Environmental Noise Assessment

C & J Parcel Map

El Dorado County, California

BAC Job # 2017-021

Prepared For:

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Exhibit F

Introduction

The C&J Parcel Map (project) proposes the subdivision of a 38.5 acre lot (APN 037-010-72) located just north of Highway 50 in El Dorado County, California. The project area and tentative parcel map are shown in Figures 1 and 2, respectively. As shown in Figure 2, the project proposes to subdivide the project parcel into three separate parcels ranging in size from 10 acres to 18.5 acres.

Due to the proximity of the project site to Highway 50, Bollard Acoustical Consultants, Inc. (BAC) was retained by the project applicant to prepare this analysis. Specifically, the purpose of this analysis is to quantify noise levels associated with traffic on Highway 50, and to compare those levels against the applicable El Dorado County standards for acceptable exterior and interior noise exposure at the proposed lots.

Noise Fundamentals and Terminology

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard, and thus are called sound. Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness. Appendix A contains definitions of Acoustical Terminology. Figure 3 shows common noise levels associated with various sources.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels in decibels.

Community noise is commonly described in terms of the “ambient” noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

Legend

- Project Parcel (APN: 037-010-72)
- Highway 50

N

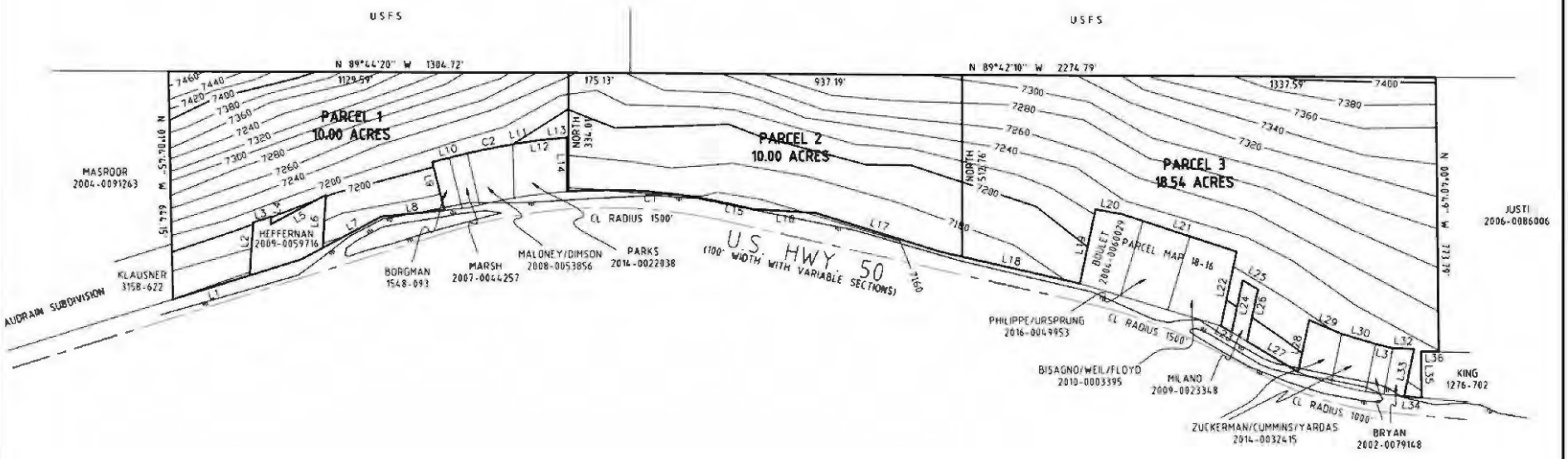
Scale (feet)

0 500 1,000

Figure 1

Project Area

C&J Parcel Map - El Dorado County, California



N

Scale (feet)

