AGENDA TRANSMITTAL FORM

	AGEND.	AIRANSINI	TITAL FURIN	
To: <u>Board</u>	<u>l of Supervisors</u>			Consent Agenda Blue Slip
Date: April 15, 20)13			Closed Session
From: Susan C. Gr	ijalva	PI	hone Ext. <u>380</u>	Meeting Date Requested: April 23, 2013
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Department Hea	$C \cap C$	2 (X	(sijolva)	
Agenda Title:			1	
Linco	oln Project - Blast and Noise Monitoring F			
Sutter Gold Mining	detailed summary of the purpose of thi g Co. will present the results of bl ge project located on the east sid	last and noise mor	nitoring conducted during t	the months of January and February Creek and Amador City.
Recommendation/Re None	quested Action:			
	h budget transfer form if appropriate)		Staffing Impacts None.	
None.			None.	
ls a 4/5ths vote requi	ired? Yes ☐ No ⊠		Contract Attached:	Yes No N/A X Yes No N/A X
Committee Review? Name		N/A 🔀	Ordinance Attached Comments:	Yes No N/A
Committee Recomme	endation:		OSITION CO.	
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Planning				
		FOR CLERK US	SE ONLY	
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Completed by	Department For meeting	ATTEST:		
of Clerk or Deputy Board Clerk				

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Environmental Noise Assessment

Lincoln Mine Off-Site Blasting Noise Assessment

Sutter Creek, California (Amador County)
BAC Job #2013-001

Prepared For:

Sutter Gold Mining Company

Mr. David Cochrane 11500 Stringbean Alley P.O. Box 1689 Sutter Creek, CA. 95685

Prepared By:

Bollard Acoustical Consultants, Inc.

Paul Bollard, President

April 16, 2013



Introduction

Sutter Gold Mining Company's Lincoln Mine is located between Amador City and Sutter Creek in Amador County, California. The mine location is shown in Figure 1. In response to concerns expressed by residents in Amador City, Sutter Gold Mining Company retained Bollard Acoustical Consultants, Inc. (BAC) to monitor off-site noise levels associated with blasting activities at the Lincoln Mine. This report contains the results of that noise monitoring program.

Fundamentals of Noise

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), then they can be heard and thus are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz). It is not uncommon for blasting events to generate peak overpressures at frequencies below 20 Hz.

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

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, perception of loudness is relatively predictable, and can be approximated by the A-weighing network. There is a strong correlation between general community A-weighted sound levels (expressed as dBA) and the way the human ear perceives noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment.

As noted in the blasting program developed by Revey & Associates for the Lincoln Mine, regular acoustical noise measurements taken for the purpose of monitoring compliance with local noise ordinances almost always use A-weighted (dBA) scales. Instruments used for these A measurements filter out most of the air-overpressure occurring below a frequency of 20 Hz because humans cannot hear it and are generally not annoyed by it. Much of the air-overpressure frequency spectrum created by rock blasting occurs at frequencies below 20 Hz.

Accordingly, linear scale measurements capture air-overpressure fluctuations occurring from 2 to 200 Hz. A significant amount of the energy in blast-induced air-pressure waves occurs at frequencies below 20 Hz.

Table 1 shows typical noise levels associated with common activities. Appendix A provides acoustical terminology.

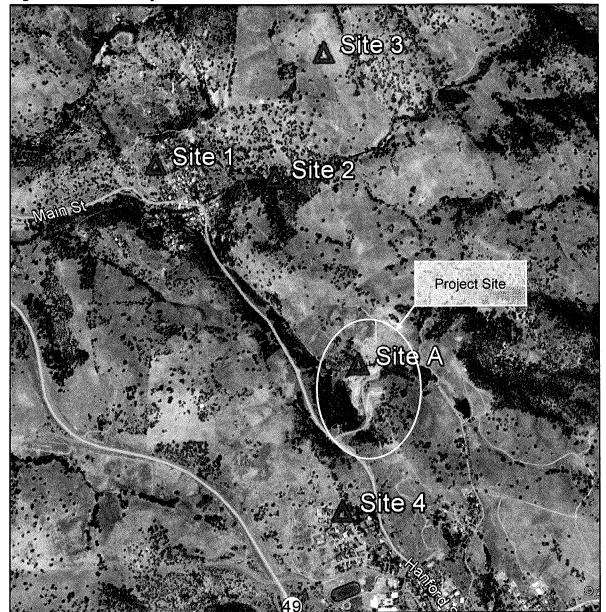


Figure 1 – Site Vicinity and Noise Measurement Locations

Table 1 Typical A-Weighted Sound Levels of Common Noise Sources				
Loudness Ratio	dBA ¹	Description		
128	130	Threshold of pain		
64	120	Jet aircraft take-off at 100 feet		
32	110	Riveting machine at operators position		
16	100	Shotgun at 200 feet		
8	90	Bulldozer at 50 feet		
4	80	Diesel locomotive at 300 feet		
2	70	Commercial jet aircraft interior during flight		
1	60	Normal conversation speech at 5-10 feet		
1/2	50	Open office background level		
1/4	40	Background level within a residence		
1/8	30	Soft whisper at 2 feet		
1/16	20	Interior of recording studio		

