4.8 Noise

This section describes the existing noise environment in the area of the Proposed Project site, and the potential of construction and operation of the Proposed Project to significantly increase noise and vibration levels. The analysis included in this section was developed based on field investigation to measure existing noise levels, noise standards provided in the *City of Sacramento 2030 General Plan*,[1] information in the *City of Sacramento 2030 General Plan Master Environmental Impact Report*,[2] the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment*,[3] and the Federal Highway Administration (FHWA) Noise Prediction Model with traffic data provided by Fehr & Peers.

Public comments received in response to the Notice of Preparation (see Appendix A) covered a range of noise issues, including vibration impacts to historic buildings and noise impacts to nearby residences and businesses associated with arena event crowds and traffic. All of these issues and concerns have been addressed in this section.

4.8.1 Environmental Setting

Technical Background

Noise can be generally defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in Figure 4.8-1.

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1 City of Sacramento, 2009a. *City of Sacramento 2030 General Plan.* Adopted March 3, 2009.
2 City of Sacramento, 2009b. *City of Sacramento 2030 General Plan Master Environmental Impact Report*. Certified March 3, 2009.
3 Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment*. May 2006.

COMMON OUTDOOR ACTIVITIES	NOISE LEVEL (dBA)	COMMON INDOOR ACTIVITIES
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	
Noisy urban area, daytime		
Gas lawnmower at 100 feet	70	Garbage disposal at 3 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60	
		Large business office
Quiet urban daytime	50	Dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime		
	30	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
	0	

SOURCE: CaSIL, 2013

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Figure 4.8-1
Typical Noise Levels

Noise Exposure and Community Noise

Noise *exposure* is a measure of noise over a period of time. Noise *level* is a measure of noise at a given instant in time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual receptor. These successive additions of sound to the community noise environment vary the community noise level from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts.

This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

Leq: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

Lmax: the instantaneous maximum noise level for a specified period of time.

L_{50}: the noise level that is equaled or exceeded 50 percent of the specified time period. The L_{50} represents the median sound level.

L_{90}: the noise level that is equaled or exceeded 90 percent of the specific time period. This is considered the background noise level during a given time period.

DNL: also abbreviated Ldn, it is a 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night (“penalizing” nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: similar to DNL, the Community Noise Equivalent Level (CNEL) adds a 5-dBA “penalty” for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

As a general rule, in areas where the noise environment is dominated by traffic, the Leq during the peak-hour is generally within one to two decibels of the Ldn at that location.

Effects of Noise on People

When a new noise is introduced to an environment, human reaction can be predicted by comparing the new noise to the *ambient* noise level, which is the existing noise level comprised

of all sources of noise in a given location. In general, the more a new noise exceeds the ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:[4]

- except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- a change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- a 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion, hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such at traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement.[5]

Noise levels may also be reduced by intervening structures, such as a row of buildings, a solid wall, or a berm located between the receptor and the noise source. According to the U.S. Department of Housing and Urban Development (HUD) *Noise Guidebook*,[6] standard building construction results in an exterior-to-interior noise reduction of 20 dBA with windows closed.

4 Caltrans, 2009. *Technical Noise Supplement*. November 2009. p. 2-48 to 2-49.
5 Caltrans, 2009. *Technical Noise Supplement*. November 2009. p. 2-32.
6 U.S. Department of Housing and Urban Development, 2009. *Noise Guidebook*. March 2009. p. 14.

Fundamentals of Vibration

As described in the FTA's *Transit Noise and Vibration Impact Assessment*[7]ground-borne vibration can be a serious concern for nearby neighbors, causing buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, sheet pile-driving and operating heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the affect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to express RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration assessment include structures (especially older masonry structures), people who spend a lot of time indoors (especially residents, students, the elderly and sick), and vibration sensitive equipment such as hospital analytical equipment and equipment used in computer chip manufacturing.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and sheet pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance can be well below the damage threshold for normal buildings.

Existing Noise Setting

Downtown Project Site

The noise environment surrounding the Downtown project site is influenced primarily by truck and automobile traffic on local streets. Light rail, stationary sources, and landscape maintenance equipment also contribute to the ambient noise environment. To quantify the existing noise environment, 10 short-term (ST) ten-minute and two long-term (LT) 48-hour noise level measurements were taken near noise sensitive uses around the site. Noise measurements locations are shown in Figure 4.8-2. Results of the noise measurements are presented in Table 4.8-1.

7 Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment*. May 2006. p. 7-1.

SOURCE: Microsoft, 2012; ESA, 2013

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Figure 4.8-2

Short- and Long-Term Noise Measurement Locations

TABLE 4.8-1
EXISTING NOISE ENVIRONMENT IN THE DOWNTOWN PROJECT SITE VICINITY

Location		Time Period	Noise Level (dBA)	Noise Sources	
LT-1:	Wong Center. Southeast corner of building, along J Street, 3rd floor.	24– hour CNEL measurements were: Wed. Sept 11: 73 dBA Thurs. Sept 12: 73 dBA	Hourly Average Leq range: Sept 11: 60 – 73 6-7pm[a]: 69 10-11pm[a]: 67 Sept 12: 60 – 72 6-7pm[a]: 69 10-11pm[a]: 67	Unattended noise measurements do not specifically identify noise sources.	
LT-2:	US Bank Tower. Along L Street, 4th level of parking garage.	24– hour CNEL measurements were: Wed. Sept 11: 69 dBA Thurs. Sept 12: 70 dBA	Hourly Average Leq range: Sept 11: 54 – 69 6-7pm[a]: 66 10-11pm[a]: 62 Sept 12: 54 – 75 6-7pm[a]: 67 10-11pm[a]: 64	Unattended noise measurements do not specifically identify noise sources.	
ST-1:	6th and I St (35' to center of intersection)	10 Minutes (Tuesday September 10, 2013 at 4:15 pm)	Leq: 73 Lmax: 93	• Cars and diesel trucks • Pedestrians talking	• Bus and motorcycle pass by
ST-2:	J and 6th St (30' to center of intersection)	10 Minutes (Tuesday September 10, 2013 at 4:34 pm)	Leq: 71 Lmax: 89	• Cars and motorcycle on roadways • Bus stop, air brakes/warning signal	• Pedestrians talking • Car stereo
ST-3:	K and 7th St (Ice rink area, 130' to center of intersection)	10 Minutes (Tuesday September 10, 2013 at 4:48 pm)	Leq: 66 Lmax: 79	• Car horn • Pedestrians talking and whistle • Sirens	• Light Rail • Bus • Wind
ST-4:	4th and J St (50' to center of intersection)	10 Minutes (Tuesday September 10, 2013 at 5:09 pm)	Leq: 71 Lmax: 82	• Cars and diesel truck • * Pedestrians talking	• Car stereo • Bus and motorcycle passby
ST-5:	J and 5th St Plaza (250' to J St CL)	10 Minutes (Tuesday September 10, 2013 at 5:21 pm)	Leq: 57 Lmax: 68	• Cars and bus • Pedestrians talking • Cellphone ringing and a radio	• Car door closing • Wind and birds
ST-6:	J and 4th St (Grass area near mall, 60' to center of intersection)	10 Minutes (Tuesday September 10, 2013 at 5:35 pm)	Leq: 68 Lmax: 81	• Cars, motorcycle, bus at stop • Pedestrians laughing	• Car horn and radio
ST-7:	Outside Holiday Inn at west end of Downtown Plaza	10 Minutes (Tuesday September 10, 2013 at 5:48 pm)	Leq: 64 Lmax: 68	• Radio, music	• Pedestrians talking, laughing

TABLE 4.8-1 (CONTINUED)
EXISTING NOISE ENVIRONMENT IN THE DOWNTOWN PROJECT SITE VICINITY

Location		Time Period	Noise Level (dBA)	Noise Sources	
ST-8:	Plaza West Garage along 3rd St (65' to 3rd St CL)	10 Minutes (Thursday September 12, 2013 at 4:01 pm)	Leq: 77 Lmax: 84	• Freeway traffic • Motorcycle	• Semi Trucks
ST-9:	Along L St b/t 6th and 7th, in front of US Bank Tower parking garage	10 Minutes (Thursday September 12, 2013 at 4:24 pm)	Leq: 69 Lmax: 82	• Cars, motorcycle, bus and warning signal • Pedestrians talking	• Light rail
ST-10:	N St, at end where 6th St would meet (15' to N St CL)	10 Minutes (Thursday September 12, 2013 at 4:42 pm)	Leq: 67 Lmax: 80	• Cars and bus • Pedestrians talking	• Light rail

NOTES: CL = centerline; LT = long-term; ST = short-term
a. Existing peak-hour noise levels that represent future pre-event (6-7 p.m.) and post-event (10-11 p.m.) peak hours

SOURCE: ESA, 2013

Offsite Digital Billboards

The potential sites for the offsite digital billboards would be in close proximity to major highways for maximum billboard exposure. As such, the existing noise environment would be dominated by substantial roadway noise.

Existing Vibration Setting

Downtown Project Site

The background vibration level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans, which is around 65 VdB. Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people or slamming of doors. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible.[8] The primary source of existing ground-borne vibration in the vicinity of the Downtown project site would be the light rail track on the east side of the site.

Offsite Digital Billboards

The potential sites for the offsite digital billboards would be in close proximity to major highways for maximum billboard exposure. Several sites are in the vicinity of rail lines as well. These would be the primary sources of existing vibration near the digital billboards.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others, due to the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks and other outdoor recreation areas are land uses with users that are generally more sensitive to noise than are the users of commercial (other than lodging facilities), industrial, and other non-residential land uses.

Additional sensitive receptors of ground-borne vibration would be historic buildings, which are more susceptible to structural damage from vibration.

Downtown Project Site

The nearest sensitive receptors to the Downtown project site would be residents of the historic Hotel Marshall (adjacent to project site), at the Jade Apartments (about 30 feet east of the project site), the Wong Center across J Street (approximately 115 feet north of the project site), and the Riverview Plaza residential building at 6th and I Street (approximately 270 feet north of the project site). In addition, the Proposed Project would include construction of up to 550 multi-family residential units, likely in two or more towers on the project site, as well as a hotel in one of the towers. There is also an existing Holiday Inn (approximately 50 feet from the project site)

8 Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment*. May 2006. p. 7-5.

and the Church of Scientology located in the historic Ramona Hotel building (approximately 30 feet from the project site). The University of San Francisco is an educational use that has a satellite campus in the 630 K Street building adjacent to the project site. Finally, St. Rose of Lima Park, located at 7th and K Streets (approximately 60 feet east of the project site), would be considered a noise sensitive land use.

Several other historic buildings in the Proposed Project vicinity include the Traveler's Hotel (428 J Street) and the California Fruit Building (4th and J Street). Existing uses in these buildings are office and other commercial, and therefore, would be less noise-sensitive than those uses listed above. However, along with the Hotel Marshall and Ramona Hotel, these historic buildings would be vibration sensitive and are analyzed as such below.

Offsite Digital Billboards

The Proposed Project would include the construction and operation of up to six offsite digital billboards. Sensitive receptors at each of these potential locations are described below.

- **I-5 at Water Tank.** Sensitive receptors in the vicinity of this site are residents of homes on El Morro Court and El Rito Way to the northwest and west, the nearest of which is approximately 85 feet northwest of the potential site.

