Appendix K

Environmental Noise Assessment

Environmental Noise & Vibration Assessment

Boca Quarry Expansion Project

Nevada County, California

BAC Job # 2017-136

Prepared For:

Teichert

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April 6, 2018

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Introduction

The acoustical consulting firm of Bollard Acoustical Consultants, Inc. (BAC), was retained by Teichert Aggregates to assess noise and vibration impacts associated with the proposed Boca Quarry Expansion Project (project) in Nevada County, California. The project site location is shown on Figure 1. Figure 2 shows the proposed mine plan.

Teichert currently mines, processes, and transports crushed rock from the Boca Quarry to off-site markets. The proposed expansion is primarily a sidehill quarry operation, involving excavation of the West Pit quarry. Mining for the overall Project will occur in three phases, beginning with the Phase I East Pit (largely complete). The second and third phases will involve mining of the West Pit. During Phase II, the lower (southern) portion of the West Pit will be mined to its maximum width and depth. The upper ridge of the West Pit will then be mined (Phase III), and the overburden from the ridge will be moved down to the lower area to be used as backfill in the lower pit, facilitating partially concurrent reclamation of the lowest (Phase II) bench. The project would allow for an increase in production from the facility's historical maximum of approximately 300,000 tons per year to up to 1 million tons per year, as needed to meet market demand.

Noise and vibration-generating activities at the project site will include periodic blasting, excavation (loaders, haul trucks, excavators, etc.), material load-out (front-loaders), aggregate processing (crushers, screens, conveyors), and reclamation (scrapers, graders, etc.). Proposed operations would typically occur during daytime hours, but the project application does not preclude nighttime operations if needed. Blasting would always be limited to daytime hours.

This report is a revision to BAC's August 29, 2013 analysis, which was used to develop the noise section of the September 2012 Draft Environmental Impact Report (DEIR) for the Boca Quarry Project. The revisions resulted from updated noise and vibration surveys. This report describes the noise and vibration environment in the vicinity of the Teichert Boca Quarry Expansion Project (project), and analyzes potential noise and vibration impacts associated with the proposed project.

Objectives

The objectives of this analysis are as follows:

- To provide background information pertaining to the effects of noise and vibration.
- To identify existing noise-sensitive land uses in the immediate project vicinity.
- To quantify existing ambient noise and vibration levels at those nearest noise-sensitive land uses.
- To use the guidelines of the California Environmental Quality Act (CEQA), with local Nevada County noise standards and measured existing noise and vibration levels to develop appropriate standards of significance for this project.
- To predict project-related noise and vibration levels at the nearest sensitive receptor areas and to compare those levels against the project standards of significance.
- Where significant project-related noise or vibration impacts are identified, to evaluate mitigation options.