^{1 –} Levels shown in this table are measured using the "slow" meter response time. For impulsive noise sources, such as blasting, the "Impulse" setting is commonly used, which results in higher measured sound pressure levels.

Criteria for Acceptable Blast Noise Exposure

A summary of the blasting restrictions included in the Conditional Use Permit (CUP) issued by Amador County CA are as follows:

- 43.2.1. Blasting shall be allowed 24 hours per day and is Subject to the following restrictions:
 - 43.2.1.1. From 7:00 a.m. to 9:00 p.m., blast vibration shall not exceed 0.20 inches/second peak particle velocity, measured at or adjacent to the residential structure nearest the blast. Airblast shall not exceed 0.013 psi (linear, unweighted peak air-overpressure), measured at or adjacent to the residential structure nearest the blast, and;
 - 43.2.1.2. From 9:00 p.m. to 7:00 a.m., blast vibration shall not exceed 0.03 inches/second peak particle velocity, measured at or adjacent to the residential structure nearest the blast. Airblast shall not exceed 0.000003 psi (linear, unweighted peak air-overpressure), measured at or adjacent to the residential structure nearest the blast:

(It is important to note that the daytime limit of 0.013 psi is equivalent to 133 dBL and that the nighttime limit of 0.000003 psi is equivalent to 60 dBL.)

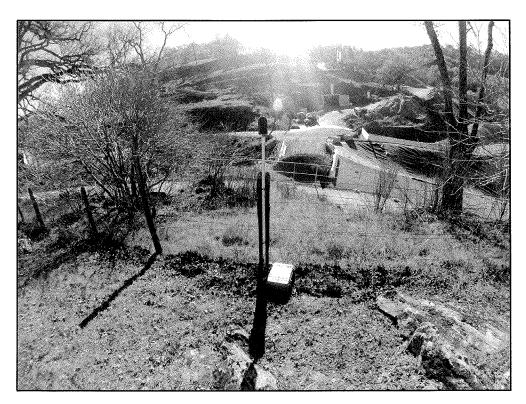
Description of Blast Noise Monitoring Program

The noise monitoring program conducted for this study consisted of the following primary components:

- The survey was initially conducted at Sites A (mine site), and Sites 1-3 (Amador City), from January 16 through February 28, 2013.
- Site 4, located in Sutter Creek, was added on February 1 and monitored through February 28, 2013.
- The noise monitoring locations are identified on Figure 1.
- Five (5) Matched Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the noise level measurements survey.
- The meters were calibrated with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements.
- The equipment used meets all specifications of the American National Standards Institute requirements for Type 1 sound level meters (ANSI S1.4).
- The microphones used for this study were designed for random sound incidence, oriented vertically, fitted with windscreens provided by the manufacturer, and positioned at a height of approximately 5 feet above ground at each site.
- The meters were time-synchronized and programmed to log statistical data on 5-minute increments.
- The meters were programmed to report A-weighted and Linear (unweighted) Peak sound pressure levels.
- The meters were programmed with "Impulsive" response times in an effort to capture the brief blasting-related noise levels.
- Blasting logs were maintained by Sutter Gold Mining Corporation for correlation with noise levels measured by BAC.
- Weather Data was also provided by Sutter Gold Mining Corporation to attempt to determine the effects of variable atmospheric conditions on the blast noise monitoring results.
- Aerial and site photographs of the noise monitoring locations follow.