- **US 50 at Pioneer Reservoir.** The closest sensitive receptors in the vicinity of this site are users of Leiva Park (approximately 600 feet northeast) and residents of homes on 3rd Street (approximately 1,750 feet northeast).

- **Business 80 at Sutter's Landing Regional Park.** The nearest sensitive receptors in the vicinity of this site are users of Sutter's Landing Regional Park (adjacent) and residents of homes on B Street in East Sacramento (approximately 1,350 feet south).

- **Business 80 at Del Paso Regional Park/Haggin Oaks.** The nearest sensitive receptors in the vicinity of this site are the golfers on the adjacent Alister MacKenzie golf course (especially holes 3, 4, 8 and 9), guests at a Hampton Inn motel (about 265 feet south), Quest Diagnostics Medical Laboratory (approximately 275 feet south), residents at the Ladi Senior Apartments (approximately 325 feet south), and guests at a Holiday Inn Express (about 465 feet south).

- **Business 80 at Sutter's Landing Regional Park/American River.** Sensitive receptors in the vicinity of this site are residents of homes on the west side of Erlewine Circle in the River Park neighborhood, the nearest of which is approximately 250 feet southeast of the potential site.

- **I-80 at Roseville Road.** Sensitive receptors in the vicinity of this site are residential uses off Winters Street, approximately 1,850 feet to the west, and the golfers playing the Arcade Creek and Alister MacKenzie golf courses, approximately 750 feet south of the potential site.

- **SR 99 at Calvine Road.** Sensitive receptors in the vicinity of this site are residents of the Coppertown Village multi-family residential development on West Stockton Boulevard, approximately 550 feet south of the potential site.

- **I-5 at Bayou Road.** Sensitive receptors in the vicinity of this site are residents of homes across Bayou Road on Gresham Lane, Rynders Way, and Lanfranco Circle, the nearest of which is approximately 550 feet south of the potential site.

- **I-5 at San Juan Road.** Sensitive receptors in the vicinity of this site are residents of homes across San Juan Road, the nearest of which is approximately 100 feet southwest of the potential site.

- **I-5 at Sacramento Railyards.** Sensitive receptors in the vicinity of this site are residents at the Wong Center, approximately 530 feet south of the potential site and the Ping Yuen Apartments, approximately 650 feet east of the potential site. In addition, a Vagabond Inn motel is located about 375 feet south of the site.

4.8.2 Regulatory Framework

Federal

Federal regulations establish noise limits for medium and heavy trucks (more than 4.8 tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205, Subpart B. The federal truck pass-by noise standard is 80 dBA at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

State

The State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the State pass-by standard is consistent with the federal limit of 80 dB. The State pass-by standard for light trucks and passenger cars (less than 4.8 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

The State has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of DNL 45 dBA in any habitable room. They require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than DNL 60 dBA. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local

City of Sacramento 2030 General Plan

The following goals and policies from the *Sacramento 2030 General Plan*[9] are relevant to noise.

Goal EC 3.1 Noise Reduction. Minimize noise impacts on human activity to ensure the health and safety of the community.

Policies

- **EC 3.1.1 Exterior Noise Standards.** The City shall require noise mitigation for all development where the projected exterior noise levels exceed those shown in Table 4.8-2 (Table EC 1 in the General Plan), to the extent feasible.

TABLE 4.8-2
EXTERIOR NOISE COMPATIBILITY STANDARDS FOR VARIOUS LAND USES

Land Use Type	Highest Level of Noise Exposure that is Regarded as "Normally Acceptable"[a] (L_{dn}[b] or CNEL[c])
Residential—Low Density Single Family, Duplex, Mobile Homes	60 dBA[d,e]
Residential—Multi-family	65 dBA
Urban Residential Infill[f] and Mixed-Use Projects[g]	70 dBA
Transient Lodging—Motels, Hotels	65 dBA
Schools, Libraries, Churches, Hospitals, Nursing Homes	70 dBA
Auditoriums, Concert Halls, Amphitheaters	Mitigation based on site-specific study
Sports Arena, Outdoor Spectator Sports	Mitigation based on site-specific study
Playgrounds, Neighborhood Parks	70 dBA
Golf Courses, Riding Stables, Water Recreation, Cemeteries	75 dBA
Office Buildings—Business, Commercial and Professional	70 dBA
Industrial, Manufacturing, Utilities, Agriculture	75 dBA

a. As defined in the *State of California General Plan Guidelines*, "Normally Acceptable" means that the "specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements."
b. Ldn or Day Night Average Level is an average 24-hour noise measurement that factors in day and night noise levels.
c. CNEL or Community Noise Equivalent Level measurements are a weighted average of sound levels gathered throughout a 24-hour period.
d. dBA or A-weighted decibel scale is a measurement of noise levels.
e. The exterior noise standard for the residential area west of McClellan Airport known as McClellan Heights/Parker Homes is 65 dBA.
f. With land use designations of Central Business District, Urban Neighborhood (Low, Medium, or High) Urban Center (Low or High), Urban Corridor (Low or High).
g. All mixed-use projects located anywhere in the City of Sacramento.

SOURCE: City of Sacramento, 2009a. *City of Sacramento 2030 General Plan.* Adopted March 3, 2009. p. 2-338.

- **EC 3.1.2 Exterior Incremental Noise Standards.** The City shall require noise mitigation for all development that increases existing noise levels by more than the allowable increment shown in Table 4.8-3 (Table EC 2 in the General Plan), to the extent feasible.

9 City of Sacramento, 2009a. *City of Sacramento 2030 General Plan.* Adopted March 3, 2009. pp. 2-337 to 2-341.

TABLE 4.8-3
EXTERIOR INCREMENTAL NOISE IMPACT STANDARDS FOR NOISE-SENSITIVE USES (dBA)

Residences and Buildings where People Normally Sleep[a]		Institutional Land Uses with Primarily Daytime and Evening Uses[b]	
Existing L_{dn}	Allowable Noise Increment	Existing Peak Hour L_{eq}	Allowable Noise Increment
45	8	45	12
50	5	50	9
55	3	55	6
60	2	60	5
65	1	65	3
70	1	70	3
75	0	75	1
80	0	80	0

a. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
b. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

SOURCE: City of Sacramento, 2009a. *City of Sacramento 2030 General Plan.* Adopted March 3, 2009. p. 2-339.

- **EC 3.1.3 Interior Noise Standards.** The City shall require new development to include noise mitigation to assure acceptable interior noise levels appropriate to the land use type: 45 dBA Ldn for residential, transient lodgings, hospitals, nursing homes and other uses where people normally sleep; and 45 dBA Leq (peak hour) for office buildings and similar uses.

- **EC 3.1.4 Interior Noise Review for Multiple, Loud Short-Term Events.** In cases where new development is proposed in areas subject to frequent, high-noise events (such as aircraft over-flights, or train and truck pass-bys), the City shall evaluate noise impacts on any sensitive receptors from such events when considering whether to approve the development proposal, taking into account potential for sleep disturbance, undue annoyance, and interruption in conversation, to ensure that the proposed development is compatible within the context of its surroundings.

- **EC 3.1.5 Interior Vibration Standards.** The City shall require construction projects anticipated to generate a significant amount of vibration to ensure acceptable interior vibration levels at nearby residential and commercial uses based on the current City or Federal Transit Administration (FTA) criteria.

- **EC 3.1.6 Vibration Screening Distances.** The City shall require new residential and commercial projects located adjacent to major freeways, hard rail lines, or light rail lines to follow the FTA screening distance criteria.

- **EC 3.1.7 Vibration.** The City shall require an assessment of the damage potential of vibration-induced construction activities, highways, and rail lines in close proximity to historic buildings and archaeological sites and require all feasible mitigation measures be implemented to ensure no damage would occur.

- **EC 3.1.8 Operational Noise.** The City shall require mixed-use, commercial, and industrial projects to mitigate operational noise impacts to adjoining sensitive uses when operational noise thresholds are exceeded.

- **EC 3.1.9 Compatibility with Park and Recreation Uses.** The City shall limit the hours of operation for parks and active recreation areas in residential areas to minimize disturbance to residences.

- **EC 3.1.10 Construction Noise.** The City shall require development projects subject to discretionary approval to assess potential construction noise impacts on nearby sensitive uses and to minimize impacts on these uses, to the extent feasible.

- **EC 3.1.11 Alternatives to Sound Walls.** The City shall encourage the use of design strategies and other noise reduction methods along transportation corridors in lieu of sound walls to mitigate noise impacts and enhance aesthetics.

- **EC 3.1.12 Residential Streets.** The City shall discourage widening streets or converting streets to one-way in residential areas where the resulting increased traffic volumes would raise ambient noise levels.

The Proposed Project would generate noise and vibration during short-term construction activities and long-term operations. The Proposed Project would also locate sensitive residential receptors in an urban environment, subject to noise (primarily from on-road transportation) and vibration (primarily from light rail). Consistent with Policy EC 3.1.1 and as discussed below under Impact 4.8-1, on-road traffic noise associated with the project would not result in noise levels that would exceed the normally acceptable Ldn for Urban Residential Infill and Mixed-Use Projects. Also as described under Impact 4.8-1, although the projected noise levels of the project plus existing traffic would exceed the allowable incremental noise levels of Policy EC 3.1.2, no mitigation measures are found to be feasible to reduce this impact. Consistent with policies EC 3.1.3 and EC 3.1.4, new development under the Proposed Project would be designed to meet the City interior standards, and interior noise from multiple loud, short-term events was analyzed. Construction and operational vibration impacts were assessed in Impacts 4.8-4 and 4.8-5 and were determined to be consistent with policies EC 3.1.5, EC 3.1.6, and EC 3.1.7. Operational noise of the Proposed Project and outdoor recreation events at the ESC were assessed and mitigated in Impact 4.8-1. The project would be consistent with policies EC 3.1.8 and EC 3.1.9. Consistent with EC 3.1.10, construction noise of the Proposed Project was analyzed and mitigated to the extent feasible in Impact 4.8-3. The project would not include sound wall construction, nor would it widen streets or convert streets to one-way in residential areas, and would thus be consistent with policies EC 3.1.11 and EC 3.1.12.

Sacramento Central City Community Plan

In addition to the General Plan, the City of Sacramento has also developed plans that are more specific to the various communities in the City. The City's *Central City Community Plan*[10] does not contain goals and policies specific to noise.

City of Sacramento Municipal Code (Noise Ordinance)

The Sacramento Municipal Code includes noise regulations in Title 8 – Health and Safety, Chapter 8.68 – Noise Control (referred to generally as the Noise Ordinance). Of the regulations in Chapter 8.68, not all are applicable to the Proposed Project. The following regulations would apply to the Proposed Project:

- Section 8.68.060 sets standards for cumulative exterior noise levels at residential and agricultural properties, including exterior noise standards of 55 dBA from 7 a.m. to 10 p.m., and 50 dBA from 10 p.m. to 7 a.m. Per Section 8.68.060(b), the allowable decibel increase above the exterior noise standards in any one hour are:

    1. 0 dBA for cumulative period of 30 minutes per hour;
    2. 5 dBA for cumulative period of 15 minutes per hour;
    3. 10 dBA for cumulative period of 5 minutes per hour;
    4. 15 dBA for cumulative period of 1 minutes per hour; or
    5. 20 dBA not to be exceeded for any time per hour.

