APPENDIX O

ENVIRONMENTAL NOISE ANALYSIS

ENVIRONMENTAL NOISE ANALYSIS

POINT MOLATE RESORT CASINO PROJECT

Richmond, California

BBA Project No. 05-212

Prepared For

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INTRODUCTION

This document analyzes the potential short-term, long-term, and cumulative noise impacts resulting from the construction and operation of the Proposed Project. The Proposed Project involves a fee-to-trust transfer of approximately 415 acres at Point Molate in Richmond, California, and subsequent development of a resort and casino. The Proposed Project consists of the construction of a 182,000 square foot casino (to be housed within existing Winehaven building and a new adjacent structure), up to two hotels (500 rooms maximum) with ancillary restaurants and retail, a 150,000 square foot business, conference and entertainment center, and approximately 5,000 parking spaces. Existing historic cottages on the site will be restored and used as guest suites and related facilities for one of the luxury hotels. The Proposed Project would also include the development of a ferry terminal on the existing fueling pier; construction of a Bay Trail within the project limits; construction of public plazas; a shoreline park; a Tribal park (including park/government headquarters, Tribal dance grounds and roundhouse); and development of interior site shuttle facilities.

The Proposed Project would introduce noise sensitive land uses in proximity to Western Drive and other potentially significant noise sources. The Proposed Project would also result in increases in traffic on Highway 580 off- and on-ramps, and on adjacent local streets, which could affect existing residential areas and the new noise sensitive land uses. There are no noise sensitive land uses on, or immediately adjacent to, the project site at this time.

FUNDAMENTALS OF ACOUSTICS

Noise is often described as unwanted sound, and thus is a subjective reaction to the physical phenomenon of sound. Sound is variations in air pressure that the ear can detect.

The ear responds to pressure changes over a range of 10^{14} to 1. This is roughly equivalent to the range of 1 second as compared to 3.2 million years, or 1 square yard compared to the entire surface area of the earth. To deal with the extreme range of pressures which the ear can detect, researchers express the amount of acoustical energy of a sound by comparing the measured sound pressure to a reference pressure, then taking the logarithm (base 10) of the square of that number. This original unit of sound measurement, named the bel after Alexander Graham Bell, corresponded well to human hearing characteristics if it was divided by a factor of 10. The resulting unit, one tenth of a bel, is called the decibel, and is abbreviated as dB.

The threshold of hearing is considered to be zero (0) dB, and the range of sounds in normal human experience is 0 to 140 dB.

Because sound pressure levels are defined as logarithmic numbers, the values cannot be directly added or subtracted. For example, two sound sources, each producing 50 dB, will produce 53 dB when combined, not 100 dB. This is because two sources have two times the energy of one source, and 10 times the logarithm of 2 equals 3. Similarly, ten sources produce a 10 dB higher sound pressure level than one source, as ten times the logarithm of 10 equals 10.

The ear responds to pressure variations in the air from about 20 times per second to about 20,000 times per second. The frequency of the variations is described in terms of hertz (Hz), formerly called cycles per second. The ear does not respond equally to all frequencies. For example, we do not hear very low frequency sounds as well as we hear higher frequency sounds, nor do we hear very high frequency sounds very well. This difference in perceived loudness varies with the sound pressure level of the sound. In general, the maximum sensitivity of the ear occurs at frequencies between about 500 and 8000 Hz.

To compensate for the fact that the ear is not as sensitive at some frequencies and sound pressure levels as at others, a number of frequency weighting scales have been developed. The "A" weighting scale is most commonly used for environmental noise assessment, as sound pressure levels measured using an A-weighting filter correlate well with community response to noise sources such as aircraft and traffic.

When an A-weighting filter is used to measure sound pressure levels, the results may be expressed as *sound levels*, in decibels (dB). It is sufficient to use the abbreviation "dB" if these terms are well defined, but many people prefer to use the expressions dBA or dB(A) for clarity. For convenience, many people use the term "noise level" interchangeably with "sound level." Table 1 shows typical sound levels and relative loudness for various types of noise environments.

The ambient noise level is defined as the noise from all sources near and far. A similar term is background noise level. This term usually refers the ambient noise level that is present before a noise source being studied is introduced. A synonymous term is pre-project noise level.

Noise exposure contours or noise contours are lines drawn about a noise source representing constant levels of noise exposure. CNEL or L_{dn} (DNL) contours are frequently utilized to graphically portray community noise exposure. The terms CNEL and L_{dn} (DNL) are defined in the following section.

Most environmental noise sources produce varying amounts of noise over time, so the measured sound levels also vary. For example, noise produced during a train passage will vary from relatively quiet background levels before the event to a maximum value when the train passes by, then returning down to background levels as the train leaves the observer's vicinity. Similarly, noise from traffic varies with the number and types of vehicles, speed and proximity to the observer.

Variations in sound levels may be addressed by statistical methods. The simplest of these are the maximum (L_{max}) and minimum (L_{min}) noise levels, which are the highest and lowest levels observed. To describe less extreme variations in sound levels, other statistical descriptors may be used, such as the L_{10} and L_{50} and L_{90}. The L_{10} is the A-weighted sound level equaled or exceeded during 10 percent of a time period. Similarly, the L_{50} and L_{90} are the sound levels equaled or exceeded during 50 and 90 percent of a time period. The most common time period used with these statistical descriptors is 1 hour, although any time period could be used so long as it is stated.

Because statistical descriptors such as L_{10}, L_{50}, etc. are sometimes cumbersome to calculate, the equivalent sound level (L_{eq}) or energy average sound level is often used to describe the "average" sound level during stated time period, usually 1 hour.

TABLE 1
EXAMPLES OF A-WEIGHTED SOUND LEVELS AND RELATIVE LOUDNESS

Sound Source	Sound Level (dBA)	Relative Loudness (approximate)	Relative Sound Energy
Jet aircraft, 100 feet	130	128	10,000,000
Rock music with amplifier	120	64	1,000,000
Thunder, snowmobile (operator)	110	32	100,000
Boiler shop, power mower	100	16	10,000
Orchestral crescendo at 25 feet, noisy kitchen	90	8	1,000
Busy street	80	4	100
Interior of department store	70	2	10
Ordinary conversation, 3 feet away	60	1	1
Quiet automobile at low speed	50	½	.1
Average office	40	1/4	.01
City residence	30	1/8	.001
Quiet country residence	20	1/16	.0001
Rustle of leaves	10	1/32	.00001
Threshold of hearing	0	1/64	.000001

Source: U.S. Department of Housing and Urban Development, "Aircraft Noise Impact -- Planning Guidelines for Local Agencies," 1972.