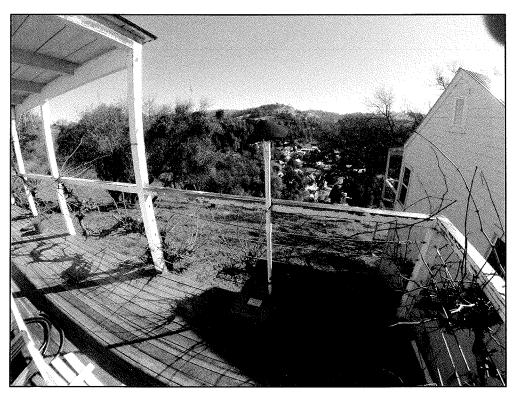
Site A- Mine site overlooking the main portal





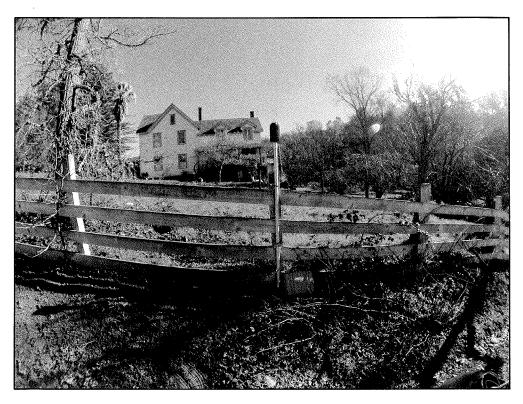
Site 1- 10451 Bunker Hill Road, Amador City



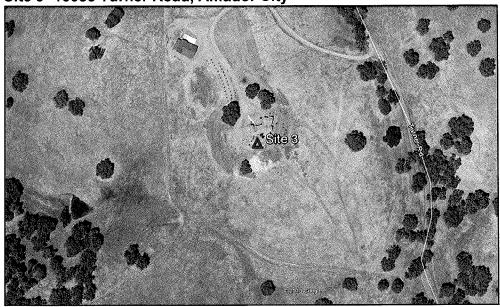


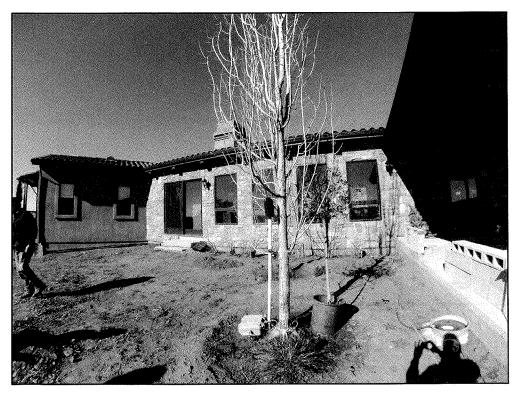
Site 2- 11040 Amador Creek Road, Amador City





Site 3- 15085 Turner Road, Amador City





Site 4- 300 California Drive, Sutter Creek





Blast Noise Monitoring Program Results

During the noise monitoring survey spanning January 16 through February 28, blasting logs provided by Sutter Gold indicate that blasting occurred on 10 of the days monitored in January and 17 days in February. On the days when blasting did occur, the vast majority of blasting events occurred within 15 minutes of 5 pm (4:45-5:15 pm). In January, approximately 18 shots occurred in the early afternoon hours, whereas only two shots occurred outside the 5 pm window during the month of February. On days when shots did occur, blast logs indicate that there were typically 3-5 shots within a fairly tight time frame (15 minute span).

Overall, blast logs provided by Sutter Gold indicate a total of 97 blasting events occurred at the mine site during the noise monitoring survey (35 blasts from January 16-31 & 62 blasts in the month of February). Because blasting on different levels within the mine frequently occurred within seconds of each other, not all of these blast events registered on BAC's noise meters as separate events. Table 2 shows the breakdown of blasting events by time and location.

Table 2
Blast Operations Information
Sutter Gold Project – Amador County

Description	Number
Total Number of Blasts During Noise Survey	97
Blasting Events Sorted by Hour of Day	
(only hours during which blasting occurred are shown)	
10 am hour	1
11 am hour	3
1 pm hour	4
3 pm hour	1
4 pm hour	21
5 pm hour	59
6 pm hour	4
Blasting Events Sorted by Location	
900	26
1100	26
11 Raise	6
1100 XC	2
1100-3EXC	2
1200	12
1300	1
8E-1S	4
Scram 6-7	18
Source: Sutter Gold Mining Company	

Table 3 summarizes the blast noise monitoring program results at each location.

Table 3
Blast Noise Monitoring Results
Sutter Gold Project – Amador County

	Site A	Site 1	Site 2	Site 3	Site 4
Number of Blast Events Logged	65	29	38	46	26
Highest Linear Peak SPL (dBL)	134	107	107	100	102
Average Linear Peak SPL (dBL)	110	92	95	89	91
Lowest Linear Peak SPL (dBL)	88	85	89	83	85

Notes:

- 1. The number of events logged at each location is not necessarily a function of blast event intensity as condensation and battery failure caused short periods of equipment malfunction at certain locations.
- 2. Due to elevated winds at Site 3, some of the measured linear peak levels were anomalously high and not attributable to blasting events. An attempt was made to filter the non-blast-related data from this table summary but it was not possible to discern whether some events were wind or blast-related. This likely accounts for the higher number of events logged at Site 3.