    In addition, per Section 8.68.060(c), each of the noise limits above shall be reduced by 5 dBA for impulsive or simple tone noises, or for noises consisting of speech or music. If the ambient noise level exceeds that permitted by any of the first four noise limit categories specified in subsection (b) above, the allowable noise limit shall be increased in five dBA increments in each category to encompass the ambient noise level. If the ambient noise level exceeds the fifth noise level category, the maximum ambient noise level shall be the noise limit for that category.

- Section 8.68.160 establishes time frames and noise limits for outdoor recreational activities, including sporting and entertainment events and concerts. Amplified sound at these events (measured no more than 150 feet from the source) is limited to 96 dBA Leq during the months of September and October and 96 dBA Leq during the months of November through August. For outdoor recreational events on Sunday through Thursday, the amplified sound shall commence no earlier than 9 a.m. and shall be terminated no later than 10 p.m. For outdoor recreational events on Friday, Saturday, and the day a holiday, the amplified sound shall commence no earlier than 9 a.m. and shall be terminated no later than 11 p.m.

[10] City of Sacramento, 2009c. *Central City Community Plan.* Adopted March 3, 2009.

- Section 8.68.190 generally prohibits any person from making "any loud, unnecessary or unusual noise which disturbs the peace and quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitiveness residing in the area."

- Section 8.68.080 exempts certain activities from Chapter 8.68, including "noise sources due to the erection (including excavation), demolition, alteration or repair of any building or structure" as long as these activities are limited to between the hours of 7 a.m. and 6 p.m. Monday through Saturday, and between the hours of 9 a.m. and 6 p.m. on Sunday. Section 8.68.080 also requires the use of exhaust and intake silencers for internal combustion engines, and provides for construction work to occur outside of the designated hours if the work is of urgent necessity and in the interest of public health and welfare for a period not to exceed three days.

4.8.3 Analysis, Impacts, and Mitigation

Significance Criteria

For purposes of this EIR, impacts due to noise may be considered significant if construction and/or implementation of the Proposed Project would:

- Result in a substantial permanent increase in ambient exterior noise levels in the project vicinity that exceed standards in the City's General Plan or Noise Ordinance;

- Result in residential interior noise levels of 45 dBA Ldn or greater caused by noise level increases due to project operation;

- Result in construction noise levels that exceed the standards in the City of Sacramento Noise Ordinance;

- Permit existing and/or planned buildings (and persons within) to be exposed to significant vibration due to project construction; or

- Permit adjacent residential and commercial buildings (and persons within) to be exposed to significant vibration due to highway traffic and rail operations.

Methods and Assumptions

Construction Noise Levels

Construction noise impacts are assessed based on a comparative analysis of the noise levels resulting from operation of specified construction equipment and the noise levels of existing conditions. Analysis of temporary construction noise effects of the proposed ESC construction was based on specific estimates of construction equipment and duration from the project construction contractor, Turner Construction. Analysis of temporary construction noise effects of the development in the PUD area was based on typical construction phases and equipment noise

levels. In both cases, the analyses accounted for attenuation of those noise levels due to distances between the construction activity and the sensitive receptors in the site vicinity.

Construction noise levels for the Proposed Project were estimated using the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM). The estimated construction noise levels resulting from the Proposed Project at the nearby off-site sensitive receptors were then compared to the City nighttime (10 p.m. to 7 a.m.) interior noise standard of 45 dBA Leq[11] and a daytime (7 a.m. to 10 p.m.) interior noise standard of 75 dBA Leq to protect against potential sleep disturbance and noise-induced hearing loss from prolonged noise, respectively. The National Institute on Deafness and Other Communication Disorders (NIDCD) of the National Institutes of Health, identified noise levels less than 75 dBA, even after long exposure, are unlikely to cause hearing loss.[12] Residents and workers in the nearby buildings would be exposed to the most prolonged noise, whereas pedestrians and other individuals outside of buildings in proximity to the project site could move elsewhere if adversely affected by construction noise.

Operational Noise Levels

Roadside noise levels were calculated for selected study street segments near sensitive receptors around the project site based on information provided in the traffic analysis presented in section 4.10, Transportation. The street segments selected for analysis are those expected to be most directly impacted by project-related traffic, which, for the purpose of this analysis, are the streets that are nearest to the project site that also experience the highest traffic volumes. These streets are forecast to experience the greatest percentage increase in traffic generated by the Proposed Project. The noise levels were calculated using the Federal Highway Administration's (FHWA) Traffic Noise Prediction Model (FHWA-RD-77-108) and traffic volumes from the project's traffic study (see Appendix C).

In addition, non-transportation noise sources, such as loading docks, HVAC equipment, and ESC event noise, are assessed below. Significance is based on comparison of the project's operational noise levels to the City Noise Ordinance standards.

Ground-borne Vibration Levels

Short-term construction and long-term operational ground-borne vibration impacts are assessed in the EIR. Ground-borne vibration levels resulting from construction activities at the project site were estimated using data and equations published by the FTA in its *Transit Noise and Vibration Impact Assessment* document. Potential vibration levels resulting from project construction are identified for land uses that are sensitive to vibration, including existing residences and historical buildings located nearby, accounting for their distance from construction activities. In regards to

[11] Per Section 8.68.070 of the City Noise Ordinance. Although this standard applies specifically to multi-family residential unit noise on the interior noise of neighboring units, it was applied to the construction analysis herein to identify potential sleep disturbance and appropriate interior noise levels.

[12] National Institute on Deafness and Other Communication Disorders, 2008. *NIDCD Fact Sheet: Noise-Induced Hearing Loss.* Publication No. 08-4233, updated December 2008. p. 1.

operations, the annoyance impact from existing sources of vibration on proposed sensitive receptors is analyzed.

Building Damage

To determine the potential for building damage at off-site land uses resulting from vibration generated from the project's construction activities, the following vibration propagation equation is used:[13]

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

Where PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance, PPV (ref) is the reference vibration level in in/sec at 25 feet, and D is the distance from the equipment to the receiver. The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration and is often used in monitoring of vibration because it is related to the stresses experienced by structures. The FTA building damage thresholds typically applied and described in the *City of Sacramento 2030 General Plan Master Environmental Impact Report*[14] are 0.2 PPV for historic buildings and 0.5 PPV for non-historic buildings.

Human Annoyance

In order to determine the potential for human annoyance from exposure to the project's construction-related vibration levels, the following calculation was performed:[15]

$$L_v(D) = L_v(25\text{ ft}) - 30\log(D/25)$$

$L_v(D)$ represents the vibration level of the equipment in decibels (VdB), $L_v(25\text{ ft})$ represents the reference vibration level at 25 feet for the construction equipment, and D is the distance from the equipment to the receiver. Table 4.8-4 presents criteria for acceptable ground-borne vibration for different land uses.

[13] Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment*. May 2006. p. 12-11.
[14] City of Sacramento, 2009b. *City of Sacramento 2030 General Plan Master Environmental Impact Report*. Certified March 3, 2009. p. 6.8-23.
[15] Federal Transit Administration, 2006. *Transit Noise and Vibration Impact Assessment*. May 2006. p. 12-11.

TABLE 4.8-4
GROUND-BORNE VIBRATION (GBV) IMPACT CRITERIA FOR GENERAL ASSESSMENT

	GBV Impact Levels (VdB re 1 µ-inch/second)		
Land Use Category	**Frequent Events[1]**	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1: Buildings where vibration would interfere with interior operations.	65 [4]	65 [4]	65 [4]
Category 2: Residences and buildings where people normally sleep.	72	75	80
Category 3: Institutional land uses with primarily daytime uses.	75	78	83

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same source per day.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels.

SOURCE: City of Sacramento, 2009b. *City of Sacramento 2030 General Plan Master Environmental Impact Report*. Certified March 3, 2009. p. 6.8-22.

Impact and Mitigation Measures

Impact 4.8-1: The Proposed Project could result in a substantial permanent increase in ambient exterior noise levels in the project vicinity.

Downtown Project Site

On-Road Transportation Noise

Vehicles traveling to and from the Proposed Project would create traffic-generated noise. As described in section 4.10, Transportation, the estimated incremental increase of daily vehicle trips for PUD land uses (i.e., residential, office, retail, and hotel) and the total daily vehicle trips for an ESC weekday evening Kings game would be 10,955 and 17,683 trips, respectively. These additional vehicle trips would result in higher noise levels along the downtown street network. Noise level projections were made using the FHWA Noise Prediction Model for those road segments that would experience the greatest increase in traffic volume and that are in proximity to sensitive receptors. The model is based on the Calveno reference noise factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, street configuration, distance to the receiver, and the acoustical characteristics of the site. The segments analyzed and results of the modeling are shown in Table 4.8-5 (daily Ldn) and Table 4.8-6 (pre-event peak hour Leq).

The results of the Ldn modeling effort (see Appendix C) are summarized in Table 4.8-5 for Existing Conditions and Existing plus Project. Although the on-road traffic noise associated with the project would not result in noise levels that would exceed the normally acceptable Ldn for Urban Residential Infill and Mixed-Use Projects listed in Table 4.8-2 (except for the Wong Center, which already exceeds the 70 dBA standard due to its proximity to I-5), the Proposed Project would result in daily Ldn noise exposure that would exceed the allowable noise incremental increases detailed in Table 4.8-3 at residential uses along roadway segment 2 (7th Street south of I Street) and segment 8 (7th Street north of L Street).

TABLE 4.8-5
EXISTING AND PROJECTED LDN TRAFFIC NOISE LEVELS ALONG STREETS IN THE DOWNTOWN PROJECT VICINITY

	Ldn, dBA[1]			
Street Segment	**Existing [A]**	**Existing Plus Project [B]**	**Incremental Increase [B-A]**	**Significant? (Yes or No)[2]**
1. 7th St north of I St	63.2	64.1	0.9	No
2. 7th St south of I St	61.9	64.4	2.5	Yes
3. 9th St north of I St	62.0	63.3	1.3	No
4. 9th St south of I St	62.4	62.8	0.4	No
5. J St east of 4th St	73.0	73.4	0.4	No
6. J St west of 4th St	73.0	73.4	0.4	No
7. 6th St north of J St	60.3	60.3	0	No
8. 7th St north of L St	65.2	67.2	2.0	Yes
9. 7th St south of L St	64.6	66.2	1.6	No
10. L St west of 7th St	68.7	69.3	0.6	No
11. Garden St north of Tower Bridge Gateway[3]	57.8	58.2	0.4	No
12. Garden St south of Tower Bridge Gateway[3]	48.6	49.2	0.6	No
13. Tower Bridge Gateway east of Garden St[3]	65.7	65.9	0.2	No
14. Tower Bridge Gateway west of Garden St[3]	65.3	65.5	0.2	No

1. Noise levels were determined using FHWA Traffic Noise Prediction Model (FHWA RD-77-108). Notably, a 3 dBA increase was included in the J St east and west of 4th St segments (segments 5 and 6) to calibrate the model based on the Ldn noise monitoring results at the Wong Building, likely due to the proximity to Interstate 5.
2. Traffic noise is considered significant if the daily Ldn exceeds the allowable noise increment at residences and buildings where people normally sleep, per Table 4.8-3 above.
3. West Sacramento intersection.

