E. NOISE

This section describes existing noise conditions in the vicinity of the project area, describes criteria for determining the significance of noise impacts, and estimates the likely noise that would result from the proposed project. Where appropriate, mitigation measures are recommended to reduce project-related noise impacts to a less-than-significant level.

1. Setting

The setting section begins with an introduction to several key concepts and terms that are used in evaluating noise. It then explains the various agencies that regulate the noise environment in the City of Redwood City and summarizes key standards that are applied to proposed development. This setting section concludes with a description of current noise sources that affect the project site and the noise conditions that are experienced in the project site vicinity.

a. Characteristics of Sound. Noise is generally defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: *pitch* and *loudness*. Pitch is the number of complete vibrations or cycles per second of a wave that results in the range of tone from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment, and it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effects on adjacent sensitive land uses.

(1) Measurement of Sound. Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. An A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units such as inches or pounds, decibels are measured on a logarithmic scale, representing points on a sharply rising curve. Table IV.E-1 contains a list of typical acoustical terms and definitions. Table IV.E-2 shows representative outdoor and indoor A-weighted sound levels.

A decibel (dB) is a unit of measurement which indicates the relative intensity of a sound. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Sound levels in dB are calculated on a logarithmic basis. An increase of 10 dB represents a 10-fold increase in acoustic energy, while 20 dB is 100 times more intense, 30 dB is 1,000 times more intense. Each 10-dB increase in sound level is perceived as approximately a doubling of loudness.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound

Table IV.E-1: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of level that denotes the ratio between two quantities proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level for 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of five decibels to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Harris, Cyril M. 1998. *Handbook of Acoustical Measurements and Noise Control.*

Table IV.E-2: Typical A-Weighted Sound Levels

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments
Near Jet Engine	140	Deafening
Civil Defense Siren	130	Threshold of pain
Hard Rock Band	120	Threshold of feeling
Accelerating Motorcycle at a Few Feet Away	110	Very loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very loud
Ambulance Siren; Food Blender	95	Very loud
Garbage Disposal	90	Very loud
Freight Cars; Living Room Music	85	Loud
Pneumatic Drill; Vacuum Cleaner	80	Loud
Busy Restaurant	75	Moderately loud
Near Freeway Auto Traffic	70	Moderately loud
Average Office	60	Moderate
Suburban Street	55	Moderate
Light Traffic; Soft Radio Music in Apartment	50	Quiet
Large Transformer	45	Quiet
Average Residence Without Stereo Playing	40	Faint
Soft Whisper	30	Faint
Rustling Leaves	20	Very faint
Human Breathing	10	Very faint

Source: Compiled by LSA Associates, Inc., 2004.

level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise sensitive receptor of concern.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The predominant rating scales for human communities in the State of California are the equivalent continuous sound level (L_{eq}), the community noise equivalent level (CNEL), and the day-night average level (L_{dn}) based on A-weighted decibels (dBA). L_{eq} is the total sound energy of time varying noise over a sample period. CNEL is the time varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale, but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within one dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours.

Other noise rating scales of importance include the maximum noise level (L_{max}), which is the highest exponential time averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis are specified in terms of maximum levels denoted by L_{max} for short-term noise impacts. L_{max} reflects peak operating conditions, and addresses the annoying aspects of intermittent noise.

Noise standards in terms of percentile exceedance levels, L_n, are often used together with the L_{max} for noise enforcement purposes. When specified, the percentile exceedance levels are not to be exceeded by an offending sound over a stated time period. For example, the L_{10} noise level represents the level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the lowest noise level experienced during a monitoring period. It is normally referred to as the background noise level. For a relatively steady noise, the measured L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first is audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dBA or greater, since, as described earlier, this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 and 3 dBA. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise level of less than 1 dBA that are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

(2) Psychological and Physiological Effects of Noise. Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects our entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, and thereby affecting blood pressure, functions of the ear, and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling.

b. Noise Regulatory Framework. The following section summarizes the regulatory framework related to noise, including federal, State, and City of Redwood City plans, policies and standards.

(1) U.S. Environmental Protection Agency (EPA). In 1972 Congress enacted the Noise Control Act. This act authorized the EPA to publish descriptive data on the effects of noise and establish levels of sound "requisite to protect the public welfare with an adequate margin of safety." These levels are separated into health (hearing loss levels) and welfare (annoyance levels), as shown in Table IV.E-3. The EPA cautions that these identified levels are not standards because they do not take into account the cost or feasibility of the levels.

For protection against hearing loss, 96 percent of the population would be protected if sound levels are less than or equal to an $L_{eq(24)}$ of 70 dB. The "(24)" signifies an L_{eq} duration of 24 hours. The EPA activity and interference guidelines are designed to ensure reliable speech communication at about 5 feet in the outdoor environment. For outdoor and indoor environments, interference with activity and annoyance should not occur if levels are below 55 dBA and 45 dBA, respectively.

