.g., disking, plowing) are typically sporadic or seasonal and occur over a large area, which results in varying levels of exposure at nearby receptors. In addition, given that agricultural activities typically occur during the daytime hours, noise generated by nearby agricultural activities would likely be somewhat masked by nearby traffic noise. Furthermore, the proposed Project has generally been designed to largely sheild proposed on-site noise-sensitive land uses from the more extensive areas of agricultural uses, including areas located to the south and east of the Project site. Proposed nonresidential uses along the southern boundary of the site would provide a 900- to 2,000-foot separation between residential uses and agricultural, with the exception of the estate residential use proposed in the panhandle portion of the Project area, which would be separated only by the drainage channel. At Bruceville Road, there would be a 168-foot separation between agricultural uses and residential uses. For these reasons, nearby planned noise-sensitive land uses are not anticipated to be exposed to agricultural noise levels for extended periods of time. As a result, exposure to agricultural noise would be considered to have a less than significant impact.

Impact Summary

The proposed Project includes a mix of land uses, including commercial, office, industrial, residential, open space/recreational, and elementary school uses. Utility infrastructure facilities (e.g., pump stations and electrical substations) would also be required. Depending on the specific land uses developed, equipment used, and site design, non-transportation noise generated by planned commercial, industrial, elementary school, and utility infrastructure facilities could exceed applicable noise impact criteria. As a result, increases in non-transportation noise associated with these land uses would be considered to have a **potentially significant** impact.

Mitigation Measures

MM 5.10.3 The City shall require acoustical assessments to be prepared as part of the environmental review process for future land use development projects. The acoustical assessments shall evaluate potential environmental noise impacts attributable to the proposed Project, as well as the compatibility of proposed land uses in comparison to applicable City noise standards. Where the acoustical analysis determines that noise levels would exceed applicable City

noise standards, noise reduction measures shall be identified and included in the Project. Such measures may include, but are not limited to, the incorporation of setbacks, sound barriers, berms, hourly limitations, or equipment enclosures. The emphasis of such measures shall be placed on site planning and Project design. The acoustical analysis shall be prepared in accordance with City requirements, as noted in the City's General Plan, Table NO-B, Requirements for Acoustical Analysis.

Timing/Implementation: *Prior to construction*

Enforcement/Monitoring: *City of Elk Grove Planning Department*

Implementation of mitigation measure **MM 5.10.3** would substantially reduce operational noise impacts associated with the proposed Project. However, success of mitigation cannot be guaranteed and depending on the specific land uses developed, equipment used, and site design, non-transportation noise generated by planned land uses could conceivably continue to exceed applicable noise impact criteria at some nearby land uses. As a result, this impact is considered **significant and unavoidable**.

Groundborne Vibration Impacts (Standard of Significance 2)

Impact 5.10.4 Groundborne vibration levels associated with construction activities and planned transit facilities may exceed applicable groundborne vibration criterion at nearby land uses. This impact would be **potentially significant**.

Ground vibration spreads through the ground and diminishes in strength with distance. The effects of ground vibration can vary from no perceptible effects at the lowest levels, low rumbling sounds and detectable vibrations at moderate levels, and slight damage to nearby structures at the highest levels. At the highest levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely result in structural damage. As noted earlier in this section (refer to **Table 5.10-8**), a vibration threshold of 0.2 in/sec ppv is typically considered sufficient to protect against structural damage. This same threshold also represents the level at which vibrations would be potentially annoying to people in buildings (Caltrans 2002b, 2004).

Short-Term Construction

Increases in groundborne vibration levels attributable to the proposed Project would be primarily associated with short-term construction-related activities. Groundborne vibration levels associated with construction equipment are summarized in **Table 5.10-11.** Based on the levels shown, construction activities often associated with development projects that do not require the use of pile drivers would typically generate ground vibration levels of approximately 0.09 in/sec ppv, or less, at 25 feet.