Figure 1
Project Location
Teichert Boca Quarry Project

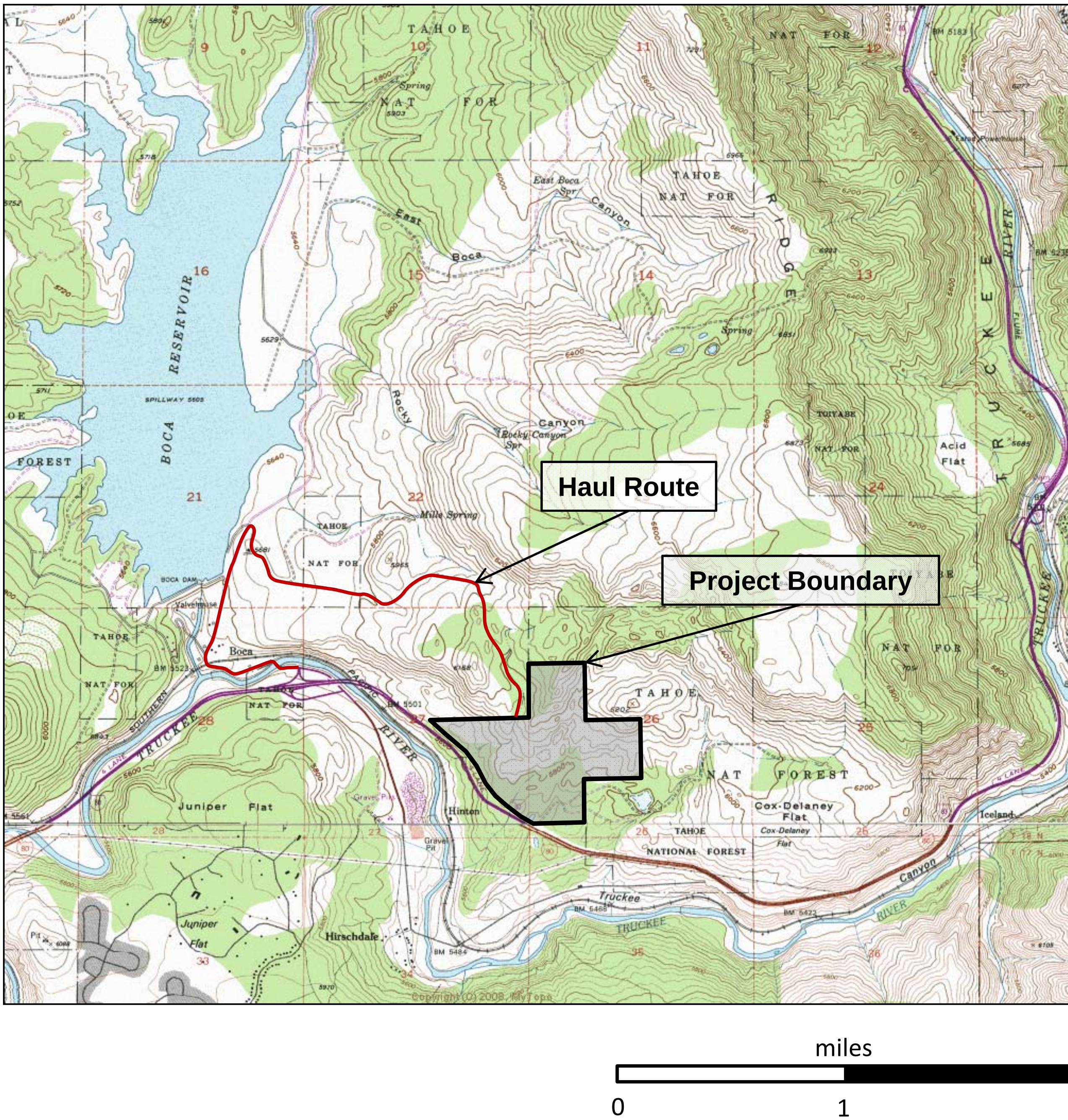

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Figure 2
Project Site Plan
Teichert Boca Quarry Project

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Fundamentals and Terminology

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), they can be heard and hence 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).

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 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. Another useful aspect of the decibel scale is that changes in levels (dB) 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, 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.

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}), which corresponds to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

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.

The Nevada County noise standards, which are discussed in detail later in this report, are expressed in terms of the hourly average and single-event maximum noise level performance standards. In addition to applying the County's noise standards to this Project, the California Environmental Quality Act (CEQA) requires that noise impacts be assessed relative to ambient noise levels that are present without the project. As a result, ambient noise surveys were conducted, and comparisons of Project to No-Project noise levels were used to assess noise impacts (in addition to comparison to Nevada County noise standards). Specifically, individual maximum (L_{max}) noise levels and hourly average (L_{eq}) noise levels, both with and without the project, were compared so that the assessment of noise impacts was not based solely on an assessment of project-generated noise in terms of 24-hour averages (L_{dn}), but also on short-term fluctuations in the ambient noise environment.

Audibility

It should be noted that audibility is not a test of significance according to CEQA. If this were the case, any project which added any audible amount of noise to the environment would be considered unacceptable according to CEQA. Because every physical process creates noise, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change. The discussion of what constitutes a substantial change in noise environments, both existing and cumulative, is provided in the Regulatory Setting section of this report.

Single-Event Noise & Sleep Disturbance

A single event is an individual distinct loud activity, such as a blasting event at an aggregate quarry, an aircraft overflight, a train or truck passage, or any other brief and discrete noise-generating activity. Because most noise policies applicable to transportation noise sources are typically specified in terms of 24-hour-averaged descriptors, such as L_{dn} or CNEL, the potential for annoyance or sleep disturbance associated with individual loud events can be masked by the averaging process.

Extensive studies have been conducted regarding the effects of single-event noise on sleep disturbance, with the Sound Exposure Level (SEL) metric being a common metric used for such assessments. SEL represents the entire sound energy of a given single-event normalized into a one-second period regardless of event duration. As a result, the single-number SEL metric contains information pertaining to both event duration and intensity. Another descriptor utilized to assess single-event noise is the maximum, or L_{max}, noise level associated with the event. A problem with utilizing L_{max} to assess singe events is that the duration of the event is not considered.