0 200 400

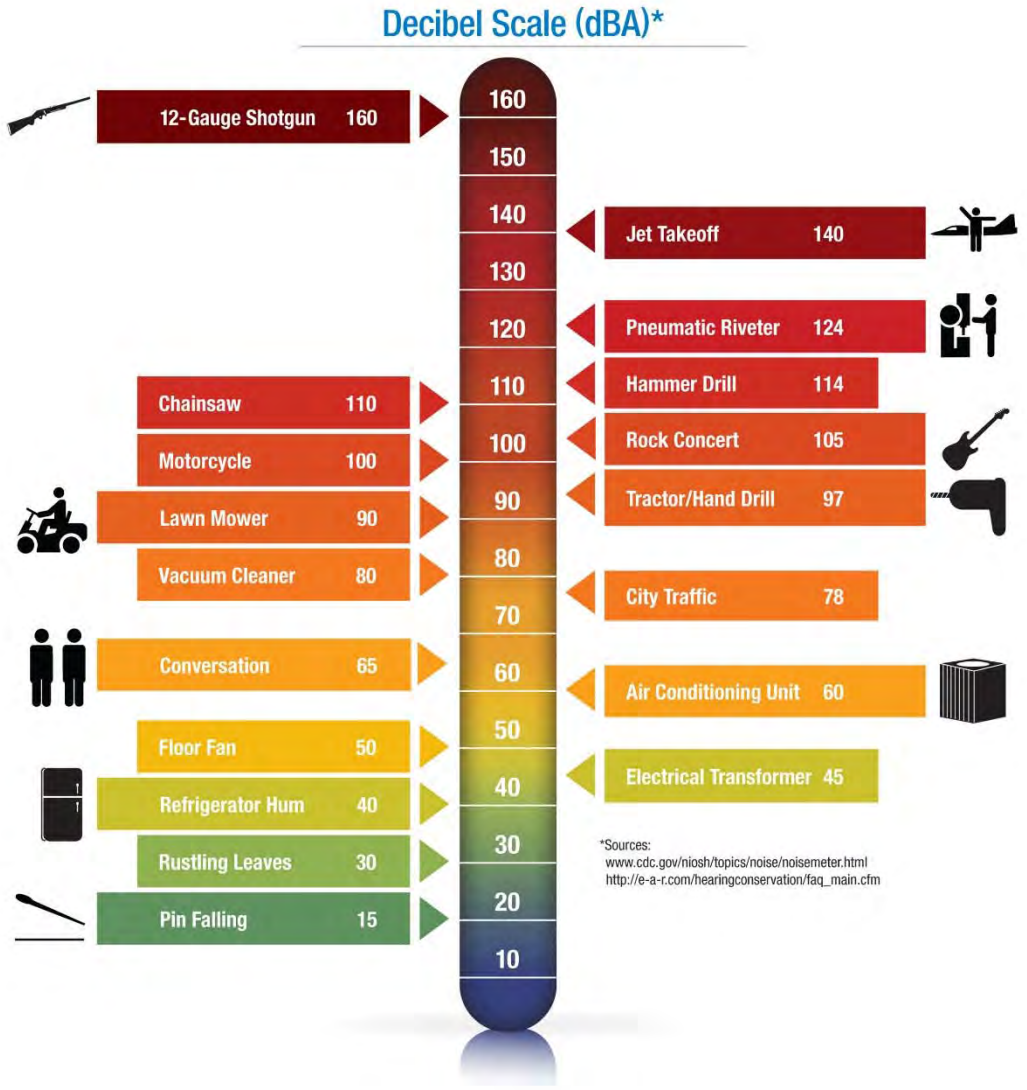
Figure 2

Tentative Parcel Map

C&J Parcel Map - El Dorado County, California

The Day-Night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn}-based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

Figure 3
Typical A-Weighted Sound Levels of Common Noise Sources



Criteria for Acceptable Noise Exposure

El Dorado County General Plan

The Noise Element of the El Dorado County General Plan contains policies to ensure that County residents are not subjected to noise beyond acceptable levels.

Policy 6.5.1.1 of the County Noise Element requires an acoustical analysis for new residential developments located in potentially noise-impacted areas.

Policy 6.5.1.3 states that where noise mitigation measures are required to achieve the County's exterior noise standards, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project and the noise barriers are not incompatible with the surroundings.

Policy 6.5.1.8 establishes 45 and 60 dB L_{dn} as being acceptable interior and exterior noise levels, respectively, for new residential uses affected by traffic noise sources. Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn} or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB L_{dn} may be allowed provided that available exterior noise reduction measures have been implemented and interior noise levels are in compliance with the 45 dB L_{dn} standard.

Evaluation of Future Highway 50 Traffic Noise Levels

Traffic Noise Prediction Methodology

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to predict traffic noise levels at the project site. 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 the 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 in most situations.

Predicted Future Traffic Noise Levels at the Project Site

The exact location of residential building structures has yet to be determined. As a result, the FHWA Model was used with future traffic data to predict future traffic noise levels at various setback distances from Highway 50. Setback distances were set at 20-foot increments from 80 feet to 500 feet from the roadway centerline. Future average daily traffic (ADT) volumes for Highway 50 were estimated by assuming a 50 percent increase relative to existing conditions. Existing ADT volumes (10,500) were obtained from the Caltrans Traffic Census Program

website (www.dot.ca.gov/trafficops/census). The FHWA Model inputs and results are provided in Appendices B-D. The predicted future traffic noise levels at the various setback distances are summarized in Table 1.