TABLE 5.10-11
REPRESENTATIVE CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Equipment		Peak Particle Velocity at 25 Feet (in/sec)
Pile Driver (Impact)	Upper Range	1.518
	Typical	0.644
Pile Driver (Sonic)	Upper Range	0.734
	Typical	0.170
Vibratory Roller		0.210
Hoe Ram		0.089
Caisson Drill		0.089
Large Bulldozers		0.089
Loaded Trucks		0.076
Jackhammer		0.035
Small Bulldozers		0.003

Source: FTA 2006; Caltrans 2004

For most construction projects, groundborne vibration levels would not pose a significant risk to nearby structures or occupants. However, the construction of some facilities, such as a large stadium, may require the use of pile drivers. In addition, road improvement projects often require the use of vibratory rollers, which when operated close to existing structures can result in increased levels of annoyance. As depicted in **Table 5.10-11**, ground vibration levels associated with pile drivers can reach levels of approximately 1.52 in/sec ppv at 25 feet. Vibratory rollers can generate ground vibration levels of approximately 0.21 in/sec ppv at 25 feet.

Distance to the projected 0.2 in/sec ppv contour for construction equipment is summarized in **Table 5.10-12**. As depicted, the use of pile drivers can generated ground vibration levels of 0.2 in/sec ppv at distances up to approximately 200 feet. Depending on the distance to nearby existing structures, the more vibration-intensive construction activities (e.g., pile driving, vibratory rollers) could potentially exceed the criterion of 0.2 in/sec ppv at nearby structures. Such activities may therefore pose a potentially significant impact to nearby structures and increased levels of annoyance to building occupants.

TABLE 5.10-12
DISTANCE TO POTENTIAL IMPACT CONTOUR FOR CONSTRUCTION EQUIPMENT

Equipment	Peak Particle Velocity at 25 Feet (in/sec) [1]	Distance to Vibration Impact Contour (0.2 in/sec ppv, feet) [2, 3]
Pile Driver (Impact)	0.644–1.518	94–200
Pile Driver (Sonic)	0.170–0.734	28–105
Vibratory Roller	0.210	33
Other Equipment [4]	0.089	15

Source: FTA 2006; Caltrans 2004

1. Does not include the simultaneous operation of multiple pieces of equipment.

2. Based on a vibration threshold of 0.2 in/sec ppv, which is typically considered sufficient to protect against structural damage (excluding fragile and historic structures). This same threshold also represents the level at which vibrations would be potentially annoying to people in buildings (Caltrans 2002b, 2004). Does not include vibration-sensitive exterior activities.

3. Based on conservative ground attenuation rates. Actual levels/contour distances may vary depending on equipment selected and site conditions.

4. Includes hoe rams, bulldozers, tractors, front-end loaders, caisson drills, loaded trucks, and jackhammers.

Long-Term Operation

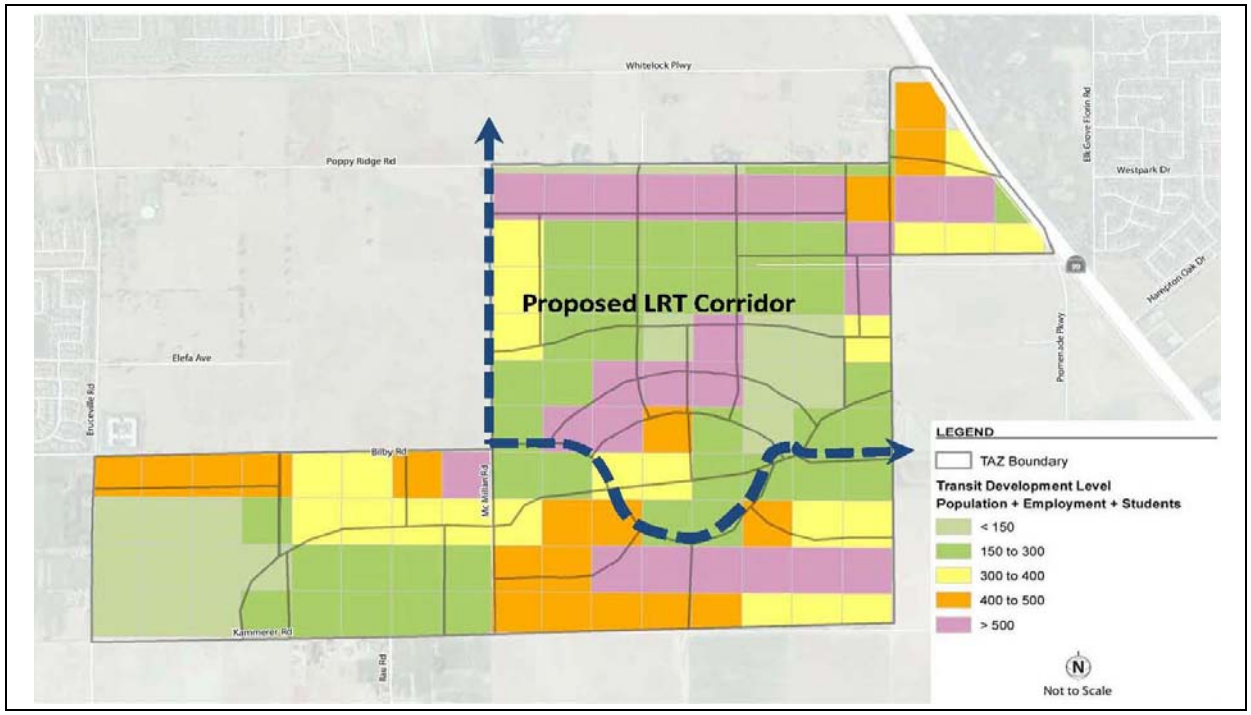
Long-term operational activities associated with the proposed Project would not be anticipated to involve the use of any equipment or processes that would result in potentially significant levels of ground vibration. Roadway vehicles are typically not considered to be significant sources of ground vibration that would cause structural damage or increased levels of annoyance to nearby land uses. However, light-rail transit (LRT) vehicles traveling along rail corridors, as well as activities conducted at transit stations, may be a potentially significant source of ground vibration, which may result in increased levels of annoyance to occupants of nearby structures.