The noise effects associated with an outdoor L_{dn} of 55 dB are summarized in Table IV.E-4. At 55 dB L_{dn}, 95 percent sentence clarity (intelligibility) may be expected at 3.5 meters, and no community reaction. However, 1 percent of the population may complain about noise at this level and 17 percent may indicate annoyance.

(2) State of California. The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the "State Noise Insulation Standard," it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. State regulations include requirements for the construction of new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings that are intended to limit the extent of noise transmitted into habitable spaces.

Table IV.E-3: Summary of EPA Noise Levels

Effect	Level	Area
Hearing loss	$L_{eq}(24) \leq 70$ dB	All areas.
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq}(24) \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{eq} \leq 45$ dB	Indoor residential areas.
	$L_{eq}(24) \leq 45$ dB	Other indoor areas with human activities such as schools, etc.

Source: U.S. Environmental Protection Agency, 1974. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." March.

Table IV.E-4: Summary of Human Effects in Areas Exposed to 55 dBA L_{dn}

Type of Effects	Magnitude of Effect
Speech – Indoors	100 percent sentence intelligibility (average) with a 5 dB margin of safety.
Speech – Outdoors	100 percent sentence intelligibility (average) at 0.35 meters. 99 percent sentence intelligibility (average) at 1.0 meters. 95 percent sentence intelligibility (average) at 3.5 meters.
Average Community Reaction	None evident; 7 dB below level of significant complaints and threats of legal action and at least 16 dB below "vigorous action."
Complaints	1 percent dependent on attitude and other non-level related factors.
Annoyance	17 percent dependent on attitude and other non-level related factors.
Attitude Towards Area	Noise essentially the least important of various factors.

Source: U.S. Environmental Protection Agency, 1974. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." March.

These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. For limiting noise transmitted between adjacent dwelling units, the noise insulation standards specify the extent to which walls, doors, and floor ceiling assemblies must block or absorb sound. For limiting noise from exterior noise sources, the noise insulation standards set an interior standard of 45 dBA CNEL in any habitable room with all doors and windows closed. In addition, the standards require preparation of an acoustical analysis demonstrating the manner in which dwelling units have been designed to meet this interior standard, where such units are proposed in an area with exterior noise levels greater than 60 dBA CNEL.

The State has also established land use compatibility guidelines for determining acceptable noise levels for specified land uses. The City has adopted and modified the State's land use compatibility guidelines, as discussed below.

(3) City of Redwood City. The City of Redwood City addresses noise in the Noise Element of the 1990 Redwood City Strategic General Plan[1] and in the Municipal Code[2]. The following general land use recommendations are listed in the Noise Element:

- Residential land uses are considered satisfactory in noise environments of less than 55 dBA CNEL.
- Noise environments of between 55 dBA and 60 dBA CNEL are considered conditionally acceptable for residential development. Under these conditions, new development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features are included in the project's design.
- New residential construction or development should not be undertaken in noise environments exceeding 60 dBA CNEL.

The Noise Element also contains the following policies that are pertinent to the proposed project:

- Policy N-5: Land uses within the Planning Boundary of San Carlos Airport shall be compatible with the Aircraft Noise/Land Use Compatibility Standards found at page 8 [IV-28] of the 1981 San Mateo County Airport Land Use Plan [updated December 1996]. The "Planning Boundary" for the San Carlos Airport is considered the ground area encompassed by the combination of the line depicting the 55 CNEL Noise Contour, as shown on the Noise Contour Map at page 7 [IV-26] of the 1981 [1996] San Mateo County Airport Land Use Plan and the outer boundary (Elevation 359) of the Hazard Zoning Plan at page 11 [IV-36] of the 1981 [1996] San Mateo County Airport Land Use Plan.
- Policy N-7: Redwood City will take appropriate steps to reduce noise impacts to residents living near the San Carlos Airport and major arterials, particularly the Bayshore Freeway.

The Redwood City Municipal Code addresses temporary construction noise in Chapter 24, Article II, Sections 24.30 - 24.35. The code limits noise-producing construction related activities, including demolition, alteration, repair or remodeling of or to existing structures and the construction of new structures on property in a residential district or within 500 feet of a residential district in the City, between the hours of 7:00 a.m. to 8:00 p.m., Monday through Friday of any week. No construction activity is permitted at any time on Saturdays, Sundays or holidays if the noise level generated by any

[1] Redwood City, City of, 1990. *Redwood City Strategic General Plan*.

[2] Redwood City, City of, 2006. *Municipal Code*. July 24.

such activity exceeds the local ambient measured at any point within the residential district and outside of the plane of said property.

The code also requires that a sign be posted at all entrances to the work site prior to commencement of the work for the purpose of informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the property of the basic limitations upon noise and construction activities based on the Municipal Code.