Site A Results

Noise monitoring Site A was located within the mine site, approximately 220 feet from the main mine portal. Due to its proximity to the mine portal, Site A was used as a reference location against which the other blast noise level data could be compared. As a result of the proximity of Site A to the mine portal, it is not surprising that the highest linear peak overpressures were recorded at this location. That being said, there were several blast events (33%) which, despite their proximity to this monitoring station, were too low in amplitude to register at Site A (events below 83 dBL did not register).

Site 1 Results

Monitoring Site 1 was located on the deck of Ms. Susan Bragstad. This location has the most direct, and unimpeded, line of sight to the Lincoln Mine. The data collected at this site reflects this greater exposure as the highest, maximum, peak overpressure (107 dBL) measured during blasting events were logged at this location and Site 2. As with the other locations, however, many of the blast events (70%) were too low in intensity to register on the sound level meter and/or were inaudible. All of the peak overpressures measured at this location which could practically be correlated with blasting events were well below the project significance threshold and well below thresholds at which damage to structures would occur. Although noise generated by some blasting events were clearly audible at this location (as evidenced by both BAC observations and logs kept by Mrs. Bragstad), the sample ambient data shown in Appendix B-2 indicate that maximum A-weighted noise levels associated with blasting events

were typically below maximum noise levels generated by local sources not related to the mine blasting (barking dogs, local traffic, small aircraft overflights, etc.).

Site 2 Results

Monitoring Site 2 was located next to the home of Joyce Sandau. Although the mine cannot be seen from this location, Site 2 represents the closest monitoring position in Amador City to the Lincoln Mine site. While it is possible that some of the peak overpressures attributed to blasting events in Table 3 may have been caused by local sources, the highest maximum (107 dBL) and average overpressures (95 dBL) were logged at this location. As with the other locations, many of the blast events (60%) were too low in intensity to register on the sound level meter, and/or were inaudible. All of the peak overpressures measured at this location which could practically be correlated with blasting events were well below the project significance threshold and well below thresholds at which damage to structures would occur. Although noise generated by some blasting events were clearly audible at this location (as evidenced by both BAC observations and statements made by Ms. Sandau), the sample ambient data shown in Appendix B-3 indicate that maximum A-weighted noise levels associated with blasting events were typically below maximum noise levels generated by local sources not related to the mine blasting (barking dogs, local traffic, small aircraft overflights, etc.).

Site 3 Results

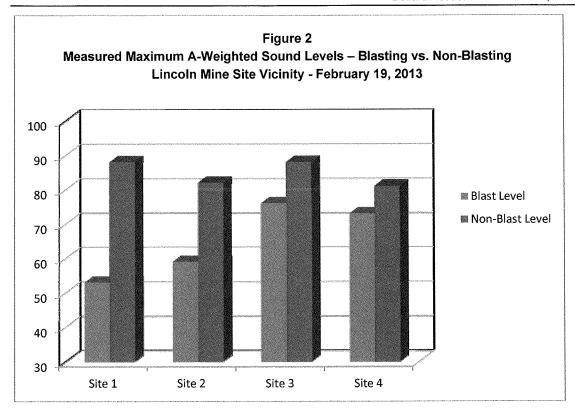
Monitoring Site 3 was located next to the home of Les Brusatori. This site is the most elevated of the Amador City monitoring locations, but only has a direct line of sight to the 1,300 level portal of the Lincoln Mine. Blasting within the 1,300 level of the mine was completed in mid January, which likely accounts for Mr. Brusatori's initial concerns regarding blasting, and his comments to BAC staff that noise from blasting events seemed to be decreasing. Because of the elevated position of this residence, the measured ambient noise levels were often affected by strong afternoon winds which affect this residence. Site 3 is also the most distant monitoring site from the Lincoln Mine. As a result of the distance and shielding, the lowest peak overpressures attributable to blasting events (100 dBL) were measured at this location. As with the other locations, many of the blast events (53%) were too low in intensity to register on the sound level meter, and/or were inaudible. All of the peak overpressures measured at this location which could practically be correlated with blasting events were well below the project significance threshold and well below thresholds at which damage to structures would occur. Although noise generated by some blasting events were clearly audible at this location (as evidenced by statements made by Mr. Brusatori, the sample ambient data shown in Appendix B-4 indicated that maximum A-weighted noise levels associated with blasting events were typically below maximum noise levels generated by local sources not related to the mine blasting (wind, small aircraft overflights, property maintenance, etc.).