The proposed Project includes a mix of land uses that would be located near the proposed LRT corridor and transit station. These land uses include commercial, office, industrial, and residential. Potential vibration impacts to nearby land uses typically vary depending on various factors, including distance from source, site and geological conditions, and LRT operation characteristics (e.g., number of events, speed, vehicle suspension, and track/vehicle wheel conditions). The planned LRT corridor is depicted in **Figure 5.10-5**.

The specific location of proposed LRT facilities in relation to future planned land uses has not yet been identified. In addition, operational characteristics associated with future LRT operations, such as the number of trains, train speeds, and facility designs, are currently not available. As such, a detailed evaluation of operational groundborne vibration levels cannot be conducted at this time. However, the Federal Transit Administration (FTA) has developed screening distance criteria for the assessment of potential transit-related vibration impacts based on land use category designations. The FTA's screening criteria related to LRT facilities and stations are summarized in **Table 5.10-13**.

Based on the FTA's screening distance impact assessment criteria, occupants of residential structures located within approximately 150 feet of an LRT corridor could be exposed to levels resulting in potential sleep disruption. In addition, institutional land uses and offices located within approximately 100 feet of an LRT corridor may experience ground vibration levels that could interfere with interior activities (FTA 2006). Given that LRT facilities could be located in close proximity to planned land uses, within the distances noted in FTA's screening criteria, potential exposure to groundborne vibration generated by on-site LRT and transit operations would be considered **potentially significant**.

FIGURE 5.10-5
PROPOSED LIGHT-RAIL TRANSIT CORRIDOR



Source: Fehr & Peers 2014

TABLE 5.10-13
SCREENING DISTANCES FOR TRANSIT VIBRATION ASSESSMENT

Transportation Source	Category 1 High-Sensitivity Land Uses (feet)	Category 2 Residential & Lodging Land Uses (feet)	Category 3 Institutional Land Uses (feet)
Light Rail Transit	450	150	100
Bus Facilities	100	50	--

Source: FTA 2006

Potential impacts to nearby land uses will vary depending on various factors including distance from source, site and geological conditions, and LRT operation characteristics (e.g., number of events, speed, vehicle suspension, and track/vehicle wheel conditions). In addition, the proper design of LRT facilities, including the use of welded as opposed to jointed track and track bed construction can substantially reduce groundborne vibration levels.

***Vibration Category 1**: This category includes buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance. Typical land uses covered by Category 1 are vibration-sensitive research and manufacturing, hospitals with vibration-sensitive equipment, and university research operations.*

***Vibration Category 2**: This category includes all residential land uses, as well as any buildings where people sleep, such as hotels and hospitals.*

***Vibration Category 3**: This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference. Although it is generally appropriate to include office buildings in this category, it is not appropriate to include all buildings that have any office space. For example, most industrial buildings have office space, but it is not intended that buildings primarily for industrial use be included in this category.*

Mitigation Measures

MM 5.10.4 A vibration impact assessment shall be prepared for construction projects that would involve the use of major vibration-generating equipment (e.g., pile drivers, vibratory rollers) that could generate groundborne vibration levels in excess of 0.2 in/sec ppv at nearby structures (refer to **Table 5.10-12** for distances to the projected 0.2 in/sec ppv contours). Measures to reduce ground vibration levels shall be identified for potentially significant impacts. Such measures may include, but are not limited to, changes in site design and/or use of alternative construction techniques (e.g., sonic or drilled piles).