The Community Noise Equivalent Level (CNEL) is calculated from hourly L_{eq} values, after adding a "penalty" to the noise levels measured during the evening (7 p.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) periods. The penalty for evening hours is a factor of 3, which is equivalent to 4.77 dB. The penalty for nighttime hours is a factor of 10, which is equivalent to 10 dB. To calculate L_{dn} (also called DNL), the evening penalty is omitted.

ENVIRONMENTAL SETTING

Ambient Noise and Vibration

Long-term ambient noise measurements were performed at a single location on the project site between June 28 and July 7, 2005, and at two locations on the project site between July 12 and July 20, 2007. These sites were selected from available, secure sites in two areas of the project site that were intended for noise-sensitive development. The sites also were intended to describe the overall 24-hour noise environment, which is dominated by distant traffic on Highway 580. The monitoring sites are shown in Figure 1. Continuous noise measurements were conducted to describe the day/night distribution of ambient traffic noise levels, and to calculate hourly noise levels and Day/Night Levels. Table 2 summarizes the noise measurement results. Appendix A presents the noise measurement data in graphic format.

A short-term noise measurement was conducted on July 12, 2007, to verify that the long-term noise measurement sites reasonably represented noise exposures in other portions of the project site. This noise measurement was performed at Site 3, for a period of 15 minutes beginning at 11 a.m. The noise measurement site is shown by Figure 1, and the results are presented in Table 3.

The sound measurement equipment used consisted of Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters equipped with B&K Type 4176 ½" microphones. The measurement equipment was calibrated immediately before measurements using an LDL CA-250 calibrator, to meet the specifications of the American National Standards Institute (ANSI) for Type 1 sound measurement systems. The microphones were placed at a height of about 6 feet above existing grade.

Noise measurements were conducted in terms of the L_{eq}, L_{max} and other statistical descriptors. The noise level measurements were used to determine statistical trends in ambient noise levels throughout the day and nighttime periods, as illustrated by Appendix A.

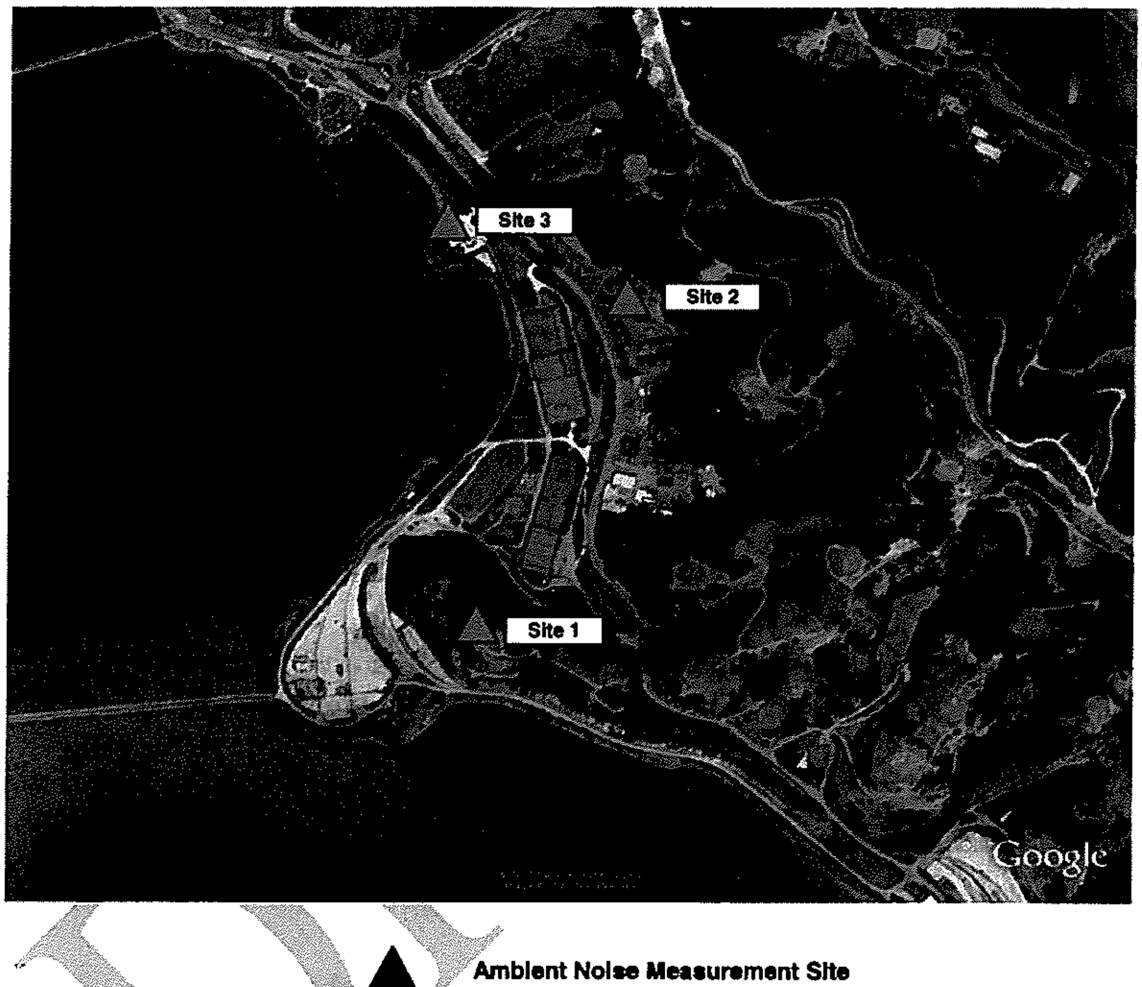
The dominant noise source at the monitoring locations was distant traffic on U.S. Highway 580. noise from nighttime Fourth of July celebrations appeared to affect ambient noise levels on July 4 and July 5, 2005. In 2007, noise from nearby brush-clearing activity occasionally elevated the noise levels for short periods.

In general, average daytime ambient noise levels are in the range of 50 dB at all locations, but may be elevated to between 50 and 55 dB at the site overlooking the San Francisco Bay under certain atmospheric conditions.