(4) San Carlos Airport Influence Area Boundary C/CAG has adopted an Airport Influence Area boundary for the San Carlos Airport. The project site is within the Area A boundary, which extends from the Burlingame/San Mateo border to the San Mateo/Santa Clara County line. Area A defines a boundary within which disclosure of the proximity of an airport is required, per State law, as part of all real estate sales.

c. Existing Noise Environment. The proposed project would be located in a primarily urban area that is adjacent to open space areas. The following section describes the existing noise environment and identifies primary noise sources in the vicinity of the project.

(1) Existing Ambient Noise Levels. Existing ambient noise levels at the site were measured on June 5, 2007, between 11:00 a.m. and 1:00 p.m. for continuous periods of 20 minutes at three locations. Noise monitoring locations are shown in Figure IV.E-1.

Table IV.E-5: Ambient Noise Monitoring Results

Monitoring Location	L_{eq} [a]	L_{min} [b]	L_{max} [c]	Location
1	57.6	45.1	74.3	Salt Court & Marina Parkway
2	58.7	45.0	74.4	Shearwater Parkway
3	60.8	42.5	78.3	Shearwater Parkway

[a] L_{eq} represents the average of the sound energy occurring over the 20-minute time period.
[b] L_{min} is the lowest instantaneous sound level measured during the 20-minute time period.
[c] L_{max} is the highest instantaneous sound level measured during the 20-minute time period.
Source: LSA Associates, Inc., June 2007.

Table IV.E-6: Atmospheric Conditions

Monitoring Location	Maximum Wind Velocity (mph)	Average Wind Velocity (mph)	Temperature (F)	Relative Humidity (%)
1	12.4	4.8	63	66
2	10.0	4.1	68	53
3	8.4	4.2	69	60

Source: LSA Associates, Inc., June 2007.

As shown in Table IV.E-5, monitoring results indicate that current noise levels on the site range from 57.6 to 60.8 dBA L_{eq}. The primary noise source for each location was traffic on Marina Parkway and Shearwater Parkway. Other audible noise sources included aircraft traffic associated with San Francisco International Airport and San Carlos Airport; wind and landscaping equipment noise were also audible.

The atmospheric conditions during each of the noise monitoring sessions are shown in Table IV.E-6. The wind was from the west, with partly cloudy skies.

(2) Existing Aircraft Noise Levels. San Francisco International Airport is located approximately 7.5 miles northwest of the project site. San Carlos Airport is located approximately 1.7 miles south of the project site. Aircraft related noise from arriving flights is audible on the project site as documented in the ambient noise monitoring results.

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FIGURE IV.E-1

The Preserve at Redwood Shores- Area H

Noise Monitoring Locations Map

N

3 MONITOR LOCATIONS

SOURCE: MSN LIVE SEARCH MAPS, JUNE 2007

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(3) Existing Traffic Noise Levels. Vehicular traffic is a major source of ambient noise levels in urban settings. The existing traffic noise levels for roadway segments in the project vicinity are listed in Table IV.E-7 below. This table was generated from roadway traffic volumes data, vehicle speeds, and roadway geometry, using the Federal Highways Administration (FHWA) Highway Traffic Noise Prediction Model. Existing noise levels along select roadway segments in the vicinity of the project (at 50 feet from the centerline of the outermost travel lane) range from 57.9 dBA CNEL to 66.6 dBA CNEL.

2. Impacts and Mitigation Measures.

This section evaluates potential noise impacts associated with implementation of the proposed project. It also identifies mitigation measures to address these impacts where appropriate.

a. Criteria of Significance. A project would have a significant noise effect if it would substantially increase the ambient noise levels for adjoining areas or conflict with adopted environmental plans and goals of the community in which it is located. The applicable noise standards governing the project site are the State's noise criteria, the City of Redwood City's Noise Element of the Strategic General Plan, and applicable sections of the City's Municipal Code. For the purposes of this EIR, a noise impact is considered significant if the project will result in:

- Exposure of persons to or generation of noise levels in excess of standard established in the local general plan or noise ordinance, or applicable standards of other agencies; or
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels; or
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; or
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or
- For a project located within an airport land use plan or, where such a plan as not been adopted, within two miles of a public airport, exposure of people residing or working in the project area to excessive noise levels.

These criteria are adapted from the CEQA Guidelines Environmental Checklist.

b. Less-Than-Significant Noise Impacts. The following noise types/sources would produce less-than-significant noise effects at or near the project site.