Site 4 Results

Monitoring Site 4 was located at the home of James Higgins in Sutter Creek. This site is the only monitoring location in Sutter Creek, and is the closest off-site monitoring site to the Lincoln Mine. Despite this proximity, the second lowest peak overpressures (102 dBL) were measured at this location. As with the other locations, many of the blast events (73%) were too low in intensity to register on the sound level meter, and/or were inaudible. All of the peak overpressures measured at this location which could practically be correlated with blasting events were well below the project significance threshold and well below thresholds at which damage to structures would occur. Although noise generated by some blasting events were likely audible at this location, the sample ambient data shown in Appendix B-5 indicated that maximum A-weighted noise levels associated with blasting events were typically below maximum noise levels generated by local sources not related to the mine blasting (local traffic, neighborhood activities, small aircraft overflights, etc.).

Ambient Noise Levels When Blasting Was Not Present

The Table 3 data present a concise synopsis of the data collected during the noise measurement period, as approximately 197,000 separate data points were collected over the course of the program. Of the 37,815 separate 5-minute intervals logged at the four residences, blasting noise registered in only 142 of those intervals, for a total of 0.4% of the intervals. Although the presentation of graphical data for the entire population of data would be unwieldy, Appendix B was prepared to illustrate measured average and maximum sound levels for a representative 24-hour period (February 19, 2013) at each site. This data was selected because a blast event occurred at 5 pm which was clearly identifiable at the noise meter located at the mine site (See Appendix B-1). However, the data for sites 1-4 for this same 24-hour period in time indicate that, either the blast event did not register appreciably at those measurement sites and/or that the maximum noise level generated by the blast event was substantially lower than maximum noise levels registered at those positions which were caused by sources of noise other than Sutter Gold Operations. Figure 2 shows the numeric differences between blast-related and non-blast-related measured A-weighted maximum noise levels for this sample day.



Conclusions of Blast Noise Monitoring Survey

The following conclusions were reached regarding the Table 2 & 3 summaries as well as analysis of the discrete datapoints collected during each blasting event at each residence:

- The blast data logged at all of the residences was well below the 133 dBL daytime threshold established in the project conditions of approval. Therefore, the blasting operations complied with the project conditions of approval regarding peak overpressure levels during nighttime hours.
- The peak overpressures measured by BAC confirm the results of the Sutter Gold Mining monitoring overpressure measurements, as all levels measured by both BAC and Sutter Gold Mining were below the 133 dBL threshold at the residences monitored.
- Because peak overpressures below 83 dBL were too low to register on the sound level meters, it was not possible to measure linear peak overpressures as low as 60 dBL (0.000003 psi) to determine whether or not the quieter blast events would have complied with the 60 dBL nighttime blast condition of approval. For this reason, it is likely that the 60 dBL threshold was inadvertently derived from the County's 60 dB Ldn standard applicable to transportation noise. Because many of the blast events were inaudible in the communities of Sutter Creek and Amador City at peak overpressures higher than 60 dBL, a higher nighttime threshold of significance for blasting overpressures could be

accommodated without resulting in significant adverse noise impacts in nearby residential areas.

- Blast logs maintained by Amador creek residents, conversations with residents where
 the blast noise monitoring took place, and BAC staff field observations indicated that
 some of the blasting events which occurred during the noise monitoring program were
 distinctly audible but that a greater percentage were inaudible.
- The highest registered sound levels at the mine site were associated with blasting at the 1100 level.
- The highest recorded sound levels in Amador City occurred during periods of both cold temperatures and high relative humidity. This result was expected as these conditions offer the least resistance to sound propagation over distance and indicates that the January/February monitoring period likely represents worst-case sound propagation characteristics of the entire year. During warmer months, the audibility of blasting events at the mine site is expected to be further diminished.
- There was no discernible correlation between wind speed and direction with measured blast-related sound levels in either Amador City or Sutter Creek.
- None of the measured linear peak overpressures believed to be caused by blasting events exceed thresholds at which damage to structures could be expected (appx 150 dBL).
- A common comment made by residents towards the end of the monitoring program was
 that "sound levels seem to have tapered off significantly". Sutter Gold Mining
 representatives anticipated this condition as blast noise levels were anticipated to
 diminish as mining advanced further underground.

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.