TABLE 2 MEASURED AMBIENT NOISE LEVELS POINT MOLATE PROJECT		
Date	Ldn, dB	
	Site 1	Site 2
June 29, 2005	50.7	--
June 30, 2005	52.2	--
July 1, 2005	52.4	--
July 2, 2005	56.0	--
July 3, 2005	53.7	--
July 4, 2005	58.7	--
July 5, 2005	62.3	--
July 6, 2005	59.7	--
July 13, 2007	52.1	52.4
July 14, 2007	53.1	52.1
July 15, 2007	53.1	51.9
July 16, 2007	52.4	52.1
July 17, 2007	51.8	52.9
July 18, 2007	52.0	52.3
July 19, 2007	50.3	52.3

TABLE 3 SHORT-TERM NOISE MEASUREMENT RESULTS POINT MOLATE SITE 3 July 12, 2007						
Sound Level, dB						
Leq	Lmax	L02	L08	L25	L50	L90
49.2	56.5	53	50	49	48	47

FIGURE 1
AMBIENT NOISE MEASUREMENT LOCATIONS



Other existing noise sources that are potentially significant include local traffic, adjacent industrial uses, and nighttime aircraft operations at Oakland International Airport.

There is relatively little local traffic on the surface roads (primarily Western Avenue) at this time, and there is a relatively high proportion of truck traffic as compared to residential areas.

The industrial uses adjacent to the Proposed Project include oil wells, pumps, and storage tanks. These operations generate relatively little noise, except that well maintenance may involve use of diesel-powered equipment. Most of the oilfield equipment nearby is shielded from view of the project site by topography.

In February 2002, the U.S. Navy prepared an EIS/EIR for the transfer of Point Molate to the City of Richmond. That document included a description of the existing noise environment, and noted that the dominant noise source on the site at that time was traffic on Western Drive. In addition, the EIS/EIR noted that Chevron has internal emergency sirens located near the ridgeline east of the project site, and that those sirens are tested on a weekly basis. The Navy report indicated that "because the sirens are distant from the proposed developed areas of the property, and testing is infrequent (currently, on a weekly basis), this effect is not expected to be significant."

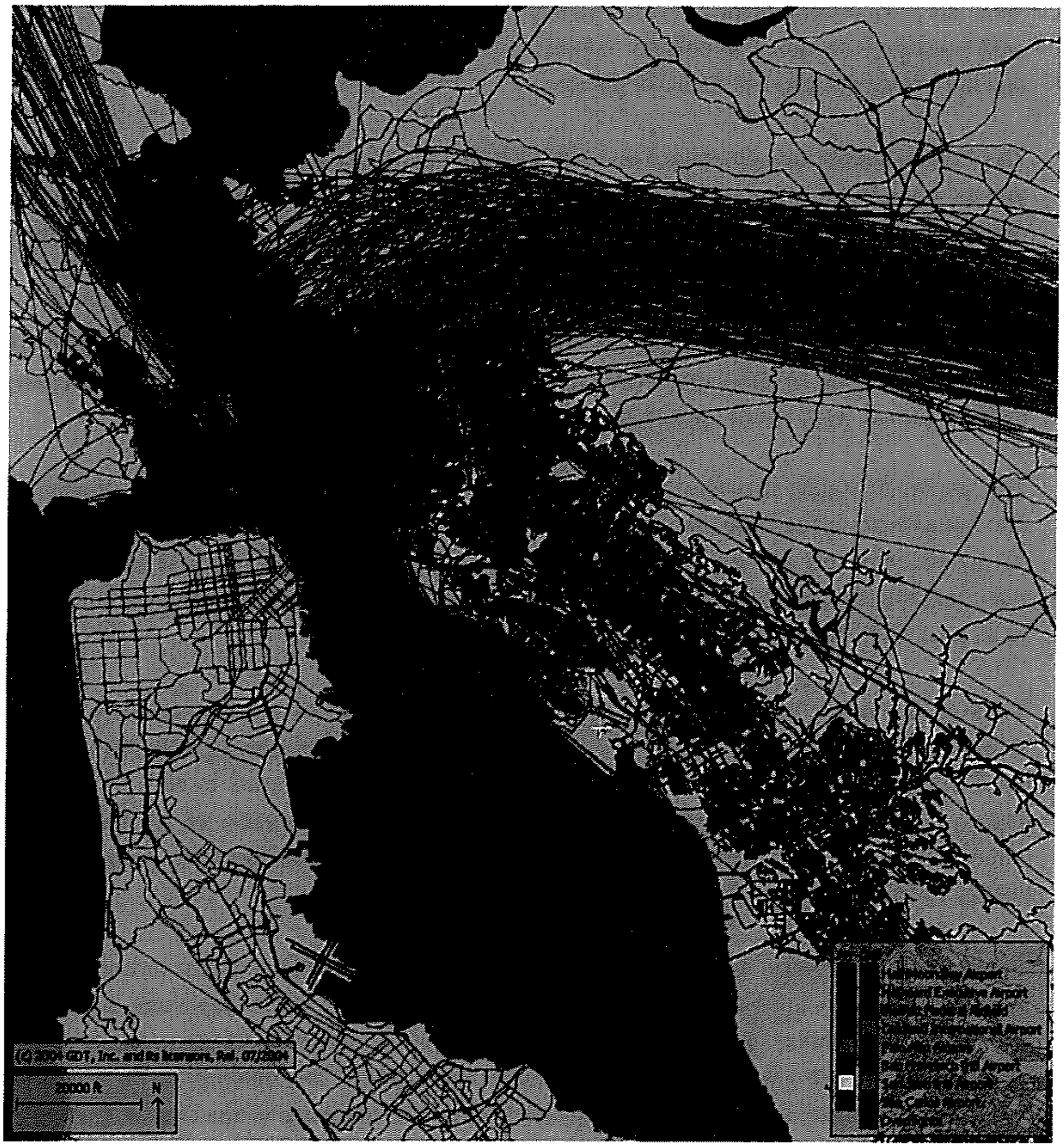
During nighttime hours, aircraft arriving at Oakland International Airport (OAK) may pass over or near the project site. To illustrate the nature of aircraft operations flying near the project site, staff at the Noise Abatement Office at OAK prepared a "gate" analysis for the period from about 11:30 a.m. December 10, 2007 to midnight December 14, 2007[1]. In that time period, the range of altitudes associated with a total of 115 OAK arrivals flying near Point Molate was from 4,950 to 7,100 feet above sea level. Figure 2 shows the flight tracks associated with OAK arrivals during the 48-hour period of December 2 and 3, 2007.