A vibration impact assessment shall be prepared for the development of on-site transit facilities, as well as planned land uses that could be exposed to high levels of transit-generated ground vibration levels (refer to **Table 5.10-13** for distances to potentially significant transit-related vibration contours). Vibration-reduction measures shall be identified for groundborne vibration levels in excess of 0.2 in/sec ppv at nearby structures. Such measures may include, but are not limited to, incorporation of building setbacks, and improvements to LRT track, including the use of track ballast mats, high-resilience fasteners, welded track, and/or a floating slab trackbed.

Timing/Implementation: *Prior to/during environmental review process*

Enforcement/Monitoring: *City of Elk Grove Planning Department*

Implementation of mitigation measure **MM 5.10.4** would substantially reduce short-term construction and long-term operational vibration impacts associated with the proposed Project. Various measures commonly employed to reduce short-term vibration levels, such as the use of alternative construction techniques, can significantly reduce groundborne vibration levels. In addition, with careful site and facility design and implementation of available technologies and construction techniques, groundborne vibration levels associated with LRT facilities can be effectively reduced to below applicable criteria. However, the location of sensitive receptors relative to construction activities and whether alternate construction techniques would be feasible for all construction projects are not known. This impact would be considered **significant and unavoidable**.

Land Use Compatibility (Standard of Significance 1)

Impact 5.10.5 Projected on-site noise levels at proposed on-site land uses associated with vehicular traffic on nearby roadways and on-site light-rail transit operations could potentially exceed the City's noise standards for land use compatibility. As a result, this impact is considered **potentially significant**.

Major transportation noise sources in the Project area, which could adversely affect nearby planned land uses, would be associated with vehicle traffic along area roadways and on-site LRT operations. Planned noise-sensitive land uses in the Project area that could be adversely affected by nearby roadway traffic and LRT noise would include residential, park, and elementary school uses. Depending on the specific land uses developed, commercial, mixed-use, and office land uses may also be sensitive to increased noise levels.

As noted in **Table 5.10-6**, the City's noise criteria for determination of land use compatibility with transportation noise sources ranges from an exterior noise level of 60 dBA CNEL/L_{dn} for residential

uses to 70 dBA CNEL/L_{dn} for parks and playgrounds. The City has also established an interior noise standard of 45 dBA CNEL/L_{dn} for residential, school, and office uses exposed to transportation noise sources. Potential noise levels associated with roadway vehicle traffic and LRT operations in the Project area and the compatibility of proposed nearby land uses are discussed in greater detail below.

Roadway Traffic

As noted, noise levels within the Project area are predominantly influenced by vehicle traffic noise emanating from area roadways. Vehicular traffic along on-site roadways would also contribute to projected increases in transportation noise conditions at planned land uses. Predicted future cumulative traffic noise levels for nearby existing and planned on-site roadways are summarized in **Table 5.10-14**.

As shown in **Table 5.10-14**, predicted future traffic noise levels along on-site roadways, assuming an average travel speed of 45 mph, would range from approximately 59 to 70 dBA CNEL/L_{dn} at 50 feet from the near-travel-lane centerline. The projected future 60 dBA noise contour for on-site roadways would extend from approximately 57 to 336 feet from the roadway centerline. It is important to note that roadway design speeds are not currently available for planned on-site roadways. For purposes of this analysis and to be conservative, an average travel speed of 45 mph was assumed based on the highest vehicle speeds noted on nearby existing collector roadways. Reductions in vehicle speeds along on-site planned roadways would result in reductions in associated traffic noise levels at a rate of roughly 1.5 dB per 5 mph reduction in travel speed. Nonetheless, depending on final site design, predicted on-site traffic noise levels at planned land uses could potentially exceed the City's transportation noise standards (refer to **Table 5.10-6**).