(1) Existing Aircraft Noise Impacts. San Francisco International Airport is located approximately 7.5 miles northwest of the project site. Due to the distance from this airport, the project site does not lie within the land use plan area nor within the 55 dBA CNEL noise contours of this airport. The proposed project site also does not lie within the 55 dBA CNEL noise contour of the San Carlos Airport, located approximately 1.7 miles south of the project site, nor does it lie within the outer boundary of the "Hazard Zoning Plan" of the San Mateo County Comprehensive Airport Land Use Plan.[3] Therefore, due to the project site's distance from and the flight path orientation of these airports, noise impacts from aircraft noise sources would be less-than-significant.

[3] San Mateo County, 1996. *San Mateo County Comprehensive Airport Land Use Plan*. December.

Table IV.E-7: Existing (2007) Baseline Traffic Noise Levels

Roadway Segment	ADT[a]	Center-line to 70 CNEL (feet)	Center-line to 65 CNEL (feet)	Center-line to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
Marine Parkway - US 101 NB Ramps to Twin Dolphin Drive	19,700	< 50[b]	85	170	64.9
Marine Parkway - Twin Dolphin Drive to Bridge Parkway	15,700	< 50	75	147	63.9
Marine Parkway - Bridge Parkway to Shell Parkway	6,800	< 50	< 50	85	61.0
Marine Parkway - Shell Parkway to Salt Court	5,200	< 50	< 50	72	59.8
Shearwater Parkway - Salt Court to Monaco Drive	4,300	< 50	< 50	61	60.5
Shearwater Parkway - Monaco Drive to Canvasback Way	4,200	< 50	< 50	64	58.9
Shearwater Parkway - Canvasback Way to Redwood Shores Parkway	3,300	< 50	< 50	56	57.9
Redwood Shores Parkway - Shearwater Parkway to Shell Parkway	6,300	< 50	< 50	81	60.7
Redwood Shores Parkway - Shell Parkway to Bridge Parkway	10,000	< 50	< 50	108	62.7
Redwood Shores Parkway - Bridge Parkway to Twin Dolphin Drive	14,900	< 50	68	140	64.4
Redwood Shores Parkway - Twin Dolphin Drive to US 101 NB Ramps	29,300	< 50	107	219	66.6
Bridge Parkway - Marine Parkway to Redwood Shores Parkway	4,400	< 50	< 50	66	59.1

[a] Average daily traffic volume.
[b] Traffic noise within 50 feet of the roadway centerline requires site-specific analysis.
Source: LSA Associates Inc., June 2007

(2) Traffic Noise Impacts. The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate traffic-related noise conditions in the vicinity of the project site. The resultant noise levels were weighed and summed over a 24-hour period in order to determine the CNEL values. The existing plus approved projects and existing plus approved plus project traffic volumes for roadway segments in the project vicinity were used in the traffic noise impact analysis. Table IV.E-8 shows the traffic noise levels for the existing plus approved projects conditions. The existing plus approved projects plus the project traffic noise levels for roadway segments in the project site vicinity are shown in Table IV.E-9. The shaded areas in the tables indicate the roadway segments directly adjacent to the project site. Cumulative traffic volumes are the same as existing plus approved projects plus the project traffic volumes since project buildout represents full buildout of the area.

According to the significance criteria, a significant impact would occur if implementation of the project would result in a substantial permanent increase in ambient exterior noise levels over existing levels without the project. Only audible changes in existing ambient or background noise levels are considered potentially significant. Audible increases in noise levels generally refer to a change of 3 dBA or greater. Modeling results indicate that all modeled roadway segments would experience a less than 3 dBA increase in traffic noise levels with implementation of the project. Therefore, the proposed project would result in a less-than-significant increase in traffic noise levels.

Table IV.E-8: Existing Plus Approved Projects Traffic Noise Levels

Roadway Segment	ADT[a]	Center-line to 70 CNEL (feet)	Center-line to 65 CNEL (feet)	Center-line to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
Marine Parkway - US 101 NB Ramps to Twin Dolphin Drive	20,700	< 50[b]	87	175	65.1
Marine Parkway - Twin Dolphin Drive to Bridge Parkway	16,700	< 50	78	153	64.2
Marine Parkway - Bridge Parkway to Shell Parkway	6,900	< 50	< 50	86	61.1
Marine Parkway - Shell Parkway to Salt Court	5,200	< 50	< 50	72	59.8
Shearwater Parkway - Salt Court to Monaco Drive	4,300	< 50	< 50	61	60.5
Shearwater Parkway - Monaco Drive to Canvasback Way	4,200	< 50	< 50	64	58.9
Shearwater Parkway - Canvasback Way to Redwood Shores Parkway	3,300	< 50	< 50	56	57.9
Redwood Shores Parkway - Shearwater Parkway to Shell Parkway	6,300	< 50	< 50	81	60.7
Redwood Shores Parkway - Shell Parkway to Bridge Parkway	10,000	< 50	< 50	108	62.7
Redwood Shores Parkway - Bridge Parkway to Twin Dolphin Drive	15,500	< 50	70	144	64.6
Redwood Shores Parkway - Twin Dolphin Drive to US 101 NB Ramps	30,000	< 50	108	223	66.7
Bridge Parkway - Marine Parkway to Redwood Shores Parkway	5,100	< 50	< 50	72	59.8