Based upon the long-term noise measurement results described above for June and July of 2005 and 2007, the cumulative noise exposure that included these aircraft noise events was well below 60 dB L_{dn} or CNEL.

Based upon the field investigations conducted by Brown-Buntin Associates, Inc. (BBA) in 2005 and 2007, there are currently no sources of perceptible vibration in the areas proposed for residential uses.

[1] Personal communication with Wayne Bryant, January 4, 2008.

FIGURE 2
TYPICAL OAK ARRIVAL FLIGHT TRACKS
DECEMBER 2-3, 2007



Traffic Noise

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used for the prediction of traffic noise levels. The model is based upon the CALVENO noise emission factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to receiver, and the acoustical characteristics of the site.

The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is considered to be accurate within 1.5 dB. To predict L_{dn} values, it is necessary to determine the day/night distribution of traffic and to adjust traffic volume input data to yield an equivalent hourly traffic volume.

Inputs to the FHWA model include the Average Daily Traffic volume (ADT), daytime/nighttime traffic distribution, medium and heavy truck percentages, and vehicle speed. The existing daily traffic volumes were based upon data supplied by the project traffic consultant.

The day/night traffic distribution was based upon the noise measurements conducted in July 2007 at ambient noise measurement Site 1. The FHWA model inputs are shown in Appendix B. An acoustically soft site was assumed. Based upon field experience, traffic noise levels at upper story building facades (e.g., at multi-story buildings adjacent to major roadways) are expected to be at least 3 dB higher than the noise levels reported below.

Table 4 shows the predicted worst-case traffic noise levels for existing traffic volumes at a reference distance of 50 feet from the centerlines of the major roadways adjacent to and within the Proposed Project. The reference distance for I-580 was assumed to be 150 feet from the freeway centerline. These distances represent the possible location of a typical first-floor building facade facing each roadway, and may be used to approximate the noise exposure for typical noise sensitive uses.

For existing residential land uses off the project site, the existing traffic noise levels at the reference distances approach or exceed "Clearly Unacceptable" noise exposures as described by the City of Richmond General Plan. However, since the proposed noise sensitive uses in the project site are well removed from the roadways listed above, the existing traffic noise levels at the nearest proposed noise sensitive uses satisfy the noise standards of the City of Richmond.

TABLE 4
EXISTING TRAFFIC NOISE LEVELS

Roadway Name	Segment Description: Between	Predicted Ldn, dB, at Reference Distance
Western Drive	Project Entrance and Marina	51.2
Richmond Parkway	Redwood Way and Hensley Street	74.0
Richmond Parkway	Hensley Street and Gertrude Street	73.9
Richmond Parkway	Gertrude Street and Parr Boulevard	75.9
Richmond Parkway	Parr Boulevard and San Pablo Avenue	74.7
Richmond Parkway	San Pablo Avenue and Blume Drive	74.5
EB I-580 off ramps	Standard Avenue and Castro Street	72.7
Garrard Boulevard	WB I-580 ramps and Ohio Avenue	71.2
Canal Boulevard	WB I-580 ramps and Cutting Boulevard	70.1
Garrard Boulevard	Macdonald Avenue and Barrett Avenue	71.4
I-580	Canal and Western	74.3
Source: Brown-Buntin Associates, Inc., 2008		

REGULATORY SETTING

City of Richmond

Noise Element of the General Plan

Criteria for evaluating noise impacts in the City of Richmond are set forth in the Noise Element of the General Plan, adopted in 1994 (as amended through 1998). The goal of the Noise Element with respect to community noise is to "control the level of noise pollution in the community by preventing the development of incompatible land uses, rather than relying entirely on acoustical techniques after the fact, such as sound walls, buffers, etc."

The City has adopted the land use compatibility matrix that is presented in the State General Plan Guidelines, the current version of which is reproduced as Figure 3 below.