There is currently an on-going nationwide debate regarding the appropriateness of SEL criteria as a supplement or replacement for cumulative noise level metrics such as L_{dn} and CNEL, 24-hour noise descriptors. Nonetheless, because SEL describes a receiver's total noise exposure from a single impulsive event, SEL is often used to characterize noise from individual brief loud events.

Due to the wide variation in test subjects' reactions to noises of various levels (some test subjects were awakened by indoor SEL values of 50 dB, whereas others slept through indoor SEL values exceeding 80 dB), no definitive consensus has been reached with respect to a universal criterion to apply to environmental noise assessments. To the extent that there is any guidance regarding acceptable SEL, the emphasis has been on physiological effects, not on land use planning. The Federal Interagency Committee on Aviation Noise (FICAN) has provided estimates of the percentage of people expected to be awakened when exposed to specific SEL inside a home (FICAN 1997). According to the FICAN study, an estimated 5 to 10% of the population is affected when interior SEL noise levels are between 65 and 81 dB, and few sleep awakenings (less than 5%) are predicted if the interior SEL is less than 65 dB.

Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through the ground or structures. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities (PPV, inches/second), or Velocity Decibels in terms of root-mean-square levels (VdB RMS). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity as well as root-mean-square. Although aggregate mining and processing vibration levels are not expected to be significant for this project due to the relatively large distances between project equipment (sources) and acoustically sensitive receivers, an assessment of mining-related vibration levels is addressed nonetheless.

According to the Transportation and Construction-Induced Vibration Guidance Manual (Caltrans, June 2004), operation of construction equipment and construction techniques generate ground vibration. Traffic traveling on roadways can also be a source of such vibration. At high enough amplitudes, ground vibration has the potential to damage structures and/or cause cosmetic damage (e.g., crack plaster). Ground vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities. However, traffic, including heavy trucks traveling on a highway, rarely generates vibration amplitudes high enough to cause structural or cosmetic damage.

As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. The maximum rate or velocity of particle movement is the commonly accepted descriptor of the vibration "strength."

Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases. Given the considerable distances between project-related sources of vibration and the nearest existing residences to the project site, adverse impacts associated with project-generated vibration are unlikely.

Blasting creates seismic waves that radiate along the surface of the earth and downward into the earth. If close enough to the blasting location, these surface waves can be felt as ground vibration. Airblast and ground vibration can result in effects ranging from annoyance of people to damage of structures. Table 1 summarizes the average human response to vibration that may be anticipated when a person is at rest in quiet surroundings. If the person is engaged in any type of physical activity, the level required for the responses indicated is increased considerably.

Table 1
Human Response to Ground Vibration

Response	Peak Particle Velocity (inches per second)	VdB, RMS (Root Mean Square)
Barely to distinctly perceptible	0.02–0.10	Less than 60
Distinctly perceptible to strongly perceptible	0.10–0.50	60-70
Strongly perceptible to mildly unpleasant	0.50–1.00	70-80
Mildly unpleasant to distinctly unpleasant	1.00–2.00	80-90
Distinctly unpleasant to intolerable	2.00–10.00	Greater than 90
Source: Caltrans 2004 & Federal Transit Administration (FTA) 2006		

Environmental Setting

Project Area Noise Sources

The existing ambient noise environment in the project vicinity is defined by several different sources, including Interstate 80 traffic, local traffic on Stampede Meadows Road, Union Pacific Railroad (UPRR) operations, recreational activities at the Boca Reservoir (boating and off-highway vehicle usage), small aircraft overflights associated with the Truckee airport, military and commercial aircraft overflights, and natural sounds (wind in trees).

Sensitive Receptors

Potentially affected sensitive receptors identified in the general project vicinity include recreational users of the Boca Reservoir (boaters, fishermen, campers, cyclists, etc.), the Boca Reservoir's caretaker residence located on Stampede Meadows Road just south of the dam, a planned RV park on the south side of Interstate 80 at the Hirschdale Road exit, and existing residences on the south side of Interstate 80 in the Hirschdale, Buckhorn Ridge, and Glenshire communities.