SOURCE: ESA, 2013

The daily Ldn impact at residences and buildings where people normally sleep along all other streets would be less than significant. Although the Ldn at residences along these roadways would be less than 70 dBA and would be considered normally compatible noise exposure, per Table 4.8-2 above, the incremental increase in noise levels along roadway segments 2 and 8 would be considered a ***significant impact***.

The results of the pre-event peak hour Leq modeling effort (see Appendix C) are summarized in Table 4.8-6 for Existing Conditions and Existing plus Project. The Proposed Project would result in peak hour noise exposure that would exceed the allowable noise increases detailed in Table 4.8-3 at institutional land uses along roadway segment 2 (7th Street south of I Street) and segment 3 (9th Street north of I Street). The pre-event peak hour impact at institutional land uses with primarily daytime and evening uses along all other streets would be ***less than significant***.

TABLE 4.8-6
EXISTING AND PROJECTED PRE-EVENT PEAK-HOUR TRAFFIC NOISE LEVELS ALONG STREETS IN THE DOWNTOWN PROJECT VICINITY

	Leq, dBA[1]			
Street Segment	**Existing [A]**	**Existing Plus Project [B]**	**Incremental Increase [B-A]**	**Significant? (Yes or No)[2]**
1. 7th St north of I St	60.0	65.0	5.0	No
2. 7th St south of I St	59.5	65.8	6.3	Yes
3. 9th St north of I St	57.4	64.5	7.1	Yes
4. 9th St south of I St	58.7	62.3	3.6	No
5. J St east of 4th St	69.0	70.7	1.7	No
6. J St west of 4th St	69.1	70.7	1.6	No
7. 6th St north of J St	57.8	59.6	1.8	No
8. 7th St north of L St	62.6	66.5	3.9	No
9. 7th St south of L St	61.5	66.5	5.0	No
10. L St west of 7th St	67.1	68.6	1.5	No
11. Garden St north of Tower Bridge Gateway (WS)	56.9	57.7	0.8	No
12. Garden St south of Tower Bridge Gateway (WS)	46.5	46.5	0.0	No
13. Tower Bridge Gateway east of Garden St (WS)	65.2	66.4	1.2	No
14. Tower Bridge Gateway west of Garden St (WS)	64.8	65.9	1.1	No

1. Noise levels were determined using FHWA Traffic Noise Prediction Model (FHWA RD-77-108). Notably, a 1 dBA increase was included in the J St east and west of 4th St segments (segments 5 and 6) to calibrate the model based on the 6-7pm noise monitoring results at the Wong Building, likely due to the proximity to Interstate 5.
2. Traffic noise is considered significant if the peak-hour Leq exceeds the allowable noise increment at uses where it is important to avoid interference with speech, meditation, and concentration on reading material, per Table 4.8-3 above.
3. (WS) = West Sacramento intersection.

SOURCE: ESA, 2013

Non-Transportation Noise Sources

Non-transportation noise associated with the Proposed Project operations would include stationary sources (such as HVAC units), loading docks, and ESC event noise.

Heating, Ventilation, and Air-Conditioning Systems. The HVAC systems for maintaining comfortable temperatures within commercial or other buildings would consist of packaged air conditioning systems. Such HVAC units typically generate noise levels of approximately 55 dB at a reference distance of 100 feet from the operating units during maximum heating or air conditioning operations. HVAC units could possibly be as close as 10 feet from the nearest residential (Hotel Marshall) receptors. At this distance, the nearest residences would be exposed to levels of 75 dBA, which would exceed the City day (55 dBA from 7 a.m. to 10 p.m.) and nighttime (50 dBA from 10 p.m. to 7 a.m.) Noise Ordinance standards. This impact would be ***significant***.

Loading Docks. Noise associated with commercial or other workplace land uses is variable, depending on the type of facility, the size, layout, and operational activities. Loading docks for the ESC would be located underground and would not disturb nearby sensitive receptors. In regards to uses in the PUD area, truck deliveries may be a source of elevated noise levels at sensitive

receptors nearby truck loading docks, which are currently located in the alley behind the Traveler's Hotel building, on 6th Street south of J Street, and on the alley east of the Ramona Hotel building. It is anticipated that loading for development in the PUD area would remain in these general locations. Reference noise levels of 80 dB Lmax and 60 dB Leq at a distance of 50 feet could be generated. These data include noise generated by truck arrivals and departures from the unloading area, trucks backing into the docks (including backup beepers), air brakes, and other related truck unloading noise. However, since the PUD area development would replace existing commercial and retail uses in an urban environment, including existing loading docks, the noise levels associated with potential PUD loading docks would not result in a substantial increase in the noise. This impact would be ***less than significant***.

ESC Event Noise. The main entrance to the ESC would be located generally in the northwest quadrant of the ESC site, oriented toward the 5th and K Street entrance to the event plaza. The ESC would include the performance bowl with general and premium seating, suites, indoor standing viewing areas, and outdoor event plaza and terrace/balcony areas. A portion of the event plaza near the main entrance could be cordoned off and operated as part of the ESC space. When weather permits and when it would be conducive for the specific type of event, a portion of the perimeter wall of the ESC at the main concourse/plaza level facing the event plaza could be opened, providing the opportunity for ticketed patrons to flow freely between the main concourse and the cordoned portion of the event plaza. In addition, the upper concourse walls could be opened to an outdoor terrace overlooking the event plaza. For certain events, portions of the outdoor event plaza and outdoor terraces could be equipped with video screens and speakers, which would result in noise exposure of nearby noise-sensitive receptors during these open events.

Different types of events typically are presented on different days and at different times. Most events at the ESC would occur on weekday evenings or weekends; it is estimated that 141 of the 189 annual event days would occur during these time periods. These evening and nighttime events would also be of primary concern in regards to potential noise impacts. Typically weekday and Saturday Kings games start at approximately 7:00 p.m. and conclude between 9:30 p.m. and 10:00 p.m. On Sundays, Kings games typically start at 3:00 pm or 6:00 p.m. and conclude between 5:30 p.m. and 6:00 p.m., or 8:30 p.m. and 9:00 p.m, respectively. Earlier or later starting times could occur occasionally due to the requirements of national broadcasting companies, but would be extremely infrequent and are not reasonably predictable at this time. Peak attendance at Sacramento Kings games could be up to 17,500 attendees. Other major components of the attendance profile for the ESC would include concerts (estimated to be 27 concerts with up to 15,000 attendees for larger events) and other sporting events (estimated to be 16 events with up to 5,000 attendees per event). Typically concert events start at approximately 7:00 p.m. and conclude at approximately 11:00 p.m. or later. Other sporting events could include college and high school basketball, volleyball or similar events, professional boxing or mixed martial arts, indoor soccer or tennis, or similar such sporting events.

Exterior noise from amplified sources would not result in substantial noise exposure during events when the walls of the ESC are fully closed. For events where portions of the walls of the

ESC would be open and outside speakers would be used on terraces and in the event plaza, these speakers would be the primary noise source during these events. The event plaza speakers could be approximately 550 feet from the existing Riverview Plaza residences, 550 feet from the Ping Yuen Apartments, 600 feet from the Wong Center residences, and potentially 60 feet from future PUD residences. Assuming an attenuation rate of 6 dBA and that the speakers would generate noise levels of 100 dBA Leq (measured five feet from the source), residences at the Riverview Plaza, Ping Yuen Apartments, and Wong Center could be exposed to exterior noise levels of approximately 59 dBA, 59 dBA, and 58 dBA Leq from the outdoor speakers, respectively. Future PUD residences could be exposed to exterior noise levels of approximately 78 dBA Leq from outside speakers located in the plaza. There may be a rooftop terrace on the practice facility near the Hotel Marshall and Jade Apartments. Outdoor speakers may be used but would not be amplified to the levels anticipated in the event plaza since the terrace would an enclosed space, except for the open-ceiling. The approximately 100 foot practice facility would completely block the line of site of the ESC from the Hotel Marshall and Jade Apartments residences, which would substantially reduce noise exposure at these receptors from plaza speakers.

Long-term noise measurements conducted in the proximity of the project site (Table 4.8-1) indicated that existing ambient noise levels during evening hours (6 p.m. to 11 p.m.) range between 62 to 69 dBA Leq, or an average of about 65 dBA Leq. Based on these ambient noise levels and the 5 dBA reduction in the standards due to the noise source being speech and music, the applicable Noise Ordinance daytime and nighttime exterior noise standards at nearby residences would be 60 dBA (from 7 a.m. to 10 p.m.) and 55 dBA (from 10 p.m. to 7 a.m.). The exterior amplified sound would exceed the daytime and nighttime exterior noise standards at the future PUD residences. For events that would involve exterior amplified sound after 10 p.m., noise levels at the Riverview Plaza, Ping Yuen Apartments, and Wong Center also may exceed the nighttime exterior noise standards depending on the specific orientation of the speakers and the amount of attenuation provided by intervening buildings. This impact would be **significant**. Other residential receptors in the vicinity would be located farther away and would have extensive intervening structures between the ESC and the residences.

Offsite Digital Billboards

Offsite digital billboards would be electrically powered and would not generate operational noise that would affect nearby sensitive receptors. This impact would be ***less than significant***.

<u>Mitigation Measures</u>

4.8-1(a) (ESC/PUD)

On-site mechanical equipment (e.g., HVAC units, compressors, generators) and area-source operations (e.g., loading docks) shall be located as far as possible and/or shielded from nearby noise sensitive land uses to meet City noise standards.

4.8-1(b) (ESC)

The project applicant shall retain a qualified acoustical consultant to verify that the architectural and outdoor amplified sound system designs incorporate all acoustical features in order to comply with the City of Sacramento Noise Ordinance.

Impact Significance After Mitigation: No feasible mitigation strategies have been identified to reduce the on-road transportation noise impacts to less than significant. Alternative modes of transportation (i.e., walking, biking, and transit) are already accounted for in the above traffic noise estimates. The reduction in vehicular use needed to mitigate these roadway noise impacts is not feasible for the Proposed Project. In addition, typical measures to reduce roadway noise impacts, such as noise walls, setbacks, and rubberized asphalt, are not considered feasible mitigation for development in the urban core of the City. This impact would be considered ***significant and unavoidable***.

Impacts of non-transportation noise sources (HVAC and other area source equipment noise, excluding amplified exterior sound systems), with implementation of Mitigation Measure 4.8-1(a) and (b), would be reduced to less than significant. While it is likely that the outdoor amplified sound system could be designed to minimize noise exposure at off-site residences, such as speaker height, orientation and volume control, outdoor speaker operations during events would be expected to exceed the exterior daytime and nighttime noise standards of the Noise Ordinance at future PUD residences. As a result, impacts of amplified exterior sound systems would be considered ***significant and unavoidable***.

Impact 4.8-2: The Proposed Project could result in residential interior noise levels of 45 dBA Ldn or greater caused by noise level increases due to project operation.

Downtown Project Site

Table 4.8-6 shows the areas in which new residential uses are likely to be located (i.e., along J Street) that could be exposed to noise levels up to 73 dBA Ldn, due in part to proximity of the site to Interstate 5. Other residences developed farther east would be exposed to reduced noise. An exterior noise exposure of 70 dBA or greater would result in potentially incompatible interior noise for new urban infill sensitive receptors. The multi-family residences to be developed as part of the project would be subject to Title 24 of the California Code of Regulations, which requires an interior noise standard of 45 dBA Ldn in any habitable room and requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard. To allow the project to meet the City and State interior noise requirement of 45 dBA Ldn, in habitable rooms of residential dwellings, the exterior facades of PUD area residential buildings would need to be designed to appropriately reduce sound transmission (i.e., exterior-to-interior noise).