Future cumulative traffic noise levels for nearby off-site roadway segments would range from approximately 65 to 72 dBA CNEL/L_{dn} at 50 feet from the near-travel-lane centerline. Predicted future cumulative traffic noise levels for SR 99 would be approximately 78 dBA CNEL/L_{dn} at 50 feet from the near-travel-lane centerline. The projected future 60 dBA noise contour for nearby offsite roadways would extend from approximately 148 to 496 feet from the roadway centerline. The projected future 60 dBA noise contour for SR 99 would extend approximately 1,319 feet from the highway centerline. Depending on final site design, predicted future off-site traffic noise levels at planned land uses could potentially exceed the City's transportation noise standards (refer to **Table 5.10-6**).

TABLE 5.10-14
FUTURE CUMULATIVE WITH PROJECT TRAFFIC NOISE LEVELS

Segment	ADT	CNEL/L_{dn} at 50 Feet from Near-Travel-Lane Centerline	Distance (feet) to Noise Level Contours (dBA CNEL/L_{dn}) from Roadway Centerline		
			70	65	60
On-Site Roadways					
Big Horn Blvd., Poppy Ridge Rd. to Collector 1	29,400	69.8	73	149	317
Big Horn Blvd., Collector 1 to Bilby Rd.	27,100	69.5	69	141	300
Big Horn Blvd., Bilby Rd. to Kammerer Rd.	21,800	68.5	61	123	260

Segment	ADT	CNEL/L_{dn} at 50 Feet from Near-Travel-Lane Centerline	Distance (feet) to Noise Level Contours (dBA CNEL/L_{dn}) from Roadway Centerline		
			70	65	60
Lotz Pkwy., Whitelock Parkway to Poppy Ridge Rd.	32,150	70.2	76	158	336
Lotz Pkwy., Poppy Ridge Rd. to Collector 1	19,100	67.9	57	113	238
Lotz Pkwy., Collector 1 to Bilby Rd.	15,600	67.1	WR	99	208
Lotz Pkwy., Bilby Rd. to Kammerer Rd.	18,000	67.7	WR	109	229
Residential Collector, South of Poppy Ridge Rd.	2,500	59.7	WR	WR	64
Residential Collector, South of Poppy Ridge Rd.	2,100	58.9	WR	WR	57
Poppy Ridge Rd., Big Horn Blvd. to Lotz Pkwy.	8,100	64.8	WR	65	135
W. Stockton Blvd., East of Lotz Pkwy	20,700	68.3	59	119	251
Residential Collector, Big Horn Blvd. to Lotz Pkwy.	10,200	65.8	WR	75	157
Residential Collector, East of Lotz Pkwy.	8,100	64.8	WR	65	135
Bilby Rd., Bruceville Rd. to Connector 2	10,100	65.2	WR	76	157
Bilby Rd., Connector 2 to Big Horn Blvd.	12,900	66.2	WR	88	184
Bilby Rd., Big Horn Blvd. to Connector 1	13,100	66.3	WR	89	186
Bilby Rd., Connector 1 to Lotz Pkwy.	10,600	65.4	WR	78	162
Bilby Rd., East of Lotz Pkwy.	4,200	61.9	WR	WR	88
Off-Site Roadways					
Big Horn Blvd., North of Whitelock Parkway	29,400	69.8	73	149	317
Bruceville Rd., North of Kammerer Rd.	9,200	64.8	WR	72	148
Kammerer Rd., East of Bruceville Rd.	26,700	71.6	93	194	416
Kammerer Rd., West of Promenade Pkwy.	34,800	72.2	112	232	496
Promenade Pkwy., North of Kammerer Rd.	29,100	69.8	72	148	314
SR 99, North of Grant Line Road	65,600	78.0	284	612	1,319

Source: Ambient 2014

Notes:

Traffic noise levels were calculated using the FHWA roadway noise prediction model and do not include shielding from existing structures, sound barriers, or intervening terrain.

Design speeds for planned future onsite roadways have not yet been identified. To be conservative, a travel speed of 45 mph was assumed based on existing speeds for major collectors in the Project area.

WR = Within roadway right-of-way

*Refer to **Appendix 5.10-B** for modeling assumptions and results.*

Light Rail Transit

The SEPA also identifies a preferred corridor for the future extension of Sacramento Regional Transit's light-rail transit (LRT) south line. The preferred LRT corridor would travel on Big Horn Boulevard to Bilby Road and continue east on Bilby Road through the Project area connecting to the Sterling Meadows and Elk Grove Promenade areas. The planned LRT corridor is depicted

in **Figure 5.10-5.** The proposed Project also includes an on-site intermodal transit station, although the location of this facility has not yet been identified.