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

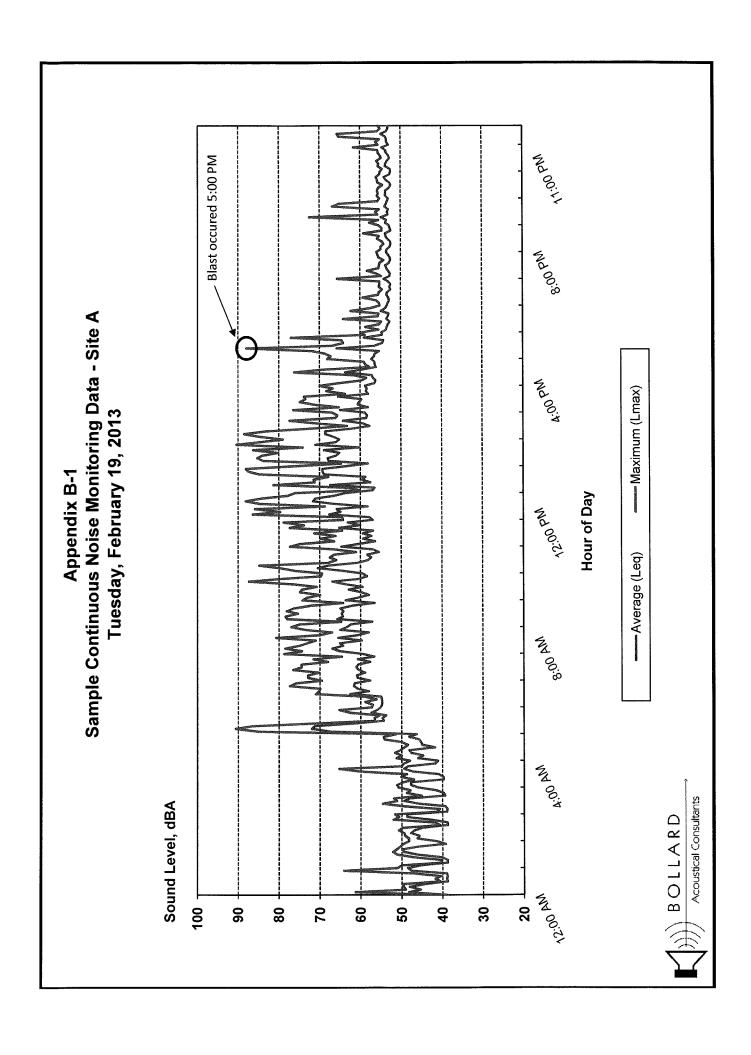
The lowest sound that can be perceived by the human auditory system, generally

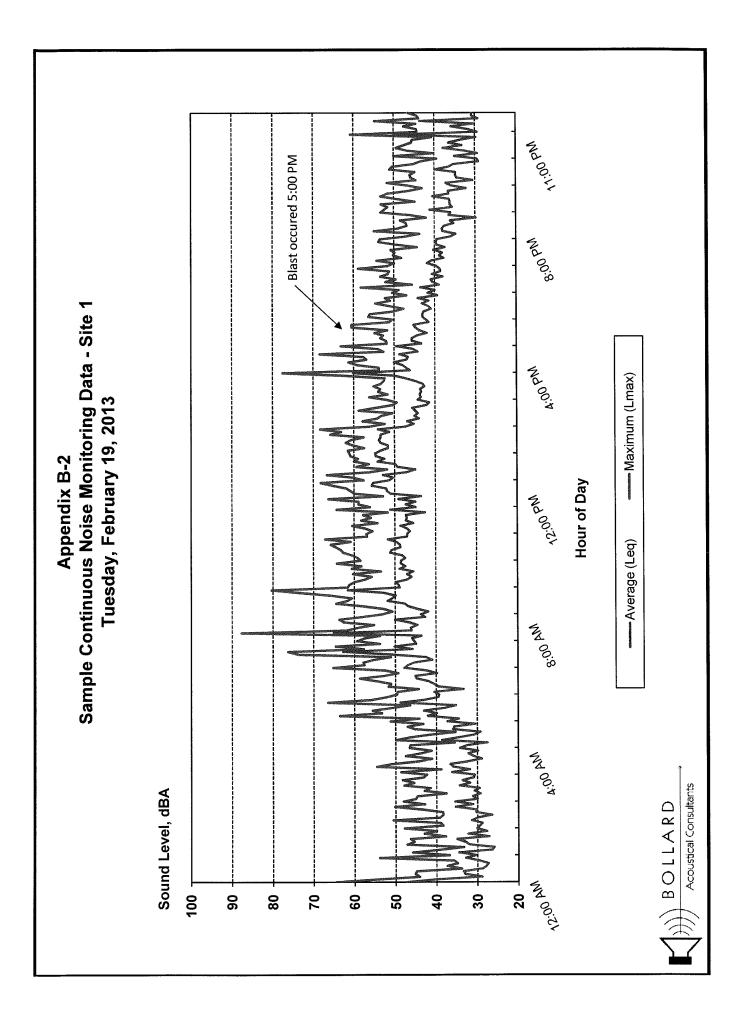
considered to be 0 dB for persons with perfect hearing.