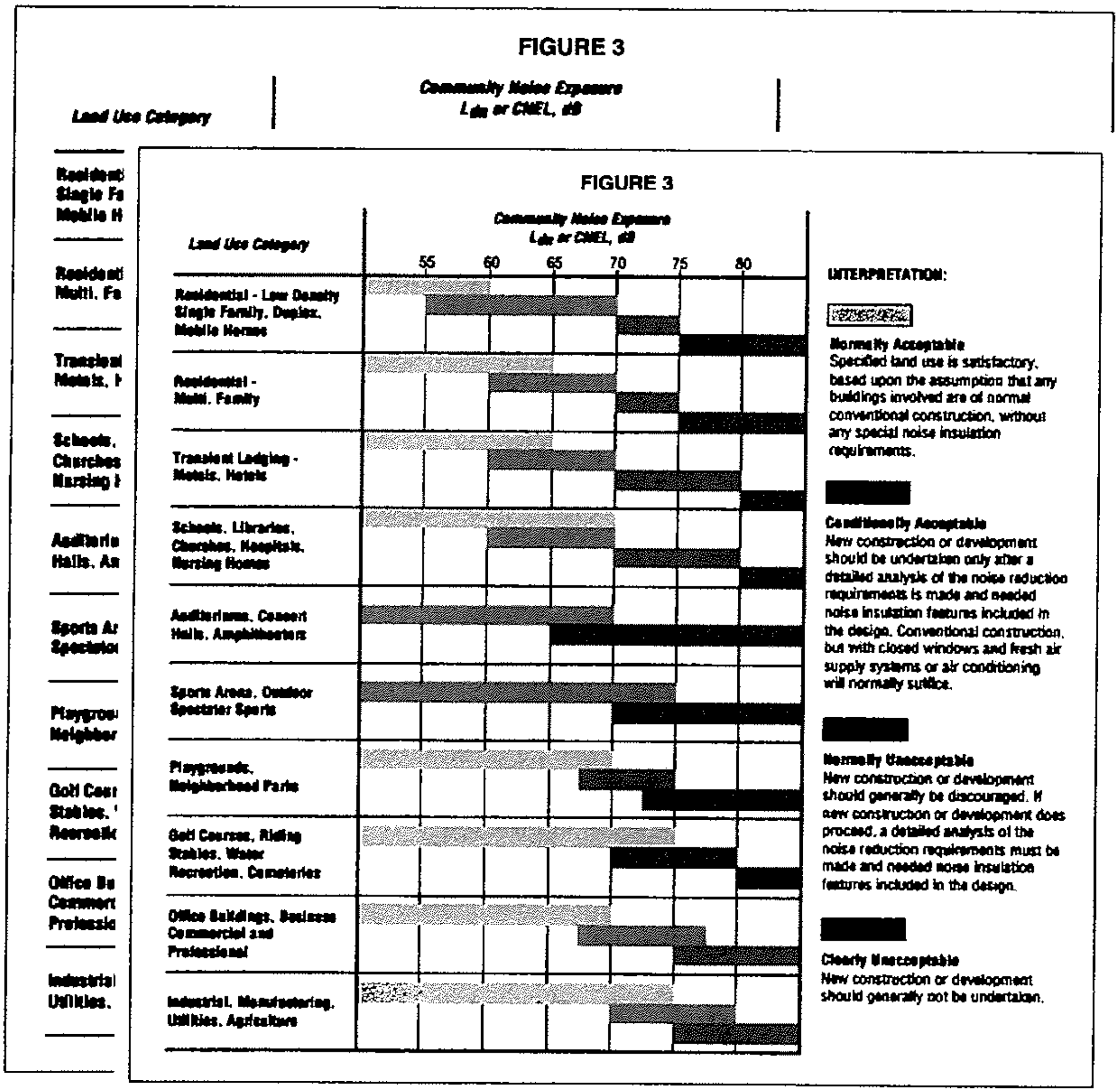


FIGURE 3
Land Use Category
Community Noise Exposure
Ldn or CNEL, dB
55
60
65
70
75
80
Residential - Low Density Single Family, Duplex, Mobile Homes
Residential - Multi. Family
Transient Lodging - Motels, Hotels
Schools, Libraries, Churches, Hospitals, Nursing Homes
Auditoriums, Concert Halls, Amphitheaters
Sports Arena, Outdoor Spectator Sports
Playgrounds, Neighborhood Parks
Golf Courses, Riding Stables, Water Recreation, Cemeteries
Office Buildings, Business Commercial and Professional
Industrial, Manufacturing, Utilities, Agriculture
INTERPRETATION:
Normally Acceptable
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
Normally Unacceptable
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable
New construction or development should generally not be undertaken.

The most relevant Noise Element policies are listed below:

NE-A.1 Discourage development, where such development will significantly increase existing noise levels, unless mitigation measures are designed as part of the project to limit noise emissions to an acceptable level compared to the existing sound level.

NE-A.2 Develop criteria establishing proper site planning and building orientation that will lessen noise intrusion and minimize noise elements.

NE-A.3 Utilize the building code to establish standards which would require sound insulation to control sound transmission within and from outside structures.

NE-A.4 Avoid land uses that place residential dwellings with "heavy" industrial and maritime uses.

NE-A.6 Require new commercial and industrial developments with potential noise and vibration producing activities to provide noise study reports prepared by a qualified professional with demonstrated experience in noise control engineering.

NE-A.7 Require new developments of proposed noise sensitive uses locating in noise impacted areas of L_{dn} 55 or greater to provide noise study reports prepared by a qualified professional with demonstrated experience in noise control engineering.

Richmond Municipal Code

The noise level performance standards of the Richmond Municipal Code (Chapter 9) are described below:

9.52.100 Exterior noise limits.

(a) No uses or activities shall create levels which exceed the following standards:

CITY OF RICHMOND COMMUNITY NOISE ORDINANCE EXTERIOR NOISE LIMITS			
Zoning District:	**Maximum Noise Level in dBA (levels not to be exceeded more than 30 minutes in any hour)**		**Maximum Noise Level in dBA (level not to be exceeded more than 5 minutes in any hour)**
	Measured at Property Line or District Boundary	**Measured at Any Boundary of a Residential Zone**	**Between 10 PM and 7AM***, Measured at Any Boundary of a Residential Zone**
Single-Family Residential	60		
Multifamily Residential	65		
Commercial	70	60	50 or ambient noise level
Lt. Industrial and Office Flex*	70	60	50 or ambient noise level
Heavy and Marine Industrial	75	65	50 or ambient noise level
Public Facilities and Community Use	65	60	50 or ambient noise level
Open Space and Recreational Districts	65	60	50 or ambient noise level

* For M-1 and M-2 the measurement will be at property lines.
** For M-3 and M-4 the measurement will be at boundary of the district.
*** Restricted hours may be modified through condition of an approved conditional use permit.

(b) In determining whether any noise exceeds the maximum exterior noise limits set forth in this section, measurements shall be taken at the property line of the property from which the noise emanates, except that for noise emanating from property in an M-3 or M-4 zoning districts, measurement shall be taken at boundary of the zoning district in which the property is located.

(c) No person shall operate or cause to be operated within a dwelling unit, any source of sound that causes the sound level when measured inside a neighboring receiving dwelling unit to exceed the allowable noise level, for any period of time

.

(d) In the event the noise, as judged by the enforcing authority, contains a steady, pure tone such as a whine, screech or hum, or is an impulsive sound such as hammering or riveting, or contains music or speech, the standard limits set forth above shall be reduced by 5 decibels.

(e) The exterior noise limits for any source of noise within any residential zone shall be reduced by 10 dBA between 10:00 p.m. and 7:00 a.m. The exterior noise limits for any source of noise in any zone other than a residential zone shall be reduced between 10:00 p.m. and 7:00 a.m. so that when measured at the property line of a "noise-sensitive use" the noise does not exceed 50 dBA.

The Municipal Code, Chapter 9, also establishes restrictions on construction activities to limit noise impacts. The following activities are prohibited:

Construction Activities. Causing or permitting the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work at any time between the hours of 7 p.m. and 7 a.m. on weekdays or 6 p.m. and 8:30 a.m. on weekends and legal holidays in any residential or commercial zoning district or adjacent to any noise-sensitive uses or so as to create a noise disturbance or cause any violation of this chapter. Prior to commencing any construction project, the project sponsor may meet and confer with the City Public Works Department to establish an appropriate construction schedule which is designed to minimize construction noise impacts and which is in conformity with the requirements of this subsection. Where construction activities on a construction project which is adjacent to any noise-sensitive use(s) are anticipated to last for a year or more, temporary noise barriers shall be constructed that break the line of sight between the noise-sensitive use(s) and the construction project, and that minimize noise impacts.