Project operations would also result in noise exposure of residential receptors in the project vicinity, as described above in Impact 4.8-1. For on-road transportation sources, the total roadway noise from existing and Proposed Project traffic would not exceed the 70 dBA Ldn standard,

except at the Wong Center, which is already exposed to noise levels above the standard. However, crowd noise, loud voices and noise generated by departing patrons, and/or outdoor amplified sound systems in the plaza associated with certain events at the ESC could result in substantial noise during the evening and nighttime hours (depending on the event timing). Exterior speaker systems are anticipated to be the loudest noise generator outside the ESC, and could result in ***potentially significant*** interior noise at future PUD residences. The nearest existing residential receptors (in the Riverview Plaza, Ping Yuen Apartments, and Wong Center) would be exposed to interior noise levels less than 45 Ldn (assuming 20 dBA exterior-to-interior attenuation by the building structure). In addition, the approximately 100 foot tall practice facility would completely block the line of site of the ESC from the Hotel Marshall and Jade Apartments residences, which would substantially reduce noise exposure at these receptors and ensure interior noise levels less than 45 Ldn.

Offsite Digital Billboards

Offsite digital billboards would be electrically powered and would not generate long-term operational noise that would affect nearby sensitive receptors. This impact would *be* ***less than significant***.

Mitigation Measures

4.8-2(a) (PUD)

Prior to the issuance of building permits, the City shall require project applicants for residential development to submit a detailed noise study, prepared by a qualified acoustical consultant, to identify design measures necessary to achieve the City interior standard of 45 Ldn in the proposed new residences. The study shall be submitted to the City for review and approval. Design measures such as the following could be required, depending on the specific findings of the noise study: double-paned glass windows facing noise sources; solid-core doors; increased sound insulation of exterior walls (such as through staggered- or double-studs, multiple layers of gypsum board, and incorporation of resilient channels); weather-tight seals for doors and windows; or sealed windows with an air conditioning system installed for ventilation. This study can be a separate report, or included as part of the Noise and Vibration Reduction Plan for the PUD. The building plans submitted for building permit approval shall be accompanied by certification of a licensed engineer that the plans include the identified noise-attenuating design measures and satisfy the requirements of this mitigation measure.

4.8-2(b) (ESC)

Implement Mitigation Measure 4.8-1(b) to minimize noise from outdoor amplified sound systems.

Impact Significance After Mitigation: Implementation of the Mitigation Measure 4.8-2 (a) and (b) would ensure that future PUD residences are designed such that interior noise levels would not exceed the City standard of 45 Ldn. This impact would be considered ***less than significant***.

Impact 4.8-3: Construction of the Proposed Project could result in noise levels that temporarily exceed the City standards.

Construction activity noise levels at and near the Proposed Project construction areas would fluctuate depending on the particular types, number, and duration of usage of various pieces of construction equipment. Construction-related material haul trips would raise ambient noise levels along haul routes, and the amount of increase would depend on the number of haul trips made and types of vehicles used. Table 4.8-7 shows typical noise levels produced by various types of construction equipment.

TABLE 4.8-7
TYPICAL NOISE LEVELS FROM DEMOLITION/ CONSTRUCTION EQUIPMENT OPERATIONS

Construction Equipment	Actual Lmax, dBA @ 50 Feet
Dump Truck	76.5
Excavator	80.7
Mounted Impact Hammer (Hoe Ram)	90.3
Pile-driver (Vibratory)	100.8
Pile-driver (Impact)	101.3
Auger Drill	84.4

SOURCE: FHWA Roadway Construction Noise Model (RCNM), Version 1.1.

Downtown Project Site

Pile driving would be required for some development on the project site, specifically for the ESC and potential high-rise development in the PUD area. In addition, demolition and excavation activities could occur adjacent to some sensitive receptors in the project vicinity. Noise from construction activities generally attenuates at a rate of 6 to 7.5 dBA per doubling of distance. Based on the flat urban project site layout and terrain, an attenuation of 6 dBA is assumed. Noise associated with development at the Downtown project site is analyzed below for different phases of construction.

Demolition/Excavation. The nearest sensitive receptors to the demolition/excavation activities associated with the ESC site, the conservative distance to equipment use for demolition/excavation, and the resultant noise exposure are shown below in Table 4.8-8.

TABLE 4.8-8
NOISE EXPOSURE FROM DEMOLITION/EXCAVATION FOR ESC SITE CONSTRUCTION

Receptor	Type	Distance to Nearest Equipment (Feet)	Unmitigated Exterior Noise Level (dBA, Leq)[a]
Hotel Marshall	Residential	5	103
Jade Apartments	Residential	30	90
Wong Center	Residential	115	77
Ping Yuen Apartments	Residential	270	73
Riverview Plaza	Residential	270	73
Holiday Inn	Hotel	50	86
Ramona Hotel (Church of Scientology)	Church	30	90
630 K St USF Campus	School	5	103
St. Rose of Lima Park	Park	60	85
Proposed PUD Area Residential & Hotel	Residential/Hotel	125	79

a. Construction noise was modeled using RCNM and an assumed equipment mix of 1-mounted hoe ram, 8-excavators, and 2-dump trucks operating at varying distances from individual sensitive receptors. See Appendix C for the RCNM outputs.
SOURCE: ESA, 2013

Foundation Pile Installation. The foundations of large buildings in downtown Sacramento typically require the installation of deep piles in order to support the weight of the building and to protect the building against uplift that could be created by shallow groundwater. There are several ways that foundation piles can be installed, including the more typical impact pile driving or some sort of pre-drilled method, including either cast-in-place or auger displacement. The nearest sensitive receptors to the potential pile installation activities associated with the Downtown project site, the conservative distance to between the sensitive receptor and the outer boundary of pile installation activity, and the resultant noise exposure for impact driven piles and for auger displacement piles are shown below in Table 4.8-9.

Summary. The noise exposure described above represents the scenarios where demolition/ excavation or pile driving activities would potentially occur in the nearest proximity to a sensitive receptor. These values represent a conservative assessment because they do not account for any shielding from buildings that are either existing or could be built in the interim (which could result in an exposure decrease of approximately 5 dBA or more) nor any mitigation measures.

TABLE 4.8-9
NOISE EXPOSURE FROM FOUNDATION PILE INSTALLATION FOR DOWNTOWN PROJECT SITE CONSTRUCTION

Receptor/Type		Distance to Closest Activity (Feet)	Impact Pile Driving Unmitigated Exterior Noise Level (dBA, Leq)[a]	Auger Displacement Pile Unmitigated Exterior Noise Level (dBA, Leq)[b]
Hotel Marshall	Residential	50	94	77
Jade Apartments	Residential	50	94	77
Wong Center	Residential	115	87	70
Ping Yuen Apartments	Residential	270	79	63
Riverview Plaza	Residential	270	79	63
Holiday Inn	Hotel	50	94	77
Ramona Hotel (Church of Scientology)	Church	50	94	77
630 K St USF Campus	School	50	94	77
7th and K St Plaza	Park	150	85	68
Proposed PUD Area Residential & Hotel	Residential/Hotel	125	86	69

a. Construction noise was modeled using RCNM for the use of an impact pile driver at the specified distance from the individual sensitive receptors. See Appendix C for the RCNM outputs.
b. Construction noise was modeled using RCNM for the use of an auger drill at the specified distance from the individual sensitive receptors. See Appendix C for the RCNM outputs.

SOURCE: ESA, 2013

As depicted in Table 4.8-8 above, the Hotel Marshall, Jade Apartments, Holiday Inn, Church of Scientology, and 630 K Street building (containing the USF Sacramento Branch Campus, an educational use, and other offices) would be exposed to the highest noise levels during the demolition/excavation phase of construction. According to the HUD *Noise Guidebook*,[16] standard building construction results in an exterior-to-interior noise reduction of 20 dBA with windows closed. Information from the construction contractor indicates that demolition, excavation, and construction would likely require 16-hour shifts, from 7 a.m. to 11 p.m, including ongoing haul truck trips that would pass-by residential uses in the vicinity of the project site. Residences that would be proximate to inbound or outbound haul routes would include the Hotel Marshall, Jade Apartments, Wong Center, Ping Yuen Apartments, 630 I Street, Governor's Square Apartments and Townhomes on 3rd Street, and the new Mercy Housing project and other homes on 7th Street between F and G Streets. Although each truck pass-by would be very brief, the noise exposure would likely be noticeable by sensitive receptors along the haul routes. In addition, it is likely that some concrete pours and material delivery would be required to occur overnight due to the length of the activity or the need to avoid daytime traffic on downtown streets.

Interior daytime or nighttime noise at the sensitive receptors closest to the Downtown project site could be as high as 83 dBA during the demolition and excavation phases. These noise levels

16 U.S. Department of Housing and Urban Development, 2009. *Noise Guidebook*. March 2009. p. 14.

would exceed the applied noise standards during the day (75 dBA Leq, from 7 a.m. to 10 p.m.) and night (45 dBA Leq, from 10 p.m. to 7 a.m.). In addition, the nighttime construction for ESC development, including construction activities associated with improvements to adjacent utility systems by the City, SMUD, or other providers, may not comply with the City of Sacramento Noise Ordinance and could result in sleep disturbance for the nearest residential sensitive receptors. It is important to note, however, that construction at any particular area on or around the project site would be short-term and the noise levels would attenuate as construction activities move further from any particular sensitive receptor.

As depicted in Table 4.8-9, pile driving would result in the most noise at the Hotel Marshall, Jade Apartments, 630 K St building, Holiday Inn and Ramona Hotel building (Church of Scientology). Impact pile driving may be used for development of high-rise structures in the PUD area, and, thus, could cause exceedances of the daytime and nighttime interior noise standards at sensitive receptors around the project site. However, auger displacement piles are proposed to be used as the method of pile installation for the proposed ESC building. With auger displacement piles, a hole is drilled into the ground up to the required elevations and concrete is then cast into it. As shown in Table 4.8-7, auger drilling generally produces noise levels approximately 17 dBA lower than pile driving. Assuming a 17 dBA reduction from auger displacement pile installation, and a 20 dBA exterior-to-interior building noise reduction, interior noise from pile installation would be about 57 dBA the nearest sensitive receptors, which would exceed the nighttime noise standard (45 dBA Leq) but would be less than the daytime interior standard (75 dBA Leq). The use of auger displacement piles would materially reduce noise levels that would be created by impact pile driving. Nevertheless, construction noise at the projected levels would be substantially greater than existing noise levels at nearby sensitive receptor locations and would temporarily exceed the City's interior noise standards.

As described above, construction noise associated with development of the ESC site would be noticeable at residential, office, school, church, and commercial uses in the area. Daytime demolition, excavation, and construction activities would generate noise that could disturb people working in the surrounding commercial and retail uses, making it difficult to concentrate and potentially harming hearing. Nighttime demolition, excavation, and/or construction could result in sleep disturbance of the nearby sensitive residential receptors and hotel patrons. Construction activities would expose occupants of nearby buildings to high levels of noise during the day and night. Although mitigation measures specified below would reduce construction noise impacts and would eliminate any potential harm to hearing, surrounding residents and businesses could be annoyed by noise associated with construction activities at the project site. Therefore, this would be considered a ***short-term significant impact***.