Table 1
Predicted Future Highway 50 Traffic Noise Levels and Required Mitigation[1]
C&J Parcel Map – El Dorado County, California

Distance From Roadway Centerline (feet)	L_{dn} (dB)	Noise Reduction Required for Exterior Standard[2]		Window Requirement to Achieve 45 dB L_{dn}[3] Interior Standard	
		65 dB L_{dn}	60 dB L_{dn}	First-Floor	Upper-Floor
80	70	5	10	STC-27	STC-32
100	68	3	8	STC-27	STC-32
120	67	2	7	STC-27	STC-27
140	66	1	6	STC-27	STC-27
160	65	0	5	STC-27	STC-27
180	64	0	4	STC-27	STC-27
200	64	0	4	STC-27	STC-27
220	63	0	3	STC-27	STC-27
240	62	0	2	STC-27	STC-27
260	62	0	2	STC-27	STC-27
280	61	0	1	STC-27	STC-27
300	61	0	1	STC-27	STC-27
320	61	0	1	STC-27	STC-27
340	60	0	0	STC-27	STC-27
360	60	0	0	STC-27	STC-27
380	59	0	0	STC-27	STC-27
400	59	0	0	STC-27	STC-27
420	59	0	0	STC-27	STC-27
440	58	0	0	STC-27	STC-27
460	58	0	0	STC-27	STC-27
480	58	0	0	STC-27	STC-27
500	58	0	0	STC-27	STC-27

Notes:

1. A complete listing of FHWA Model inputs and results are provided in Appendix B-D.
2. Amount of attenuation required (dB) in order to satisfy either the 60 dB L_{dn} or 65 dB L_{dn} exterior noise level standards.
3. Window Sound Transmission Class (STC) rating required to satisfy 45 dB L_{dn} interior noise level standard.

Source: Bollard Acoustical Consultants, Inc. (2017)

The Table 1 data indicate that future traffic noise levels at the project site decrease with increasing setback distances from the Highway 50 centerline, as expected. The Table 1 data also quantify the attenuation required to satisfy the county's 60 and 65 dB L_{dn} exterior noise level standards depending on the setback from Highway 50. Furthermore, the Table 1 data include the window Sound Transmission Class (STC) rating required to satisfy the county's 45 dB L_{dn} interior noise level standard at first- and upper-floor facades. A more detailed discussion of the required mitigation measures necessary to satisfy the El Dorado County exterior and interior transportation noise level standards is provided in the following section.

Traffic Noise Mitigation Measures

Outdoor Activity Areas

The data provided in Table 1 indicate the required attenuation required to satisfy the El Dorado County exterior noise level standards depends on the setback of the outdoor activity areas from Highway 50. For example, if the outdoor activity area is located 100 feet from the centerline of Highway 50, 3 dB of attenuation would be required to satisfy of the county's 65 dB L_{dn} standard and 8 dB of attenuation would be required to satisfy the county's conditionally acceptable 60 dB L_{dn} standard.

According to the Table 1 data, if the outdoor activity area on any of the three proposed lots is located within 320 feet of the Highway 50 centerline, mitigation would be required relative to the 60 dB L_{dn} standard. If 6 dB or less of attenuation is required, a localized noise barrier measuring 6-feet in height would provide the necessary level of attenuation provided it intercepts line of sight to the highway. If 7-8 dB of attenuation is required, a localized noise barrier measuring 8-feet in height would provide the necessary level of attenuation. An alternative to a localized noise barrier would be to have the outdoor activity area located behind the residential building structure, thereby benefitting from the screening provided by the building structure itself.

According to the Table 1 data, if the outdoor activity area on any of the three proposed lots is located within 140 feet of the Highway 50 centerline, mitigation would be required relative to the conditionally acceptable 65 dB L_{dn} standard. The same recommendations from the preceding paragraph regarding localized barriers or placing the outdoor activity areas behind the building structure would also apply.

Interior Areas

The data provided in Table 1 indicate the STC rating of first- and upper-floor windows required to satisfy the El Dorado County interior noise level standard depending on the setback of the building façade from Highway 50. Standard residential construction (stucco siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof) typically results in an exterior to interior noise reduction of about 25 dB with windows closed, and approximately 15 dB with windows open. Due to reduced ground absorption at elevated

facades, traffic noise levels at second-floor facades are expected to be approximately 3 dB higher than first-floor locations.