(b) Factors which will be considered in determining whether a violation of subsection (a) of this section has occurred, shall include, but not be limited to, the following:
(1) The intensity of the ambient noise;
(2) The proximity of the noise to residential and commercial areas;
(3) The zoning of the area within which the noise emanates (i.e., residential, commercial, open space, etc.);
(4) The number of persons affected by the noise source;
(5) The time of day or night the noise occurs;
(6) The duration of the noise (i.e., term, continuation, life, etc.);
(7) The intensity of the noise (i.e., pitch, tone, content, etc.).

State of California

The State Building Code (Part 2, Title 24, California Code of Regulations) provides that, consistent with local land use standards, residential structures located in noise critical areas, such as proximity to highways, county roads, city streets, railroads, rapid transit lines, airports or industrial areas, shall be designed to prevent the intrusion of exterior noises beyond the prescribed interior noise level of 45 dB CNEL (or L_{dn}).

Residential structures to be located where the annual L_{dn} or CNEL exceeds 60 dB shall require an acoustical analysis showing that the proposed design will achieve the prescribed allowable interior noise level.

Vibration Exposure Guidelines

Vibration assessment methodology and criteria have been described by the Federal Transit Administration (FTA) document entitled Transit Noise and Vibration Assessment, dated April 1995. In this document, the criteria for ground-borne vibration are expressed in terms of the "vibration velocity level", in VdB, with a reference velocity of 10^{-6} in/sec. These criteria are applied to railroad projects using federal funding.

The threshold of vibration perception is taken by the FTA to be 65 VdB, and the threshold of potential architectural damage to fragile structures is about 100 VdB. For residential and hospital uses, vibration levels less than 72 VdB are considered acceptable for exposures to more than 70 vibration events per day, and vibration levels less than 80 VdB are considered acceptable for exposures to fewer than 70 vibration events per day. For institutional uses with daytime activity, such as offices, these standards are relaxed to 75 VdB and 83 VdB, respectively.

In addition, Caltrans has prepared guidelines for acceptable vibration limits for transportation and construction projects in terms of the induced peak particle velocity (PPV). Tables 19 and 20 of the Caltrans "Transportation- and Construction-induced Vibration Guidance Manual"[2] are reproduced below:

Table 19. Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old building	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial building	2.00	0.50

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

[2] Jones & Stokes. 2004. *Transportation- and construction-induced vibration guidance manual.* June. (J&S 02-039.) Sacramento, CA. Prepared for California Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office, Sacramento, CA.

Table 20. Guideline Vibration Annoyance Potential Criteria		
Human Response	**Maximum PPV (in/sec)**	
	Transient Sources	**Continuous/Frequent Intermittent Sources**
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.90	0.10
Severe	2.00	0.40
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.		

SIGNIFICANCE CRITERIA

CEQA requires that significant environmental impacts be identified, and that such impacts be eliminated or mitigated to the extent feasible. A significant effect from noise may exist if a project would result in:

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

Absolute Noise Level Criteria

For non-transportation noise sources affecting single-family residential land uses, the exterior noise thresholds of significance are a daytime (7 a.m. to 10 p.m.) median (L_{50}) value of 60 dB, and a nighttime L_{08} value (not to be exceeded for more than 5 minutes in any hour) of 50 dB, or the ambient noise level. For multi-family residential uses, the daytime exterior threshold is a median value of 65 dB, and the nighttime L_{08} standard is 50 dB, or the ambient noise level.

For transportation noise sources affecting residential land uses, the exterior noise threshold of significance is 60 dB L_{dn}/CNEL, except that an exterior noise level of up to 70 dB Ldn/CNEL may be allowed, provided that practical exterior noise level reduction measures have been implemented and that an interior noise level standard of 45 dB L_{dn}/CNEL is achieved.

For transportation noise sources affecting transient lodging, the exterior noise threshold of significance is 65 dB L_{dn}/CNEL, except that an exterior noise level of up to 70 dB L_{dn}/CNEL may be allowed, provided that practical exterior noise level reduction measures have been implemented and that an interior noise level standard of 45 dB L_{dn}/CNEL is achieved..

Increases in Noise Exposure

For non-transportation noise sources affecting noise sensitive land uses, most jurisdictions consider an increase in ambient noise levels of 3 dB to be potentially significant. This amount of change in environmental noise levels is generally considered to be perceptible, though not necessarily clearly noticeable, by most people. This is the threshold of noise impact applied to this analysis for noise sensitive land uses affected by non-transportation noise sources.

Some additional guidance as to the significance of changes in ambient noise levels is provided by the 1992 findings of the Federal Interagency Committee on Noise (FICON), which assessed the annoyance effects of changes in ambient noise levels resulting from aircraft operations. The FICON findings are based upon studies that relate aircraft and traffic noise levels to the percentage of persons highly annoyed by the noise. Annoyance is a summary measure of the general adverse reaction of people to noise that generates speech interference, sleep disturbance, or interference with the desire for a tranquil environment.

The rationale for the FICON findings is that it is possible to consistently describe the annoyance of people exposed to transportation noise in terms of L_{dn} or CNEL. The changes in noise exposure that are shown in Table 5 are expected to result in equal changes in annoyance at sensitive land uses. Although the FICON findings were specifically developed to address aircraft noise impacts, they are considered in this analysis as the thresholds of noise impacts for traffic noise.

TABLE 5
POTENTIALLY SIGNIFICANT INCREASES IN CUMULATIVE NOISE EXPOSURE FOR TRANSPORTATION NOISE SOURCES

Ambient Noise Level Without Project (Ldn or CNEL)	Change in Ambient Noise Level Due to Project
<60 dB	+5.0 dB or more
60-65 dB	+3.0 dB or more
>65 dB	+1.5 dB or more

Source: Federal Interagency Committee on Noise (FICON), 1992, as applied by Brown-Buntin Associates, Inc.

NOISE IMPACT ASSESSMENT

The FHWA Highway Traffic Noise Prediction Model was used to predict traffic noise levels for future conditions. The reference distances are 50 feet from the centerlines of the major roadways adjacent to the Proposed Project, and 150 feet from the I-580 centerline. These distances represent the possible location of a typical first-floor building facade facing each roadway, and may be used to approximate the noise exposure for typical noise sensitive uses. Table 6 shows the predicted worst-case traffic noise levels for existing and projected traffic volumes at the reference distances cited above. Upper-floor receivers adjacent to the roadways would be exposed to noise levels about 3 dB higher than shown, due to reduced ground absorption of sound.