[a] Average daily traffic volume.
[b] Traffic noise within 50 feet of the roadway centerline requires site-specific analysis.
Note: The shaded areas in the tables indicate the roadway segments directly adjacent to the project site.
Source: LSA Associates Inc., June 2007

The significance criteria also states that a significant impact would occur if the project would result in the exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. Based on the City's policies in the noise element of the General Plan, noise environments of between 55 dBA and 60 dBA CNEL are considered conditionally acceptable for residential development. Roadway segments adjacent to the project site under the existing plus approved projects conditions would experience traffic noise levels above 60 dBA CNEL. Off-site traffic noise impacts would not be considered a significant impact as a result of project implementation; however, mitigation would be required to protect the planned noise sensitive land uses within the proposed project.

Based on Figure 26 and Figure 33 of the Precise Plan[4], the planned setback for the elementary school facilities along Shearwater Parkway would be approximately 100 feet from the centerline of the roadway. At this distance the existing plus approved projects plus the project traffic noise level of 61.8 dBA CNEL at 50 feet from the centerline of the outermost travel lane of this roadway segment would be reduced to 58.5 dBA CNEL at the elementary school façade. This would be within the State's normally acceptable and City's conditionally acceptable range for new educational facilities development.

[4] Keech Properties, LLC., and Callander Associates Landscape Architecture, Inc., 2007. *The Preserve at Redwood Shores Draft Precise Plan.* September 19.

Table IV.E-9: Existing Plus Approved Projects Plus Project[a] Traffic Noise Levels

Roadway Segment	ADT[b]	Center-line to 70 CNEL (feet)	Center-line to 65 CNEL (feet)	Center-line to 60 CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Increase from Existing Plus Approved Projects Conditions
Marine Parkway - US 101 NB Ramps to Twin Dolphin Drive	20,600	< 50[c]	87	175	65.1	0.0
Marine Parkway - Twin Dolphin Drive to Bridge Parkway	21,800	< 50	90	181	65.4	1.2
Marine Parkway - Bridge Parkway to Shell Parkway	8,900	< 50	< 50	101	62.2	1.1
Marine Parkway - Shell Parkway to Salt Court	8,100	< 50	< 50	95	61.8	2.0
Shearwater Parkway - Salt Court to Monaco Drive	5,700	< 50	< 50	73	61.8	1.3
Shearwater Parkway - Monaco Drive to Canvasback Way	4,200	< 50	< 50	64	58.9	0.0
Shearwater Parkway - Canvasback Way to Redwood Shores Parkway	3,900	< 50	< 50	61	58.6	0.7
Redwood Shores Parkway - Shearwater Parkway to Shell Parkway	6,800	< 50	< 50	85	61.0	0.3
Redwood Shores Parkway - Shell Parkway to Bridge Parkway	10,500	< 50	56	112	62.9	0.2
Redwood Shores Parkway - Bridge Parkway to Twin Dolphin Drive	16,000	< 50	71	147	64.7	0.1
Redwood Shores Parkway - Twin Dolphin Drive to US 101 NB Ramps	30,500	< 50	109	225	66.8	0.1
Bridge Parkway - Marine Parkway to Redwood Shores Parkway	5,200	< 50	< 50	72	59.8	0.0

[a] The cumulative scenario is the same as existing plus approved projects plus the project scenario since buildout of the project represents full buildout of the area.
[b] Average daily traffic volume.
[c] Traffic noise within 50 feet of the roadway centerline requires site-specific analysis.
Note: The shaded areas in the tables indicate the roadway segments directly adjacent to the project site.
Source: LSA Associates Inc., June 2007

Based on Figure 26 of the Precise Plan, the planned setback for the townhomes along Shearwater Parkway would be approximately 81 feet from the centerline of the roadway. At this distance the existing plus approved projects plus the project traffic noise levels of 61.8 dBA CNEL at 50 feet from the centerline of the outermost travel lane of this roadway segment would be reduced to 59.8 dBA CNEL at the façade of these townhomes. This would be within the City's conditionally acceptable range for new residential development.

All residential developments must satisfy the requirements set forth in Title 24, part 2, of the California Administrative Code, Noise Insulation Standards. This code sets an interior noise level threshold of 45 dBA CNEL for residential development. Based on the EPA's Protective Noise Levels,[5] with a combination of walls, doors, and windows, typical central and northern California residential buildings built after 1970 provide approximately 15 dBA in exterior to interior noise reduction when windows are open, and provide 25 dBA in exterior to interior noise reduction when

[5] EPA 550/9-79-100, November 1978.

windows are closed. With windows open, the proposed townhomes adjacent to Shearwater Parkway would meet the interior noise standard (i.e., 59.8 dBA – 15 dBA = 44.8 dBA). Therefore, no mitigation would be required for future residential units to reduce traffic noise levels along Shearwater Parkway.

c. Significant Noise Impacts. The following noise sources would produce significant noise levels at or near the project site.