Light-rail transit noise levels are typically generated by the interaction of the LRT wheels with the track and the sounding of warning horns and bells. Wheel-rail noise is largely speed dependent and increases with LRT vehicle speed. Horns and bells on the moving LRT vehicle, combined with stationary bells at grade crossings, also generate intermittent noise levels, which can be considered annoying to nearby noise-sensitive land uses. LRT noise may also be generated by transit vehicles when stationary, associated with the continued operation of auxiliary equipment, such as cooling fans. Noise commonly generated by sources at fixed-transit facilities can also result from the operation transit buses, automobiles traveling to and from the station, public address systems, and building mechanical equipment. LRT electrical infrastructure, such as electrical substations, is also a potential source of noise.

As noted above, the location of proposed LRT facilities has not yet been identified. In addition, operational characteristics associated with future LRT operations, such as the number of trains, hours of operation, train speeds, and site designs, are currently not available. As such a detailed evaluation of operational noise levels cannot be conducted at this time. In general, however, operational noise levels associated with LRT vehicle operations typically range from approximately 55 to 65 dBA L_{dn}/CNEL at roughly 75 feet from the track centerline, depending primarily on LRT vehicle speed, number of LRT vehicles, and hours of operation. Signal bells used at grade crossings typically operate for periods of approximately 15 to 30 seconds and generate intermittent noise levels of approximately 70 to 75 dBA L_{max} at 50 feet. Ancillary equipment, such as LRT electrical substations, generates noise levels of approximately 40 to 50 dBA CNEL/L_{dn} at 75 feet. Operational noise levels associated with transit stations can reach levels of approximately 60 to 65 dBA CNEL/L_{dn} at 50 feet. Actual noise levels will vary depending on various factors, such as facility/site design, the number of LRT and transit vehicles operating, hours of operation, vehicle speeds, and various other operational characteristics (FTA 2006; FTA/SRTD 2000; SRTD 2009).

As depicted in **Figure 5.10-5**, LRT facilities would be located in proximity to planned residential and office land uses. Depending on light rail operational characteristics, site design, and setback distances, operational noise levels at nearby planned land uses could exceed the City's exterior and interior noise standards. As noted in Impact 5.10.4, planned land uses located near LRT facilities may also experience significant increases in groundborne vibration/noise, which can cause increased levels of annoyance and activity interference. As a result, the compatibility of future land uses with regard to on-site LRT and transit station operations would be considered **potentially significant**.

Depending on final site design, predicted future traffic noise levels from on-site and nearby off-site roadways could potentially exceed the City's applicable transportation noise standards. In addition, on-site LRT activities, which are currently planned along the on-site segments of Big Horn Boulevard and Bilby Road, would be anticipated to contribute to additional increases in cumulative transportation noise levels at planned on-site land uses. As noted previously, on-site stationary noise sources may also result in increased noise levels that could potentially exceed the City's noise standards at nearby planned land uses. As a result, the compatibility of future land uses with regard to projected on-site noise levels would be considered **potentially significant**.

Mitigation Measures

Implement mitigation measures **MM 5.10.3** and **MM 5.10.4**

Implementation of the above mitigation measures would substantially reduce operational noise impacts associated with the proposed Project. However, given that detailed development plans are not currently available, it is conceivable that noise levels at some planned land uses may continue to exceed applicable noise impact criteria. As a result, this impact is considered **significant and unavoidable**.

5.10.5 CUMULATIVE SETTING, IMPACTS, AND MITIGATION MEASURES

CUMULATIVE SETTING

The geographic extent of the cumulative setting for noise consists of the Project area and the surrounding areas in the City. Cumulative development conditions would result in increased cumulative roadway noise levels and would also result in increased noise associated with future development. As noted earlier, ambient noise levels in the Project area are influenced primarily by traffic noise emanating from area roadways, particularly SR 99, Kammerer Road, West Stockton Boulevard, Promenade Parkway, Whitelock Parkway, and Bruceville Road. No major stationary sources of noise, transit noise, or groundborne vibration sources have been identified in the Project area. The primary factor for cumulative impact analysis is therefore the consideration of future traffic noise levels.