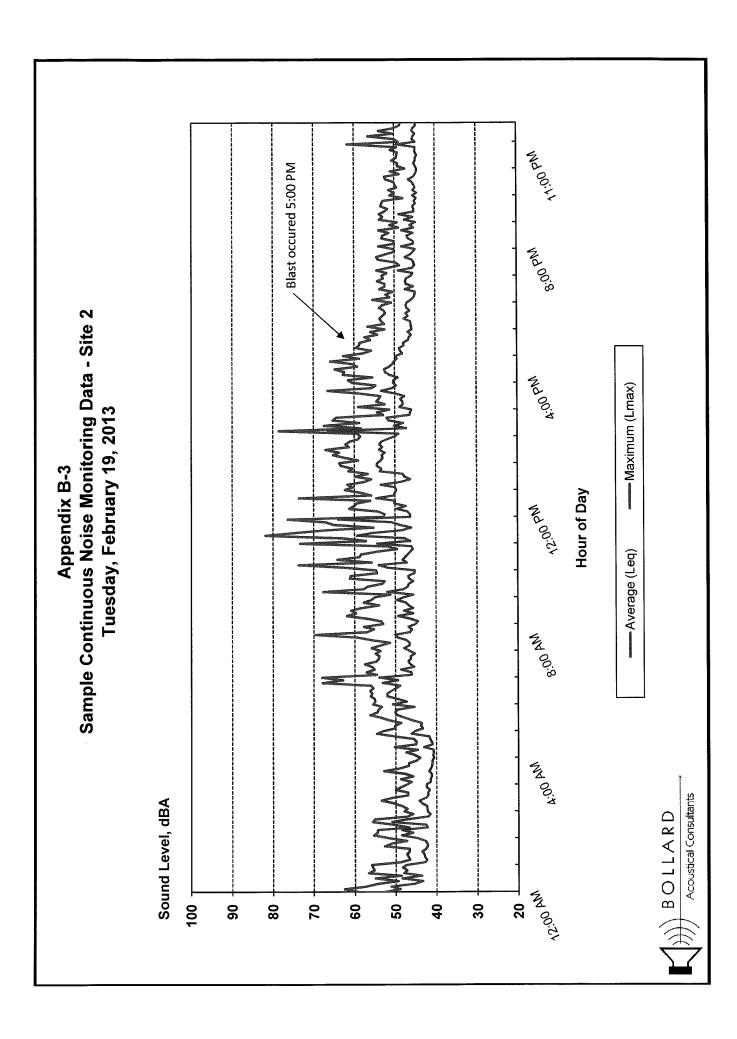
Threshold of Pain

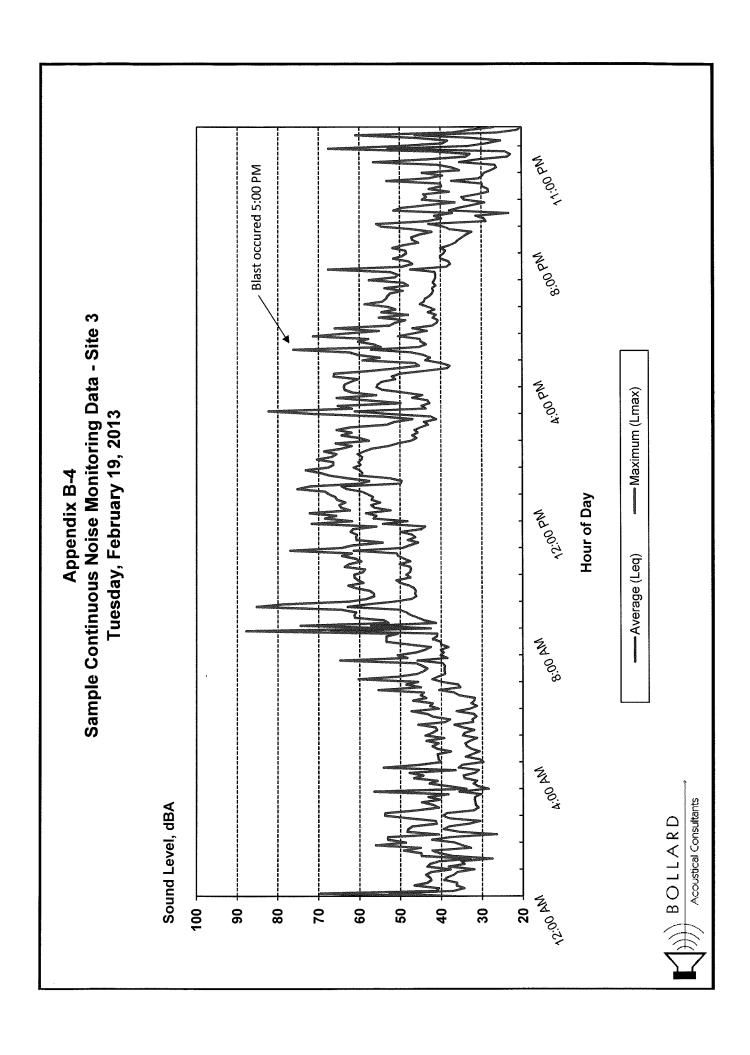
Approximately 120 dB above the threshold of hearing.