Offsite Digital Billboards

The Proposed Project would include the construction and operation of six digital billboards at ten potential locations. The nearest sensitive receptors to the construction activities associated with the digital billboards, the conservative distance to heavy equipment installation, and the resultant noise exposure are shown below in Table 4.8-10.

TABLE 4.8-10
NOISE EXPOSURE FROM EXCAVATION FOR DIGITAL BILLBOARD CONSTRUCTION

Billboard Location	Nearest Sensitive Receptor Type	Distance to Activity (Feet)	Unmitigated Exterior Noise Level (dBA, Leq)[a]
I-5 at Water Tank	Residential	85	79
US 50 at Pioneer Reservoir	Park	600	62
Business 80 at Sutter's Landing Regional Park	Park	50	83
Business 80 at Del Paso Regional Park/Haggin Oaks	Golf Course	50	83
Business 80 at Sutter's Landing Regional Park/American River	Residential	250	69
I-80 at Roseville Road	Park	750	60
SR 99 at Calvine Road	Residential	550	62
I-5 at Bayou Road	Residential	550	62
I-5 at San Juan Road	Residential	100	77
I-5 at Sacramento Railyards	Hotel/Residential	375	66

a. Construction noise was modeled using RCNM for the use of an auger drill rig, backhoe, and grader at the specified distance from the individual sensitive receptors. See Appendix C for the RCNM outputs.

SOURCE: ESA, 2013

No pile driving would be required for digital billboard construction. As depicted above in Table 4.8-10, construction of digital billboards would expose nearby noise-sensitive uses to up to 83 dBA (park uses) during the assumed operation of an auger drill, backhoe, and grader, which would likely be noticeable even though the billboards would be located along major roadways. However, billboard construction at each site is expected to be five days, which would be very temporary. The Sacramento Municipal Code, Title 8 - Health and Safety, Chapter 8.68 – Noise Control, requires that construction activity take place between the hours of 7 a.m. and 6 p.m. Monday through Saturday, and between 9 a.m. and 6 p.m. on Sunday. The City director of building inspections may also permit work to be done outside of these hours in the case of urgent necessity and in the interest of public health and welfare for a period not to exceed three days. These limited hours ensure that construction occurs only during daytime hours, thereby minimizing the chance that noise would be generated during the more "sensitive" hours when people may be trying to sleep. Therefore, this would be considered a ***less than significant*** impact.

Mitigation Measures

4.8-3 (ESC/PUD)

Prior to the issuance of any building permit for each phase of project development, the project applicant shall develop a Noise and Vibration Reduction Plan in coordination with an acoustical consultant, geotechnical engineer, and construction contractor, and submit the Plan to the City Chief Building Official for approval. The Plan shall include the following elements:

- *To mitigate noise, the Plan shall include measures such that off-road equipment will not exceed interior noise of 45 dBA Leq (between 10 p.m. and 7 a.m.) and 75 dBA Leq (between 7 a.m. and 10 p.m.) at nearby receptors.*
- *To mitigate vibration, the Plan shall include measures such that surrounding buildings will be exposed to less than 80 VdB and 83 VdB where people sleep and work, respectively, and less than 0.2 PPV for historic buildings and 0.5 PPV for non-historic buildings to prevent building damage.*

Measures and controls shall be identified based on project-specific final design plans, and may include, but are not limited to, some or all of the following:

- *Buffer distances and types of equipment selected to minimize noise and vibration impacts during demolition/construction at nearby receptors in order to meet the specified standards.*
- *Haul routes that affect the fewest number of people shall be selected and subject to preapproval by the City.*
- *Construction contractors shall utilize equipment and trucks equipped with the best available noise control techniques, such as improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, wherever feasible.*
- *Impact tools (i.e., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used to lower noise levels from the exhaust by up to about 10 dBA. External jackets shall be used on impact tools, where feasible, in order to achieve a further reduction of 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever feasible.*
- *Stationary noise sources shall be located as far from adjacent receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.*
- *Erection of a six-foot or greater solid plywood construction/noise barrier, where feasible, around the outside perimeter of the project site where the demolition or construction activity area faces occupied uses (i.e., excluding parking garages). The barrier shall not contain any significant gaps at its base or face, except for site access and surveying openings.*
- *Use of "quiet" pile driving technology (such as auger displacement installation), where feasible in consideration of geotechnical and structural requirements and conditions.*
- *Erection of a scaffold with reinforced noise blankets to completely block the line of site of the Jade Apartments and accessible faces of the Hotel Marshall prior to commencement of demolition, and shall extend the scaffold to screen the Hotel Marshall incrementally as access is provided by demolition of the adjacent Macy's building. Alternatively, residents of these two buildings could be temporarily relocated during demolition, excavation, and construction activities that could result in noise and vibration levels that exceed the above listed thresholds.*
- *Implement a vibration, crack, and line and grade monitoring program at existing historic and non-historic buildings located within 20 feet and 10 feet of*

demolition/construction activities, respectively. The following elements shall be included in this program:

- *Pre-Demolition and Construction:*
  - *To assist with measures regarding impacts to historical resources, the project applicant and construction contractor shall solicit input and review of plan components from a person(s) who meets the SOI Professional Qualification Standards for Architectural History, and, as appropriate, an architect that meets the SOI Professional Qualification Standard for Historic Architect. These qualification standards are defined in Title 36 Code of Federal Regulations Part 61.*
  - *Photos of current conditions shall be included as part of the crack survey that the construction contractor will undertake. This includes photos of existing cracks and other material conditions present on or at the surveyed buildings. Images of interior conditions shall be included if possible. Photos in the report shall be labeled in detail and dated.*
  - *The construction contractors shall install crack gauges on cracks in the walls of the historical and non-historical buildings to measure changes in existing cracks during project activities. Crack gauges shall be installed on multiple representative cracks, particularly on sides of the building facing the project.*
  - *The construction contractor shall determine the number and placement of vibration receptors at the affected historic and non-historic buildings in consultation with the consulting architectural historian and/or architect. The number of units and their locations shall take into account proposed demolition and construction activities so that adequate measurements can be taken illustrating vibration levels during the course of the project, and if/when levels exceed the established threshold.*
  - *A line and grade pre-construction survey at the affected historic and non-historic buildings shall be conducted.*
- *During Demolition and Construction:*
  - *The construction contractor shall regularly inspect and photograph crack gauges, maintaining records of these inspections to be included in post-construction reporting. Gauges shall be inspected every two weeks, or more frequently during periods of active project actions in close proximity to crack monitors, such as during demolition of the Macy's Men's and Furniture Department Building near the Hotel Marshall.*
  - *The construction contractor shall collect vibration data from receptors and report vibration levels to the City Chief Building Official on a monthly basis. The reports shall include annotations regarding project activities as necessary to explain changes in vibration levels, along with proposed corrective actions to avoid vibration levels approaching or exceeding the established threshold.*

- *With regards to historic structures, if vibration levels exceed the threshold and monitoring or inspection indicates that the project is damaging the building, the historic building shall be provided additional protection or stabilization. If necessary and with approval by the City Chief Building Official, the construction contractor shall install temporary shoring or stabilization to help avoid permanent impacts. Stabilization may involve structural reinforcement or corrections for deterioration that would minimize or avoid potential structural failures or avoid accelerating damage to the historic structure. Stabilization shall be conducted following the Secretary of Interior Standards Treatment of Preservation. This treatment shall ensure retention of the historical resource's character-defining features. Stabilization may temporarily impair the historic integrity of the building's design, material, or setting, and as such, the stabilization must be conducted in a manner that will not permanently impair a building's ability to convey its significance. Measures to shore or stabilize the building shall be installed in a manner that when they are removed, the historic integrity of the building remains, including integrity of material.*

- *Post-Construction*
  - *The applicant (and its construction contractor) shall provide a report to the City Chief Building Official regarding crack and vibration monitoring conducted during demolition and construction. In addition to a narrative summary of the monitoring activities and their findings, this report shall include photographs illustrating the post-construction state of cracks and material conditions that were presented in the pre-construction assessment report, along with images of other relevant conditions showing the impact, or lack of impact, of project activities. The photographs shall sufficiently illustrate damage, if any, caused by the project and/or show how the project did not cause physical damage to the historic and non-historic buildings. The report shall include annotated analysis of vibration data related to project activities, as well as summarize efforts undertaken to avoid vibration impacts. Finally, a post-construction line and grade survey shall also be included in this report.*
  - *The project applicant (and its construction contractor) shall be responsible for repairs from damage to historic and non-historic buildings if damage is caused by vibration or movement during the demolition and/or construction activities. Repairs may be necessary to address, for example, cracks that expanded as a result of the project, physical damage visible in post-construction assessment, or holes or connection points that were needed for shoring or stabilization. Repairs shall be directly related to project impacts and will not apply to general rehabilitation or restoration activities of the buildings. If necessary for historic structures, repairs shall be conducted in compliance with the Secretary of Interior Standards Treatment of Preservation. The project applicant shall provide the City Chief Building Official and City Preservation Officer for review and comment both a work plan for*

the repairs and a completion report to ensure compliance with the SOI Standards.

- *Designate a disturbance coordinator and conspicuously post this person's number around the project site, in adjacent public spaces, and in construction notifications. The disturbance coordinator shall be responsible for responding to any local complaints about construction activities. This disturbance coordinator shall receive all public complaints about construction noise disturbances and be responsible for determining the cause of the complaint and implementation of feasible measures to be taken to alleviate the problem. The disturbance coordinator shall have the authority to halt noise- or vibration-generating activity if necessary to protect public health and safety.*
- *Adjacent noise-sensitive residents and commercial uses (i.e., educational, religious, transient lodging) within 200 feet of demolition and pile driving activity shall be notified of the construction schedule, as well as the name and contact information of the project disturbance coordinator.*

Impact Significance After Mitigation: Implementation of these mitigation measures would reduce construction noise at the Downtown project site to the extent feasible. Restricting heavy-duty equipment operations in close proximity to buildings would substantially reduce exterior and interior noise at adjacent buildings. Auger displacement pile installation could reduce associated noise by 17 dBA (compared to impact pile driving) and intervening noise barriers (i.e., fences or noise blankets) could reduce noise exposure at the nearest receptors by 10 to 15 dBA. These measures would minimize interior noise and associated sleep disturbance and any potential hearing loss effects at nearby receptors during demolition, excavation, and construction. However, even with implementation of these mitigation measures, it is likely that construction activities would result in increased levels of annoyance, interruption of conversation, and potential sleep disturbance at surrounding receptors during the day and occasionally at night. This impact would be considered ***significant and unavoidable*** during the short-term duration of demolition and construction activities on the Downtown project site.

Impact 4.8-4: Construction of the Proposed Project would expose existing and/or planned buildings, and persons within, to significant vibration that could disturb people and damage buildings.