(1) Construction Period Impacts. The project site is currently surrounded by open space and residential land uses. Project construction would result in short-term noise impacts on these adjacent land uses. The level and types of noise impacts that would occur during construction are described below.

Impact NOI-1: Construction period activities for all components of the proposed project (wetland restoration, neighborhood park, residential uses, and school) could create significant short-term noise impacts on existing residential properties and on noise sensitive land uses within the project site that would become occupied before completion of the entire project (S).

Noise levels from grading and other construction activities for the proposed project may range up to 91 dBA L_{max} at the closest residential uses adjacent to the project site for very limited times when construction occurs near the project's boundary. Construction related noise impacts from the proposed project would be potentially adverse; however, compliance with the City's construction hours requirement would reduce the impact to a less-than-significant level.

Short-term noise impacts would be associated with excavation, grading, and erecting of buildings on site during construction of the proposed project. Construction related short-term noise levels would be higher than existing ambient noise levels in the project area but would no longer occur once construction of the project is completed.

Two types of short-term noise impacts could occur during the construction of the proposed project. First, construction crew commutes and the transport of construction equipment and materials to the site for the proposed project would incrementally increase noise levels on access roads leading to the site. Although there would be a relatively high single event noise exposure potential causing intermittent noise nuisance (passing trucks at 50 feet would generate up to a maximum of 86 dBA L_{max}), the effect on longer term (hourly or daily) ambient noise levels would be small. Therefore, short-term construction

Table IV.E-10: Typical Construction Equipment Maximum Noise Levels

Type of Equipment	Range of Maximum Sound Levels (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)
Pile Drivers	81 to 96	93
Rock Drills	83 to 99	96
Jackhammers	75 to 85	82
Pneumatic Tools	78 to 88	85
Pumps	68 to 80	77
Scrapers	83 to 91	87
Haul Trucks	83 to 94	88
Electric Saws	66 to 72	70
Portable Generators	71 to 87	80
Rollers	75 to 82	80
Dozers	85 to 90	88
Tractors	77 to 82	80
Front-End Loaders	86 to 90	88
Hydraulic Backhoe	81 to 90	86
Hydraulic Excavators	81 to 90	86
Graders	79 to 89	85
Air Compressors	76 to 89	85
Trucks	81 to 87	85

Source: Bolt, Beranek & Newman, 1987. *Noise Control for Buildings and Manufacturing Plants.*

related impacts associated with worker commute and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during excavation, grading, and erection of buildings on the project site. Construction is completed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the site and, therefore, the noise levels surrounding the site as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction related noise ranges to be categorized by work phase. Table IV.E-10 lists typical construction equipment noise levels recommended for noise impact assessments, based on a distance of 50 feet between the equipment and a noise receptor. Typical noise levels range up to 91 dBA L_{max} at 50 feet during the noisiest construction phases. The site preparation phase, which includes excavation and grading of the site, tends to generate the highest noise levels, because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backhoes, bulldozers, draglines, and front loaders. Earthmoving and compacting equipment includes compactors, scrapers, and graders. Typical operating cycles for these types of construction equipment may involve one or two minutes of full-power operation followed by three or four minutes at lower power settings.

Construction of the proposed project, including the park and wetland restoration components, is expected to require the use of earthmovers such as bulldozers and scrapers, loaders and graders, water trucks, and other trucks. Use of pile drivers and rock drills is not expected during construction of this project. As shown in Table IV.E-9, the typical maximum noise level generated by backhoes on the proposed project site is assumed to be 86 dBA L_{max} at 50 feet from the operating equipment. The maximum noise level generated by bulldozers is approximately 88 dBA L_{max} at 50 feet. The maximum noise level generated by water and other trucks is approximately 85 dBA L_{max} at 50 feet from these vehicles. Each doubling of the sound sources with equal strength would increase the noise level by 3 dBA. Assuming each piece of construction equipment operates at some distance apart from the other equipment, the worst-case combined noise level at the nearest residences during this phase of construction would be 91 dBA L_{max} at a distance of 50 feet from an active construction area.

The closest noise sensitive receptors would be the Indian Creek Apartments located south of the proposed project site at a distance of approximately 50 feet from the project property line, or the residents that occupy the site before construction is complete. At this distance the residences would be exposed to construction noise levels of up to 91 dBA L_{max}. Other receptors would be the residential land uses located south of Shearwater Parkway on Monaco Drive, north of Shearwater Parkway on Positano Circle. These residences, located approximately 100 feet from the project property line would be exposed to construction noise levels of up to 85 dBA L_{max}.