With the exception of Western Drive, the traffic noise levels predicted at the reference distances approach or exceed "Clearly Unacceptable" noise exposures for residential land uses, as described by the City of Richmond General Plan. However, the affected land uses are existing properties outside the Project area, and are not modified by the Project.

The predicted future traffic noise levels at the nearest proposed residential land uses within the Project would exceed the noise standards of the City of Richmond.

TABLE 6 PREDICTED FUTURE TRAFFIC NOISE LEVELS					
Roadway Name	**Segment Description: Between**	**Predicted Ldn, dB at Reference Distance by Scenario**			
		Background	**Background Plus Project**	**2025**	**2025 + Project**
Western Drive	Project Entrance and Marina	51.2	69.2	52.6	71.1
Richmond Parkway	Redwood Way and Hensley Street	74.0	74.2	74.6	74.8
Richmond Parkway	Hensley Street and Gertrude Street	73.9	74.1	74.9	75.0
Richmond Parkway	Gertrude Street and Parr Boulevard	75.9	76.2	76.9	77.1
Richmond Parkway	Parr Boulevard and San Pablo Avenue	74.7	75.0	75.5	75.7
Richmond Parkway	San Pablo Avenue and Blume Drive	74.5	74.9	76.0	76.3
EB I-580 off ramps	Standard Avenue and Castro Street	72.7	72.9	73.3	73.5
Garrard Boulevard	WB I-580 ramps and Ohio Avenue	71.2	71.8	72.3	72.7
Canal Boulevard	WB I-580 ramps and Cutting Boulevard	70.1	70.1	70.4	70.4
Garrard Boulevard	Macdonald Avenue and Barrett Avenue	71.4	71.9	73.8	74.0
I-580	Canal and Western	74.3	74.4	77.3	77.3
Source: Brown-Buntin Associates, Inc., 2007					

Table 7 shows the differences between predicted noise levels for the future scenarios, comparing the noise levels with and without the Project.

TABLE 7 CHANGES IN PREDICTED FUTURE TRAFFIC NOISE LEVELS					
Roadway Name	**Segment Description: Between**	**Difference, dB at Reference Distance by Scenario**			
		Background	**Background Plus Project Minus Background**	**2025 Minus Background**	**2025 + Project Minus 2025 No Project**
Western Drive	Project Entrance and Marina	N/A	18.3	1.4	18.5
Richmond Parkway	Redwood Way and Hensley Street	N/A	0.2	0.6	0.2
Richmond Parkway	Hensley Street and Gertrude Street	N/A	0.2	0.9	0.1
Richmond Parkway	Gertrude Street and Parr Boulevard	N/A	0.2	0.9	0.2
Richmond Parkway	Parr Boulevard and San Pablo Avenue	N/A	0.3	0.8	0.3
Richmond Parkway	San Pablo Avenue and Blume Drive	N/A	0.3	1.5	0.2
EB I-580 off ramps	Standard Avenue and Castro Street	N/A	0.3	0.6	0.2
Garrard Boulevard	WB I-580 ramps and Ohio Avenue	N/A	0.5	1.1	0.4
Canal Boulevard	WB I-580 ramps and Cutting Boulevard	N/A	0.0	0.3	0.0
Garrard Boulevard	MacDonald Avenue and Barrett Avenue	N/A	0.4	2.3	0.3
I-580	Canal and Western	N/A	0.1	3.0	0.0
Note: Shaded cells indicate a significant change in traffic noise levels due to project-related traffic.					
Source: Brown-Buntin Associates, Inc., 2007					

Based upon Table 7, the Proposed Project would result in no significant increases in traffic noise levels along the roadways that are outside of the project area. The increase in traffic noise levels within the project site and along the access roadway would be significant for noise sensitive receivers. However, there are currently no noise sensitive receivers on the project site or in its vicinity, so there is no significant noise impact. Residents within the project site after development would experience a change of 0.2 dB between the project build date of about 2012 and the year 2025, which would be imperceptible.

Interior Traffic Noise

Typical facade construction in accordance with the Uniform Building Code will provide an exterior to interior traffic noise reduction of 20 to 25 dB. Compliance with the interior noise standard of 45 dB L_{dn} can therefore be expected with standard energy-conserving construction practices where the affected buildings are outside the 65 dB L_{dn} contour.

For new noise sensitive uses close to Western Drive, exterior traffic noise exposures are expected to be exceed 65 dB L_{dn}.

HVAC Noise

Commercial/retail uses would bring the possibility of noise conflicts due to operations of roof-mounted air handling units associated with building heating, ventilation and air conditioning (HVAC). The noise levels produced by HVAC systems vary with the capacities of the units, as well as with individual unit design. In this case, the commercial buildings would be located at the same grade as the residential area, so that the buildings themselves will tend to shield the HVAC units. It is not possible to calculate HVAC unit noise levels at this stage of the project design. However, standard HVAC systems are not expected to cause a significant noise impact at the adjacent residential land uses.

Refuse Handling Noise

The Project would result in the introduction of commercial and business uses in close proximity to proposed residential uses, with the attendant refuse handling activity. Noise levels due to typical refuse trucks may be as high as 84 dB at 50 feet. Noise conflicts may arise when garbage pickup occurs adjacent to residential uses at nighttime or early morning. Nighttime refuse handling could produce noise levels affecting sleep. Commercial facilities could employ waste or box compactors, which would be potentially significant noise sources.

Vibration

Residential and commercial/retail uses do not ordinarily include sources of perceptible vibration. Therefore, Project-related vibration is expected to be less than significant.

Construction Equipment Noise

Construction activities that could produce potentially significant noise levels include use of pile drivers, engine-powered equipment, power tools, impact sounds and vehicles. It is not expected that blasting will be required. Construction noise effects would be primarily related to the use of pile drivers and powered equipment, and the duration and timing of the construction is of potential concern. Table 8 lists the noise levels associated with typical construction equipment.

The actual period of construction associated with the project would vary with the location of the receiver, and it should be noted that the noise exposure for a given receiver would not be constant over the construction period. Instead, there are likely to be relatively short periods (days or weeks) of intense activity, separated from one another by days or weeks. The overall time frame for noise exposure at a given receiver would probably be limited to a few months. The Project would not result in construction activities in close proximity to existing residential uses. However, phased development could result in construction occurring while residential uses are present.