Downtown Project Site

Construction-related vibration has two potential effects: disturbance of people and damage to buildings. Ground-borne vibration at high enough levels can disturb people trying to sleep or work. The FTA has determined that infrequent events producing vibration levels in excess of 80 VdB and 83 VdB can result in a significant impact at places where people sleep or work (see Table 4.8-4). Varying degrees of ground-borne vibration can potentially damage the foundations and exteriors of buildings. The FTA building damage thresholds are 0.2 PPV for historic buildings and 0.5 PPV for non-historic buildings. Historic buildings and resources in the vicinity of the Downtown project site include the Marshall Hotel, Ramona Hotel, California Fruit Building, Travelers' Hotel, and Raised Streets and Hollow Sidewalk District (P-34-002358).

Ground-borne vibration from demolition, excavation, and pile driving activities at the Downtown project site could produce substantial vibration at nearby sensitive receptors. The extent to which these receptors would be affected depends largely on soil conditions, building design and materials, and the receptor's location in the building. Typical reference vibration levels for various pieces of equipment, including alternative foundation pile construction options, are listed below in Table 4.8-11. During demolition, potentially significant vibration impacts could occur within 15 feet of historic buildings and 10 feet of non-historic buildings with regard to structural damage. During foundation pile installation, potentially significant vibration impacts could occur within 50 feet from historic and 30 feet from non-historic buildings for impact pile driving, or 15 feet from historic and 10 feet from non-historic buildings for auger displacement drilling. In regards to human annoyance, potentially significant vibration impacts could occur within 45 feet of buildings where people sleep and 35 feet of buildings where people work during demolition. During foundation pile installation, potentially significant annoyance impacts could occur within 160 feet buildings where people sleep and 130 feet of buildings where people work for impact pile driving, or within 45 feet buildings where people sleep and 35 feet of buildings where people work for auger displacement drilling. While construction-related vibration would be limited to the duration of the construction schedule, as depicted in Table 4.8-11, due to the close proximity of existing receptors to demolition and construction activities, unmitigated vibration impacts could exceed the building damage and human annoyance thresholds and would be ***potentially significant***.

TABLE 4.8-11
VIBRATION VELOCITIES FOR CONSTRUCTION EQUIPMENT

Equipment/Activity	PPV at 25 ft (inches/second)[a]	PPV at nearest receptors to the Project	RMS at 25 ft (Vdb)[b]	RMS at nearest receptors to the Project
Large Bulldozer[c]	0.089	1.0	87	108
Hoe Ram[c]	0.089	1.0	87	108
Loaded Trucks[c]	0.076	0.85	86	107
Pile Driver (Impact)[d]	0.644	0.23	104	95
Pile Driver (Sonic)[d]	0.170	0.06	93	84
Caisson Drilling (represents Auger Drilling Pile Installation)[d]	0.089	0.03	87	78

a. Non-historical buildings can be exposed to ground-borne vibration levels of 0.5 PPV without experiencing structural damage.
b. The human annoyance response level is 80 Vdb.
c. The nearest historical and non-historical building to demolition/excavation activities would be the Hotel Marshall, the 630 K Street building, and the 24-hour fitness building, which are both adjacent to buildings to be demolished. Demolition/excavation activities of five feet from the adjacent buildings are incorporated above.
d. According to the construction contractor, pile driving could occur approximately 50 feet or further from the nearest historic and non-historic buildings. These distances are incorporated into the vibration results above.

SOURCE: ESA, 2013; FTA, 2006 (Table 12-2, p. 12-12).

Offsite Digital Billboards

The nearest vibration-sensitive receptor to the potential digital billboard locations would be a residence approximately 85 feet from the I-5/Water Tank site boundary. At this distance, assuming a large dozer would be needed during site preparation and excavation, the resultant vibration exposure at the residence would be 0.014 PPV and 71 VdB, which would not exceed the

building damage or annoyance thresholds. Construction of digital billboards would result in ***less-than-significant*** vibration impacts.

Mitigation Measures

4.8-4 (ESC/PUD)

Implement Mitigation Measure 4.8-3.

Impact Significance After Mitigation: These measures would ensure that demolition/construction activities at the Downtown project site would not result in building damage at the nearest historic and non-historic building structures, and would reduce human disturbance to the extent feasible. However, the Proposed Project would still result in infrequent but substantial vibration during demolition and construction that would likely result in disturbance impacts at the nearest receptors that operate during the daytime hours (such as the 630 K Street building, and nearby commercial and office uses) and at residential receptors if demolition/construction activities were to occur within 50 feet of receptors at night. While implementation of the mitigation measures described above would avoid vibration-caused building damage and would reduce vibration impacts to surrounding receptors, it is likely that construction activities would still adversely affect surrounding receptors at times during construction on the Downtown project site. Consequently, this impact would be ***significant and unavoidable*** during the short-term duration of demolition, excavation, and construction activities on the Downtown project site.

Impact 4.8-5: The Proposed Project would expose adjacent residential and commercial buildings, and persons within, to significant vibration due to rail operations.

Downtown Project Site

When residential or commercial uses are located in close proximity to highway or railway operations, there is the potential for exposure to ground-borne vibration that may cause structural damage to buildings and disrupt or annoy their occupants. Development of the Proposed Project at the Downtown project site would not locate proposed land uses in close proximity to major highway operations. The nearest source of potentially substantial vibration would be the RT light rail track on K Street, located about 50 feet from the project site boundary. It is assumed that mixed use development could eventually replace the existing 24 Hour Fitness Center and the 660 J Street building parallel to the light rail track, with office or commercial uses on the first few floors and potential residential dwelling units on the 3rd floor and above. Based on the 50 foot distance from the light rail track, assuming a light rail vehicle speed of 15 mph, and accounting for structural resonance, the vibration exposure at the potential elevated residences would be approximately 65 VdB. For office or commercial uses, estimated maximum vibration would be 69 VdB. According to Table 4.8-4, frequent light rail service would not exceed either the office/commercial or residential use vibration thresholds. This impact would be ***less than significant***.

Offsite Digital Billboards

Digital billboards would not be considered a vibration-sensitive land use. This impact would be ***less than significant***.

Mitigation Measures

None required.

Cumulative Impacts

The geographic context for changes in the noise and vibration environment due to development of the Proposed Project would be localized in the Central Business District of the City of Sacramento in the vicinity of the Downtown project site, as well as along roadways that would serve the Proposed Project. In order to contribute to a cumulative construction noise impact, another project in close proximity would have to be constructed at the same time as the Proposed Project. The only other active cumulative project in the vicinity is the proposed development on the 700 block of K Street. This development would renovate the existing buildings that face K Street, and behind the existing buildings would add new multi-story residential buildings ranging in height from 60-70 feet for the entire length of the 700 block between 7th and 8th Streets. Development on the 700 block of K Street would be approximately 100 feet from future PUD uses along 7th Street and about 200 feet from the ESC practice facility.

Although there have been other projects proposed in the Capitol Mall corridor, including the Aura Condominiums at 6th Street and Capitol Mall (adjacent to the US Bank Tower) and the Towers on Capitol Mall project at 3rd Street and Capitol Mall, both of which were proposals for high-rise residential buildings that would have contributed new structures to Sacramento's skyline, these proposals are currently not active and the City is not aware of new proposals for projects on these sites.

The Railyards project, two blocks north on 5th and 6th Streets, would add numerous additional medium- and high-rise structures. The City and the developer of the Railyards have been incrementally constructing infrastructure to serve the site over recent years, and are currently completing the extension of 5th and 6th Streets north over the UP railroad tracks into the area around the Central Shops. Development in the new city blocks created by this development is anticipated to take place over the coming 20-30 years. There are no specific projects in that area that are currently proposed or under review by the City of Sacramento.

As described above (Impact 4.8-5), when residential or commercial uses are located in close proximity to highway or railway operations, there is the potential for exposure to ground-borne vibration that may impact buildings and their occupants. This impact would not be affected by cumulative development.

Impact 4.8-6: The Proposed Project would contribute to cumulative increases in ambient exterior noise levels in the project vicinity.

On-road traffic associated with the Proposed Project would be the primary source that would contribute to the cumulative noise environment. Although exterior amplified sound systems at the ESC could result in significant noise, no other existing or future stationary sources of substantial noise have been identified in the vicinity of the Proposed Project.

Noise projections were made using the FHWA Noise Prediction Model for cumulative roadway volumes provided by Fehr and Peers, for those road segments that would experience the greatest increase in traffic volume and that would pass by sensitive receptors. The segments analyzed and results of the modeling are shown in Table 4.8-12 (daily Ldn) and Table 4.8-13 (pre-event peak hour Leq) for the "Existing" and "Cumulative Plus Project" scenarios in order to determine cumulative significance, as well as the "Proposed Project Contribution" in order to determine the contribution of on-road vehicles associated with the Proposed Project to the cumulative roadway noise levels**.** Results of the cumulative traffic noise model are included in Appendix C.

As shown in Table 4.8-12, the Cumulative Plus Project on-road traffic noise would not result in noise levels that would exceed the normally acceptable Ldn for Urban Residential Infill and Mixed-Use Projects listed in Table 4.8-2 along the majority of modeled roadways, except at the Wong Center and along L St west of 7th St. The Wong Center already exceeds the 70 dBA standard and there are no residential uses along L St west of 7th. The Proposed Project in conjunction with existing and future cumulative traffic would result in daily Ldn noise exposure that would exceed the allowable noise incremental increases detailed in Table 4.8-3 at residential uses along roadway segments 1 through 4 and 7 through 14. However, the Proposed Project would not result in a cumulatively considerable contribution[17] to on-road traffic noise along most of these roadway segments. The Proposed Project would result in a cumulatively considerable contribution to the daily Ldn impact at residences along segments 1 (7th St north of I St), 2 (7th St south of I St), and 8 (7th St north of L St).

As shown in Table 4.8-13 , the Proposed Project in conjunction with existing and future cumulative traffic would result in pre-event peak hour Leq noise exposure that would exceed the allowable noise incremental increases detailed in Table 4.8-3 at institutional uses along roadway segments 1 through 3, 7 through 9, and 12. However, the Proposed Project would not result in a cumulatively considerable contribution[18] to peak hour on-road traffic noise along most of these roadway segments. The Proposed Project would result in a cumulatively considerable contribution to the peak hour Leq impact at institutional uses along segments 1 (7th St north of I St), 2 (7th St south of I St), and 9 (7th St south of L St). These impacts are ***significant***.

[17] A 1-dBA increase, which cannot be perceived except in carefully controlled laboratory experiments, was used to determine if the Proposed Project would have a cumulatively considerable contribution to cumulatively significant exterior Ldn traffic noise at residences and buildings where people normally sleep.

[18] A 3-dBA increase, which is barely perceivable to the average healthy ear, was used to determine if the Proposed Project would have a cumulatively considerable contribution to cumulatively significant exterior peak hour Leq traffic noise at at institutional uses with primarily daytime and evening uses.