Components of the project that would become occupied before full build out of the project could also be exposed to construction related noise impacts. For example, completed planned residences could be impacted by construction related noise during completion of the elementary school, and vice-versa. The residences or school could be affected by grading activities for the wetland restoration if this occurs after the residences and school are built and occupied.

In compliance with City standards, implementation of the following multi-part mitigation measure for project construction would reduce potential construction period noise impacts from wetland restoration and construction of the residential and school components of the project to less-than-significant levels:

Both the project applicant and the Belmont-Redwood Shores School District shall be responsible for implementing the multi-part Mitigation Measure NOI-1a to NOI-1e.

> Mitigation Measure NOI-1a: The construction contractor shall limit all noise-producing construction related activities, including demolition, alteration, repair or remodeling of or to existing structures and the construction of new structures on property in a residential district or within 500 feet of a residential district in the City, to between the hours of 7:00 a.m. to 8:00 p.m., Monday through Friday of any week. No construction activity is permitted at any time on Saturdays, Sundays or holidays if the noise level generated by any such activity exceeds the local ambient noise levels measured at any point within the residential district and outside of the boundary of said property.
>
> Mitigation Measure NOI-1b: The construction contractor shall post a sign at all entrances to the work site prior to commencement of the work informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the property of the basic limitations upon noise and construction activities provided in the City's Municipal Code.
>
> Mitigation Measure NOI-1c: During all project site excavation and on-site grading, the construction contractor shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
>
> Mitigation Measure NOI-1d: The construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
>
> Mitigation Measure NOI-1e: The construction contractor shall locate equipment staging in areas that will create the greatest possible distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

Implementation of this multi-part mitigation measure would sufficiently mitigate construction-related noise impacts to a less-than-significant level. (LTS)

Impact NOI-2: Construction activities for all components of the proposed project (wetland restoration, neighborhood park, residential uses, and school) could generate significant groundborne vibration and groundborne noise. (S)

Vibrating objects in contact with the ground radiate vibration waves through various soil and rock strata to the foundations of nearby buildings. As the vibration propagates from the foundation throughout the remainder of a building, the vibration of floors and walls may cause perceptible vibration from the rattling of windows or a rumbling noise. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. When assessing annoyance from groundborne noise, vibration is typically expressed as root mean square (rms) velocity in units of decibels of 1 micro-inch per second. To distinguish vibration levels from noise levels, the unit is written as "VdB." Groundborne vibration is almost never annoying to people who are outdoors. Although the motion of

the ground may be perceived, without the effects associated with the shaking of the building, the motion does not provoke an adverse human reaction.

Human perception to vibration starts at levels as low as 67 VdB and sometimes lower. Annoyance due to vibration in residential settings starts at approximately 70 VdB. The proposed project would not generate permanent noise sources that would expose persons to excessive groundborne vibration or noise levels. Therefore, implementation of the proposed project would not permanently expose persons within or around the project site to excessive groundborne vibration or noise.

Construction activities associated with implementation of the proposed project could temporarily expose persons in the vicinity of the project site to excessive groundborne vibration or groundborne noise levels. Use of pile drivers and rock drills is not expected during construction of this project. Typical groundborne vibration levels measured at a distance of 50 feet from heavy construction equipment in full operation, such as bulldozers or other heavy tracked equipment, range up to approximately 94 VdB. Implementation of the following mitigation measure would reduce this impact to a less-than-significant level.

Both the project applicant and the Belmont-Redwood Shores School District shall be responsible for implementing Mitigation Measure NOI-2.

Mitigation Measure NOI-2: Implementation of Mitigation Measure NOI-1a though NOI-1e would reduce this impact to a less-than-significant level. (LTS)

(2) Operational Period Impacts. Significant long-term noise impacts that could be experienced as a result of the project include stationary noise impacts from outdoor recreational activity and parking lot activity noise sources.

Impact NOI-3: Nighttime activities on proposed recreational facilities, including the proposed public tennis courts and the elementary school outdoor recreational facilities, would generate exterior noise exceeding normally acceptable levels on adjacent land uses. (S)

Daytime (considered the hours of 7:00 a.m. to 10:00 p.m. for noise analysis) activities at the proposed outdoor recreational areas for the elementary school facility could generate noise levels that would exceed the City's exterior noise standards for noise sensitive land uses. However, these recreational areas are planned to be located on the western portion of the school site. Thus, the school buildings themselves would act as a sound barrier, blocking noise from activities on the outdoor recreational areas from impacting the proposed townhomes east of the school site. A buffer distance of approximately 280 feet would separate these recreational areas from existing residences located south of Shearwater Parkway on Monaco Drive. At this distance, daytime noise levels generated on the school's recreational areas would be reduced to less-than-significant levels for these sensitive receptors. Similarly, a buffer distance of approximately 700 feet would separate these recreational areas from the proposed townhomes to the southwest of the school site, effectively reducing daytime activity noise impacts in these recreational areas to less-than-significant levels for these sensitive receptors.