While it is recognized that there are numerous residences within the Buckhorn Ridge, Glenshire and Hirschdale communities, it is not necessary to assess project impacts at each and every individual residence. Rather, standard industry convention is to assess impacts at receptors which represent the nearest sensitive land uses to the project site (including residences located adjacent to project haul routes), groups of residences with similar exposure to the project site, and more distant receptors which may experience different topographic shielding of the project site (or lack thereof), than the nearest receptors.

For this assessment, a total of 14 sensitive receptors were selected for analysis. Those receptors, which are illustrated on Figure 3, consist of the following locations:

- 3 receptors associated with the Boca reservoir
- 1 residential receptor north of Interstate 80 (reservoir caretaker dwelling)
- 1 receptor representing the RV park on the south side of I-80
- 2 receptors in the Hirschdale Community
- 2 receptors representing residences in the Buckhorn Ridge area
- 1 receptor representing more distant Glenshire residences
- 1 potential future residential location northeast of the project site (currently undeveloped)
- 3 potential future residential locations west of the project site (currently undeveloped)

Regarding the potential future residential locations, each of the parcels where such residences could theoretically be constructed are currently vacant. Receptor 14, which is located immediately west of the project site is owned and controlled by a Teichert Subsidiary, and there are no intentions to construct a residence on this parcel. Because residences could theoretically be constructed on the parcels represented by Receptors 11 – 13, those receptor locations are included in this analysis1.

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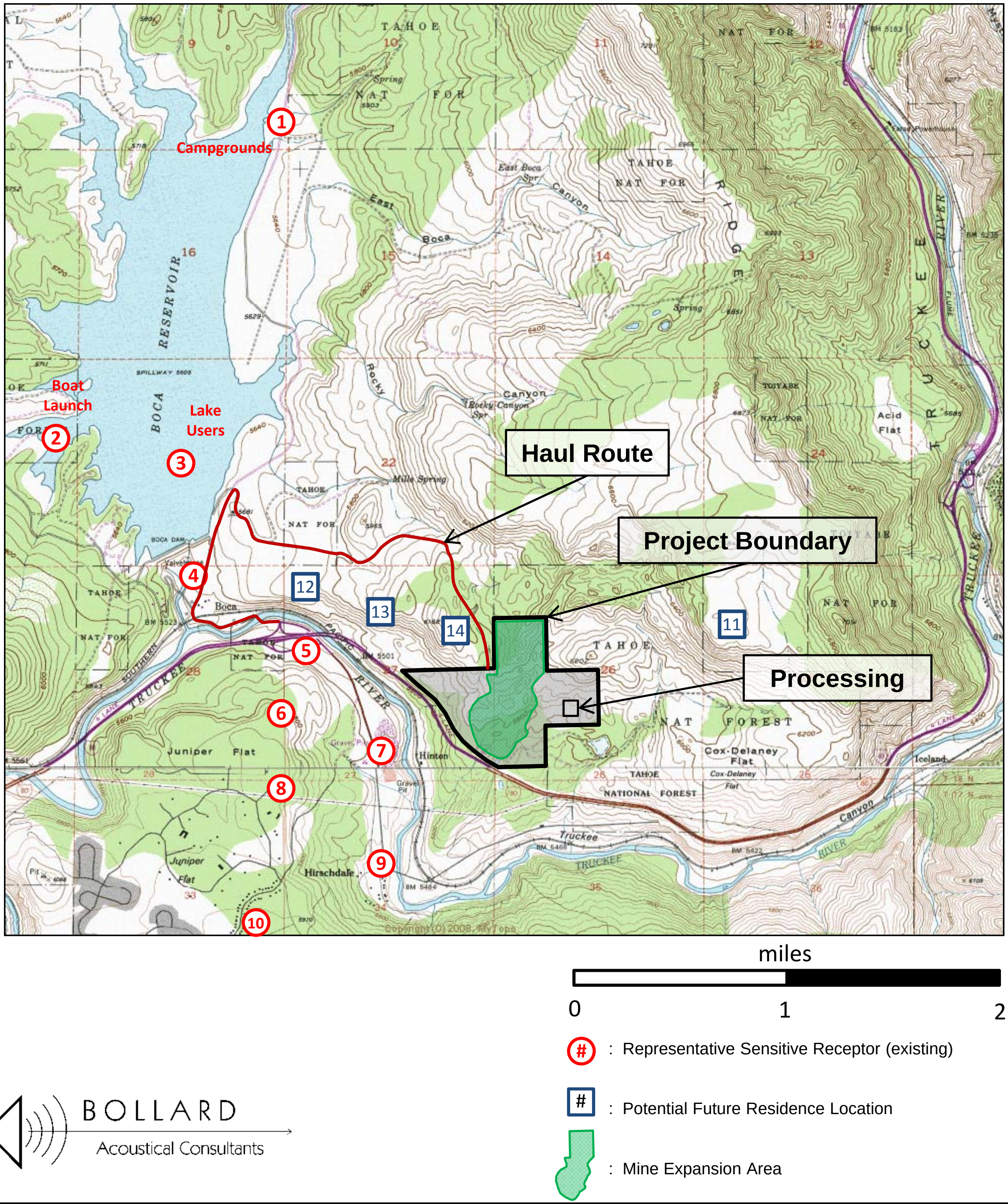
1 The three parcels represented by Receptors 11-13 are zoned FR-160 (Forest with a 160-acre minimum lot size) under the Nevada County Zoning Ordinance. The FR District is intended for "areas for the protection, production and management of timber, timber support uses, including but not limited to equipment storage and temporary offices, low intensity recreation uses, and open space." (Section L-II 2.3.B.3 of the Nevada County Zoning Ordinance.) Although the purpose of the FR District is not for residential uses, the Zoning Ordinance allows for one residential dwelling unit per parcel in the FR District. Receptors 12 and 13 are located on parcels that are substantially smaller than the 160-acre minimum lot size, but the Zoning Ordinance provides that a dwelling unit can be constructed if other site development standards can be met. (Section L-11 4.1.4.C of the Nevada County Zoning Ordinance.)