TABLE 8
CONSTRUCTION EQUIPMENT NOISE LEVELS

CONSTRUCTION PHASE	Loudest Construction Equipment	Equipment Noise Level at 50 feet (dBA)
Site Clearing and Excavation	Dump Truck	84
	Backhoe	80
Prior to Steel Erection	Impact Pile Driver	95
Concrete Pouring	Concrete Pump Truck	82
	Concrete Mixer Truck	85
Steel Erection	Crane	85
	Jack Hammer	85
Mechanical	Crane	85
	Pneumatic Tools	85
Clean-Up	Front End Loader	80
	Flat Bed Truck	84

WA Roadway Construction Noise Model User's Guide, January 2006.

Construction Equipment Vibration

Pile drivers, jackhammers and some heavy powered construction equipment could produce potentially significant vibration levels. Table 9 lists vibration levels expected for representative heavy powered equipment and pile drivers.

The actual period of construction associated with the project would vary with the location of the receiver, and it should be noted that the noise exposure for a given receiver would not be constant over the construction period. Instead, there would be a relatively short period (weeks) of intense pile driving activity. Other periods of construction activity could occur for days or weeks, separated from one another by days or weeks. The overall time frame for noise exposure at a given receiver would probably be limited to a few months. The Project would not involve construction or pile driving in close proximity to existing residential uses. However, phased development could result in construction and pile driving for mid-level and high-rise buildings occurring while residential uses are present. Of these vibration sources, pile driving has the greatest potential to result in a significant impact.

TABLE 9
CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Equipment		PPV at 25 feet (in/sec)	Vibration Level at 25 feet (VdB)
Impact Pile Driver	Upper range	1.518	112
	Typical	0.644	104
Vibratory (Sonic) Pile Driver	Upper range	0.734	105
	Typical	0.170	93
Clam shovel drop		0.202	94
Large bulldozer		0.089	87
Caisson Drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Federal Transit Administration, Transit Noise and Vibration Assessment, April 1995

IMPACT STATEMENTS AND MITIGATION MEASURES

Impact

Traffic Noise Impact

The Project would result in the exposure of future residences in the project area to traffic noise in excess of standards established in the City of Richmond General Plan. This noise source is a significant impact.

Mitigation Measure

Traffic Noise Impact

Items (a) through (c) provide a discussion of the practicality of potential noise mitigation measures. Implementation of items (d) and (e) will assure that the Proposed Project will result in a less than significant impact.

(a) Appropriate noise mitigation measures for exterior traffic noise exposures would include some combination of setbacks, noise barriers, and building design, depending upon the specific conditions.

(b) The required setbacks to ensure compliance of residential areas with the City of Richmond exterior noise standard of 60 dB L_{dn} under cumulative conditions would be about 275 feet from the centerline of Western Drive. Application of this setback could have a significant effect on the site design, and may be impractical.

(c) The methods required to mitigate interior noise exposures would also depend on the locations of the future residences relative to the roadways. In general, if the exterior traffic noise exposure is 65 dB L_{dn} or less, no exceptional construction techniques would be required. A setback of residences of about 125 feet from the centerline of Western Drive would ensure that exterior noise exposures would be less than 65 dB L_{dn}.

(d) In accordance with the City of Richmond General Plan, acoustical analyses should be prepared to describe the methods required to achieve the interior noise standard of 45 dB CNEL or L_{dn}. To the extent feasible, noise control measures, such as berms, building setbacks, structural design features, or other measures, should be incorporated into the development project design and construction of specified sound rating for each building element to achieve the interior noise level standard. The acoustical analysis must be provided to the City for review and approval either with, or before, the submittal of building plans.

(e) The project applicant should incorporate site-specific features in the design of residential developments on the project site that reduce noise exposure at outdoor activity areas (e.g., private balconies and common outdoor activity areas). For instance, outdoor activity areas that are part of multifamily residential developments could be located such that the building(s) serve as a sound barrier to the nearest predominant noise source. Balconies, however, should not be prohibited on the basis of noise exposure so long as applicable interior noise standards are achieved and so long as an outdoor activity area that satisfies the exterior noise standards is available to the residents.

Impact

Refuse Handling Noise

Refuse handling could result in significant noise impacts.

Mitigation Measure

Refuse Handling Noise

The following mitigation measure will assure that the Proposed Project will result in a less than significant impact.

Garbage dumpsters and commercial loading and unloading areas should be located as far as reasonably possible from existing off-site sensitive receptors, as well as from common outdoor activity areas of proposed multifamily residential buildings. They should also be located such that buildings shield nearby residential land uses from noise generated by loading dock and garbage collection activities. If determined necessary by the City, additional sound barriers should be constructed at these activity sites to protect existing and planned residential uses. Feasible shielding measures should be identified to reduce project-related noise impacts to a less than significant level by demonstrating compliance with the maximum allowable noise limits of the Municipal Code.

Impact
Construction Equipment Noise

Noise due to construction activities could result in a significant impact.

Mitigation Measure

Construction Equipment Noise

The following mitigation measures will assure that the Proposed Project will result in a less than significant impact.

(a) Construction activities should be limited to daytime hours (7 a.m. to 7 p.m.), Monday through Friday.
(b) Engine-powered construction equipment should be fitted with adequate mufflers and enclosures as supplied by the manufacturer, maintained in good condition.
(c) Engine-powered construction equipment located adjacent to residential uses for more than 5 days should be shielded from those uses by temporary barriers.

Impact

Construction Equipment Vibration

Vibration due to construction activities could result in a significant impact.

Mitigation Measure

Construction Equipment Vibration

The following mitigation measures will assure that the Proposed Project will result in a less than significant impact.

(a) Pile driving should be limited to daytime hours (7 a.m. to 7 p.m.), Monday through Friday.
(b) Earth-moving equipment should be operated as far away from occupied vibration-sensitive uses as reasonably possible.
(c) Construction should be scheduled so that earth-moving equipment and pile driving do not occur simultaneously in close proximity to occupied vibration-sensitive uses.

(d) To the extent feasible, the project structures should be designed so that driven piles are placed at least 100 feet from occupied residences. If pile driving is required within that distance, vibratory (sonic) pile driving should be used.

(e) Holes for driven piles should be pre-drilled to the maximum feasible depth.