The neighborhood park component of the proposed project would include tennis courts that would be located within approximately 50 feet of proposed townhomes. Typical use of this facility would not

result in a substantial permanent increase in the daytime ambient noise levels. However, ambient noise levels in suburban environments typically drop off substantially during the night. Nighttime hours are from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). Nighttime activities on the proposed outdoor recreational areas would generate noise levels that would result in a substantial (more than 3 dBA) permanent increase in nighttime ambient noise levels, thus resulting in a significant impact. To reduce this impact to a less-than-significant level, the following two-part mitigation measure shall be implemented.

The project applicant shall be responsible for implementation of Mitigation Measure NOI-3a.

> Mitigation Measure NOI-3a: Noise producing activities at the proposed neighborhood park tennis courts shall be restricted to the hours of 7:00 a.m. to 10:00 p.m.

The Belmont-Redwood Shores School District shall be responsible for implementation of Mitigation Measure NOI-3b.

> Mitigation Measure NOI-3b: Noise producing activities on the planned outdoor recreational facilities at the elementary school outdoor activity areas shall be restricted to the hours of 7:00 a.m. to 10:00 p.m.

Implementation of this two-part mitigation measure would sufficiently mitigate recreational activity related noise levels to comply with the City's General Plan requirements and reduce the stationary noise impacts on adjacent land uses to a less-than-significant level. (LTS)

Impact NOI-4: Parking lot activities at the elementary school could generate long-term exterior noise exceeding normally acceptable levels on adjacent land uses. (S)

Activities on the proposed parking lot area of the elementary school facility could generate noise levels that would exceed the City's exterior noise standards for active outdoor activity areas for the planned townhomes if they are located within 50 feet of the parking lot area. Representative parking lot activities such as visitors or employees conversing, doors slamming, engine startup, and vehicles cruising at low speeds would generate approximately 60 to 70 dBA L_{max} at 50 feet. Final design plans for the townhomes are not known at this time. If outdoor active use areas (such as yards, porches, or balconies) are constructed for the townhomes and located within 100 feet of and with a direct view of the elementary school parking lot, mitigation would be required to reduce this noise impact. A direct view would include any direct line of sight to the parking lot not blocked by a structure such as a minimum 6-foot high wall or intervening building (foliage screened or "side views" from porches would be considered direct views). Construction of a 6-foot high sound barrier wall or wall/berm combination along the east side of the parking lot would provide more than 5 dBA in sound attenuation for all ground level receptors. For all second floor balconies constructed within 100 feet of the elementary school parking lot, a minimum 5 foot high wall constructed on the sides of the balcony with a direct view of the elementary school parking lot would reduce typical parking lot activity noise to a less-than-significant level.

Based on the EPA's Protective Noise Levels (EPA 550/9-79-100, November 1978), with a combination of walls, doors, and windows, standard construction for northern California residential buildings would provide more than 25 dBA in exterior to interior noise reduction with windows closed and 15

dBA or more with windows open. Therefore, with windows either open or closed, noise in the interior of these homes, attributable to the parking lot activities, would be reduced to a less-than-significant level.

The Belmont-Redwood Shores School District shall be responsible for implementation of Mitigation Measure NOI-4a.

> Mitigation Measure NOI-4a: To reduce school parking lot activity noise impacts to the Area H townhomes, a sound barrier wall or wall/berm combination, at least 6 feet in height, shall be constructed along the east side of the school property adjacent to the parking lot.

The project applicant shall be responsible for implementation of Mitigation Measure NOI-4b.

> Mitigation Measure NOI-4b: To reduce school parking lot activity noise impacts on active outdoor use areas within the Area H townhomes, a minimum 5 foot high barrier shall be constructed on any side of second floor townhouse balconies that have a direct view of and are located within 100 feet of the elementary school parking lot. This barrier shall be continuous with no vertical or horizontal gaps. The construction of the barrier may be of typical wall construction, or 4 foot high wall topped by 1 foot Plexiglas that is a minimum ½ inch thick or by glass that is a minimum ¼ inch thick, or similar construction.

Implementation of this two-part mitigation measure would sufficiently mitigate parking lot activity related noise levels to comply with the City's General Plan requirements and reduce the stationary noise impacts of the school on adjacent land uses to a less-than-significant level. (LTS)

d. Conclusion. The proposed project would have potentially significant impacts with respect to noise from construction activities; ground borne vibration and noise related to construction activities; noise from recreational activities, particularly at night; and from the school parking lot on nearby townhomes; however, implementation of Mitigation Measures NOI-1 through NOI-4 would reduce the potential impacts to a less-than-significant level.