CUMULATIVE IMPACTS AND MITIGATION MEASURES

Contribution to Cumulative Traffic Noise (Standards of Significance 1 and 3)

Impact 5.10.6 Implementation of the proposed Project would result in a substantial contribution to cumulative noise levels along some area roadways. As a result, the proposed Project would be considered to have a **cumulatively considerable** contribution to traffic noise levels along area roadways.

Predicted future cumulative traffic noise levels along primarily affected roadways, with Project implementation, are summarized in **Table 5.10-13**. Predicted traffic noise levels along on-site roadways, assuming an average travel speed of 45 mph, would range from approximately 59 to 70 dBA CNEL/L_{dn} at 50 feet from the near-travel-lane centerline. As a result, predicted future cumulative traffic noise levels along planned onsite roadways could potentially exceed the City's applicable noise standards (refer to **Table 5.10-7**). It is important to note that roadway design information, including design speeds, are not currently available for planned on-site roadways. For purposes of this analysis and to be conservative, an average travel speed of 45 mph was assumed based on the highest vehicle speeds noted on nearby existing collector roadways. Reductions in vehicle speeds along on-site planned roadways would result in reductions in traffic noise levels at a rate of roughly 1.5 dB per 5 mph reduction in travel speed. Furthermore, depending on final site design, LRT activities planned along the on-site segments of Big Horn Boulevard and Bilby Road would contribute to additional increases in cumulative transportation noise levels at planned on-site land uses.

Under future cumulative conditions, predicted traffic noise levels along affected off-site roadways would increase and would range from approximately 65 to 78 dBA CNEL/L_{dn} at 50 feet from the near-travel-lane centerline (**Table 5.10-14**). As discussed in Impact 5.10.2, the proposed Project would result in significant increases in existing traffic noise levels along nearby existing segments of Kammerer Road, west of Promenade Parkway; Promenade Parkway, north of Kammerer Road; and Big Horn Boulevard, north of Whitelock Parkway. Under future cumulative conditions, predicted traffic noise levels along these same roadway segments would further increase by approximately 2 dB along Kammerer Road, 5 dB along Promenade Parkway, and

1.4 dB along Big Horn Boulevard. Although predicted increases in traffic noise levels for future cumulative conditions would be largely attributable to projected increases in development within the surrounding community, the Project's contribution to future cumulative traffic noise levels along these roadway segments would still be considered significant.

Predicted future cumulative transportation noise levels at the property line of existing and future land uses located adjacent to some on-and off-site roadway segments would be projected to exceed the City's noise standards (refer to **Table 5.10-6**). Given that the proposed Project would result in a significant contribution to projected future cumulative traffic noise levels that would exceed the City's noise standards along some area roadways, this impact would be considered **potentially significant**.

Mitigation Measures

Implement mitigation measure **MM 5.10.3**.

Implementation of the above mitigation measure would substantially reduce cumulative traffic noise impacts at nearby land uses. However, given that detailed development plans are not currently available, it is conceivable that traffic noise levels at some land uses may continue to exceed applicable noise impact criteria. In addition, commonly employed traffic noise mitigation measures, such as sound barriers, may not be feasible at some land uses, particularly existing residential land uses that front major roadways. As a result, this impact is considered **cumulatively considerable**.

Contribution to Cumulative Construction Noise and Vibration (Standards of Significance 1, 2, and 4)

Impact 5.10.7 Implementation of the proposed Project would not result in a substantial contribution to cumulative construction vibration and noise levels in the Project area. As a result, this impact would be considered **less than cumulatively considerable.**

As discussed in Impact 5.10.1, construction activities associated with future development projects may result in significant increases in ambient noise levels. Mitigation measures have been incorporated to reduce short-term construction noise impacts. In accordance with City General Plan requirements, other planned and/or approved projects in the area would also be required to evaluate construction noise impacts and implement noise-reduction measures. Construction noise impacts are typically highly localized; therefore, even if the timing of construction activities associated with on-site and/or off-site construction projects did overlap, noise and vibration associated with other off-site construction projects would not combine with construction on the Project site such that a significant cumulative effect would be anticipated to occur. Furthermore, because compliance with the City's noise requirements would limit construction activities to daytime hours and given that construction activities would be short term in duration, construction noise and vibration would not be cumulatively considerable. This impact would be considered **less than cumulatively considerable.**

Mitigation Measures

None required.

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