TABLE 4.8-12
CUMULATIVE LDN TRAFFIC NOISE LEVELS ALONG STREETS IN THE PROJECT VICINITY

Street Segment	Ldn, dBA[1]					
	Existing [A]	Cumulative Plus Project [B]	Incremental Increase [B-A]	Cumulatively Significant? (Yes or No)[2]	Project Contribution to Cumulative Increase	Cumulatively Considerable? (Yes or No)[4]
1. 7th St north of I St	63.2	66.9	3.7	Yes	1.0	Yes
2. 7th St south of I St	61.9	65.9	4.0	Yes	2.0	Yes
3. 9th St north of I St	62.0	64.1	2.1	Yes	0.3	No
4. 9th St south of I St	62.4	65.3	2.9	Yes	0	No
5. J St east of 4th St	73.0	73.9	0.9	No	0.6	No
6. J St west of 4th St	73.0	73.9	0.9	No	0.6	No
7. 6th St north of J St	60.3	66.7	6.4	Yes	0.3	No
8. 7th St north of L St	65.2	69.2	4.0	Yes	1.1	Yes
9. 7th St south of L St	64.6	67.3	2.7	Yes	0.9	No
10. L St west of 7th St	68.7	70.7	2.0	Yes	0.5	No
11. Garden St north of Tower Bridge Gateway (WS)[3]	57.8	62.9	5.1	Yes	0.3	No
12. Garden St south of Tower Bridge Gateway (WS)[3]	48.6	64.3	15.7	Yes	0	No
13. Tower Bridge Gateway east of Garden St (WS)[3]	65.7	68.1	2.4	Yes	0.4	No
14. Tower Bridge Gateway west of Garden St (WS)[3]	65.3	67.5	2.2	Yes	0.2	No

1. Noise levels were determined using FHWA Traffic Noise Prediction Model (FHWA RD-77-108). Notably, a 3 dBA increase was included in the J St east and west of 4th St segments (segments 5 and 6) to calibrate the model based on the Ldn noise monitoring results at the Wong Building, likely due to the proximity to Interstate 5.
2. Traffic noise is considered significant if the daily Ldn exceeds the allowable noise increment at residences and buildings where people normally sleep, per Table 4.8-3 above.
3. (WS) = West Sacramento intersection.
4. An allowable Ldn increment of 1-dBA was used to determine if the Project would have a cumulatively considerable contribution to cumulatively significant roadway noise at residences and buildings where people normally sleep. This level matches the scale of applied City standards (per Table 4.8-3) and equates to the allowable incremental exterior Ldn at residences and buildings where people normally sleep that have an existing exterior Ldn exposure of 65 or 70 dBA. Notably, except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived (Caltrans, 2009).

SOURCE: Caltrans, 2009. *Technical Noise Supplement*. November 2009. p. 2-48; ESA, 2013

TABLE 4.8-13
CUMULATIVE PRE-EVENT PEAK-HOUR LEQ TRAFFIC NOISE LEVELS ALONG STREETS IN THE PROJECT VICINITY

	Leq, dBA[1]					
Street Segment	**Existing [A]**	**Cumulative Plus Project [B]**	**Incremental Increase [B-A]**	**Cumulatively Significant? (Yes or No)[2]**	**Project Contribution to Cumulative Increase**	**Cumulatively Considerable? (Yes or No)[4]**
1. 7th St north of I St	60.0	67.3	7.3	Yes	3.1	Yes
2. 7th St south of I St	59.5	67.0	7.5	Yes	3.7	Yes
3. 9th St north of I St	57.4	63.9	6.5	Yes	0.6	No
4. 9th St south of I St	58.7	64.4	5.7	No	0.2	No
5. J St east of 4th St	69.0	70.6	2.6	No	0.8	No
6. J St west of 4th St	69.1	70.6	2.5	No	0.8	No
7. 6th St north of J St	57.8	65.9	8.1	Yes	0.7	No
8. 7th St north of L St	62.6	69.2	6.6	Yes	2.7	No
9. 7th St south of L St	61.5	68.1	6.6	Yes	3.2	Yes
10. L St west of 7th St	67.1	68.8	1.7	No	0.8	No
11. Garden St north of Tower Bridge Gateway (WS)[3]	56.9	62.3	5.4	No	0.3	No
12. Garden St south of Tower Bridge Gateway (WS)[3]	46.5	63.0	16.5	Yes	0	No
13. Tower Bridge Gateway east of Garden St (WS)[3]	65.2	67.3	2.1	No	0.7	No
14. Tower Bridge Gateway west of Garden St (WS)[3]	64.8	66.8	2.0	No	0.6	No

1. Noise levels were determined using FHWA Traffic Noise Prediction Model (FHWA RD-77-108). Notably, a 1 dBA increase was included in the J St east and west of 4th St segments (segments 5 and 6) to calibrate the model based on the 6-7m noise monitoring results at the Wong Building, likely due to the proximity to Interstate 5.
2. Traffic noise is considered significant if the peak-hour Leq exceeds the allowable noise increment at uses where it is important to avoid interference with speech, meditation, and concentration on reading material, per Table 4.8-3 above.
3. (WS) = West Sacramento intersection.
4. An allowable peak hour Leq increment of 3-dBA was used to determine if the Project would have a cumulatively considerable contribution to cumulatively significant roadway noise at institutional uses with primarily daytime and evening uses. This level matches the scale of applied City standards (per Table 4.8-3) and equates to the allowable incremental exterior Leq at institutional uses that have an existing exterior peak hour Leq exposure of 65 or 70 dBA. Notably, the average healthy ear can barely perceive noise level changes of 3 dBA (Caltrans, 2009).

SOURCE: Caltrans, 2009. *Technical Noise Supplement*. November 2009. p. 2-48; ESA, 2013

Operation of digital billboards would not result in noticeable noise at nearby receptors, even if other projects would be operated concurrently in the vicinity of the digital billboards, and the impact is ***less than significant***.

Mitigation Measures

4.8-6 (ESC/PUD)

Implement Mitigation Measures 4.8-1(a) and 4.8-1(b).

Impact Significance After Mitigation: Mitigation Measure 4.8-6 would reduce noise from stationary sources and exterior amplified sound systems associated with the Proposed Project to the extent feasible. In regards to cumulative traffic, no feasible mitigation strategies have been identified to reduce the on-road transportation noise impact to less than significant. Alternative modes of transportation (i.e., walking, biking, and transit) are already accounted for in the above traffic noise estimates. In addition, typical measures to reduce roadway noise impacts, such as noise walls, setbacks, and rubberized asphalt, are not considered feasible mitigation for development in the urban core of the City. This impact would be considered ***significant and unavoidable***.

Impact 4.8-7: Implementation of the Proposed Project would contribute to cumulative increases in residential interior noise levels of 45 dBA Ldn or greater.

On-road traffic associated with the Proposed Project would be the primary source that would contribute to the cumulative exterior, and thus interior, noise environment of existing and future residences. Table 4.8-12 shows the areas in which new residential uses are likely to be located (i.e., along J Street) that could be exposed to cumulative traffic noise levels up to 73 dBA Ldn, due in part to proximity of the site to Interstate 5. Other residences developed farther east would be exposed to reduced noise. L Steet west of 7th Street is also projected to exceed 70 dBA Ldn, however, there are no residences proposed along this roadway segment. An exterior noise exposure of 70 dBA or greater would result in potentially incompatible interior noise for new urban infill sensitive receptors. The multi-family residences to be developed as part of the Project would be subject to Title 24 of the California Code of Regulations, sound-rated assemblies would be required at the exterior facades of Project buildings.

Cumulative traffic would also result in noise exposure of existing residential receptors in the Project vicinity, as described above in Impact 4.8-6. For on-road transportation sources, the total roadway noise from cumulative and Proposed Project traffic would not exceed the 70 dBA Ldn standard along the majority of roadway segments, except at the Wong Center and along L Street west of 7th Street. The Wong Center is already exposed to noise levels above the standard and there are no residences located along L Street west of 7th Street.

Exterior amplified sound systems at the ESC could result in ***potentially significant*** noise at future PUD residences. Existing residential receptors in the Riverview Plaza, Ping Yuen Apartments, and Wong Center would be exposed to interior noise levels less than 45 Ldn (assuming 20 dBA

exterior-to-interior attenuation by the building structure). No other existing or future stationary sources of substantial noise have been identified in the vicinity of the Proposed Project.

Operation of digital billboards would not result in noticeable noise at nearby receptors, even if other projects would be operated concurrently in the vicinity of the digital billboards.

Mitigation Measures

4.8-7 (ESC/PUD)

Implement Mitigation Measures 4.8-2(a) and 4.8-2(b).

Impact Significance After Mitigation: Implementation of Mitigation Measure 4.8-7 would ensure that future PUD residences are designed such that interior noise levels would not exceed the City standard of 45 Ldn. This impact would be considered ***less than significant***.

Impact 4.8-8: The Proposed Project would result in exposure of people to cumulative increases in construction noise levels.

The only cumulative project that could add to project-related construction noise generated by the Proposed Project could be the proposed development on the 700 block of K Street. Development of the 700 block of K Street would probably expose the Hotel Marshall and Jade Apartments residences, as well as adjacent commercial and office uses, to substantial construction noise. The Proposed Project itself would generate substantial noise that would impact these receptors, which would be a significant nuisance impact even after mitigation. Although not known at this time, it is possible that other projects within the PUD area could be constructed at a time concurrent with other projects in the Capitol Mall, L, J, or I Street corridors.

Consequently, the Proposed Project's contribution to construction noise would be cumulatively considerable, resulting in a ***significant cumulative impact***.

Construction of digital billboards would be very short (about five days) per billboard, which would result in minimal exposure of nearby receptors to noticeable noise, even if other projects would be constructed concurrently in the vicinity of the digital billboards. Therefore, the offsite digital billboards would contribute to a ***less-than-significant cumulative impact***.

Mitigation Measures

4.8-8 (ESC/PUD)

Implement Mitigation Measure 4.8-3.

Impact Significance After Mitigation: Implementation of Mitigation Measure 4.8-8 would reduce construction noise to the extent feasible. However, even with implementation of these mitigation measures, it is likely that construction activities would still result in nuisance impacts

at surrounding receptors during the day and occasionally at night. Consequently, this impact would be ***significant and unavoidable*** during the short-term duration of demolition, excavation, and construction activities on the Downtown project site.

Impact 4.8-9: The Proposed Project would contribute to cumulative construction that could expose existing and/or planned buildings, and persons within, to significant vibration.

The only cumulative project that could add to project-related construction vibration noise would be the proposed development on the 700 block of K Street (described above). Equipment on the 700 block of K Street site and truck passbys could result in increased vibration at the Hotel Marshall and Jade Apartments residences, as well as adjacent commercial and office uses. The Proposed Project itself would generate substantial vibration that would impact these receptors, which would be a significant impact even after mitigation. Although not known at this time, it is possible that other projects within the PUD area could be constructed at a time concurrent with other projects in the Capitol Mall, L, J, or I Street corridors.

Consequently, the Proposed Project's contribution to construction vibration would be cumulatively considerable, resulting in a ***significant cumulative impact***.

Construction of digital billboards would be very short and would result in minimal exposure of nearby receptors to noticeable vibration, even if other projects would be constructed concurrently in the vicinity of the digital billboards. Therefore, the offsite digital billboards would contribute to a ***less than significant cumulative im*pact**.

Mitigation Measures

4.8-9 (ESC/PUD)

Implement Mitigation Measure 4.8-3.

Impact Significance After Mitigation: Implementation of Mitigation Measure 4.8-9 would reduce construction vibration to the extent feasible. However, even with implementation of these mitigation measures, it is likely that construction activities would still result in nuisance impacts at surrounding receptors during the day and occasionally at night. Consequently, this impact would be ***significant and unavoidable*** during the short-term duration of demolition, excavation, and construction activities on the Downtown project site.

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