As an example, if the building façade is located 100 feet from the centerline of Highway 50, the Table 1 data indicate that STC-27 windows would be required at first-floor facades, and STC-32 windows would be required at upper-floor facades. The resulting interior traffic noise levels at both first- and upper-floor facades would satisfy the El Dorado County 45 dB L_{dn} standard. It should be noted that this analysis assumes that mechanical ventilation (air conditioning) will be provided for the residences within this development to allow the occupants to close doors and windows as desired for additional acoustical isolation.

Conclusions and Recommendations

Depending on the building and outdoor activity area (backyard) setbacks from the centerline of Highway 50, future residences constructed within the proposed C&J Parcel Map project site may be exposed to future Highway 50 traffic noise exposure that exceeds the El Dorado County exterior and interior noise level criteria for residential land uses. In order to achieve compliance with the County's noise level criteria, please refer to Table 1 and the *Traffic Noise Mitigation Measures* section of this report.

These conclusions are based on the traffic data and assumptions cited in Appendix B, on the project tentative map shown on Figure 2, and on noise reduction data for standard residential dwellings and for typical STC rated window data. Deviations from the Appendix B data, or the tentative map shown on Figure 2, could cause future traffic noise levels to differ from those predicted in this analysis. In addition, Bollard Acoustical Consultants, Inc. is not responsible for degradation in acoustic performance of the building construction due to poor construction practices, failure to comply with applicable building code requirements, or for failure to adhere to the minimum building practices cited in this report.

This concludes BAC's traffic noise assessment for the proposed C&J Parcel Map project in El Dorado County, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2017-021 C&J Parcel Map
Description: Future
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Highway 50	West of Echo Lake Road	15,750	83		17	3	3	55	80	
2			15,750	83		17	3	3	55	100	
3			15,750	83		17	3	3	55	120	
4			15,750	83		17	3	3	55	140	
5			15,750	83		17	3	3	55	160	
6			15,750	83		17	3	3	55	180	
7			15,750	83		17	3	3	55	200	
8			15,750	83		17	3	3	55	220	
9			15,750	83		17	3	3	55	240	
10			15,750	83		17	3	3	55	260	
11			15,750	83		17	3	3	55	280	
12			15,750	83		17	3	3	55	300	
13			15,750	83		17	3	3	55	320	
14			15,750	83		17	3	3	55	340	
15			15,750	83		17	3	3	55	360	
16			15,750	83		17	3	3	55	380	
17			15,750	83		17	3	3	55	400	
18			15,750	83		17	3	3	55	420	
19			15,750	83		17	3	3	55	440	
20			15,750	83		17	3	3	55	460	
21			15,750	83		17	3	3	55	480	
22			15,750	83		17	3	3	55	500	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2017-021 C&J Parcel Map
Description: Future
Ldn/CNEL: Ldn
Hard/Soft: Soft

				Predicted Noise Levels, dB			
Segment	Roadway Name	Segment Description	Distance	Autos	Medium Trucks	Heavy Trucks	Total
1	Highway 50	West of Echo Lake Road	80	68	60	64	70
2			100	66	58	62	68
3			120	65	57	61	67
4			140	64	56	60	66
5			160	63	55	59	65
6			180	62	54	58	64
7			200	62	54	58	64
8			220	61	53	57	63
9			240	60	53	57	62
10			260	60	52	56	62
11			280	59	52	56	61
12			300	59	51	55	61
13			320	59	51	55	61
14			340	58	50	54	60
15			360	58	50	54	60
16			380	57	50	54	59
17			400	57	49	53	59
18			420	57	49	53	59
19			440	56	49	53	58
20			460	56	48	52	58
21			480	56	48	52	58
22			500	56	48	52	58

Appendix D

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2017-021 C&J Parcel Map
Description: Future
Ldn/CNEL: Ldn
Hard/Soft: Soft

			------- Distances to Traffic Noise Contours -------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Highway 50	West of Echo Lake Road	35	75	161	347	747
2			35	75	161	347	747
3			35	75	161	347	747
4			35	75	161	347	747
5			35	75	161	347	747
6			35	75	161	347	747
7			35	75	161	347	747
8			35	75	161	347	747
9			35	75	161	347	747
10			35	75	161	347	747
11			35	75	161	347	747
12			35	75	161	347	747
13			35	75	161	347	747
14			35	75	161	347	747
15			35	75	161	347	747
16			35	75	161	347	747
17			35	75	161	347	747
18			35	75	161	347	747
19			35	75	161	347	747
20			35	75	161	347	747
21			35	75	161	347	747
22			35	75	161	347	747