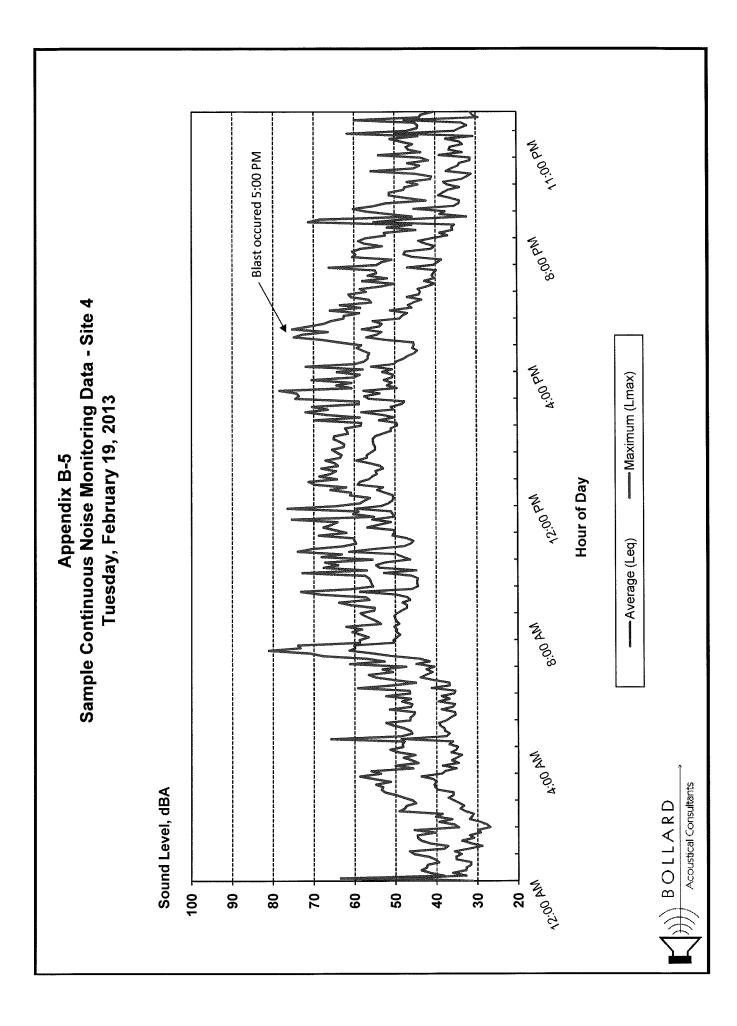












AGENDA TRANSMITTAL FORM

	<u>AGENDA</u>	ズ Regular Agenda		
To: <u>Boar</u>	<u>rd of Supervisors</u>			Consent Agenda Blue Slip
Date: April 17, 2	(013			Closed Session
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	detailed summary of the purpose of this			
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Auditor)/	GSA Direc	ctor 🋂 🛴	
CAO		Risk Mana	agement MM	
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		FOR CLERK USE	ONLY	
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Ayes:			Other:	
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AGENDA TRANSMITTAL FORM

Regular Agenda

To: Boar Date: April 18, 2	rd of Supervisors 2013				Consent Agenda Blue Slip Closed Session J Date Requested:
From: Jennifer Burns, Clerk of the Board (Department Head - please type)		<u> </u>	Phone Ext.		3, 2013
Department He	ad Signature				
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Is a 4/5ths vote required?			Contract Attached: Resolution Attached:	N/A	
Name Committee Recomm		N/A	Ordinance Attached Comments:	Yes No	
Request Reviewed	by:				
Chairman		Couns	el		
Auditor		GSA E	Director		
CAO		Risk M	Risk Management		
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Ayes: Noes Absent:		Ordinar Ordinar	-	Other:	
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