Figure 3
Nearest Sensitive Receptors
Teichert Boca Quarry Project



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Existing General Ambient Noise Environment at Sensitive Receptors

The California Environmental Quality Act (CEQA) states that a project would result in a significant noise impact if it causes a substantial increase in ambient noise levels. (See CEQA Appendix G, Section XII.) In order to determine the threshold at which a project would result in a substantial noise increase, the baseline (pre-project) ambient conditions at potentially impacted noise-sensitive land uses must be established.

2013 Ambient Noise Survey

To quantify existing (baseline) ambient noise environment in the project vicinity, continuous noise level measurements were conducted at six (6) locations representative of ambient noise conditions at ten (10) of the fourteen (14) receptors analyzed in the project vicinity. The noise measurement locations are identified on Figure 4. Figure 4 also indicates the location of a short-term noise monitoring site adjacent to the Boca Reservoir. This site was utilized for heavy truck passby single-event monitoring which is discussed in a subsequent section of this analysis.

It is noted that continuous noise monitoring was not conducted at each of the 14 sensitive receptors evaluated in this study. However, some monitoring locations are considered to be representative of ambient conditions at multiple receptor locations. For example, Monitoring Site A, which was located at the Boca Reservoir campground area (Receptor 1), was also considered to be representative of ambient conditions at the Boca Reservoir boat launch area (Receptor 2). These two areas are fairly remote relative to both I-80 and UPRR noise sources, and both are related to the recreational usage of the lake.

Monitoring Site B correspond to Receptors 3 and 4, which represent boating receptors and the dam caretakers residence, respectively, as they are both in relatively close proximity to the proposed heavy truck haul route.

Monitoring Sites C and D, represent receptors 5 and 6, respectively, with each monitoring site representing only one receptor each.

Monitoring Site E is representative of Receptors 7 and 8, and Monitoring Site F is representative of Receptors 9 and 10. These assumptions were based on BAC field observations of exposure to both distant and local noise sources, and general proximity of the receptors to each other.

The only potentially sensitive receptor locations at which monitoring was not conducted in the general vicinity were Receptors 11-14, which are currently vacant lands at which a future residence could theoretically be constructed (no residences are currently located on these properties). Ambient noise level data collected at other locations were generally used to estimate ambient conditions at these receptor locations.

Table 6, which is provided later in this report, indicates which monitoring sites were used to define ambient conditions at each sensitive receptor location evaluated in this study.

The ambient measurement period spans the continuous 48-hour period of May 14-15, 2013. Because nighttime operations will occur at the project site when local or regional construction projects require the delivery of aggregate materials during nighttime hours, the monitoring program included two complete daytime and nighttime periods.

Weather conditions present during the monitoring program were typical for the season, with cool morning temperatures, variable skies, low to moderate relative humidity, and calm to moderate winds. There were no adverse conditions which would have anomalously affected the ambient noise survey results.

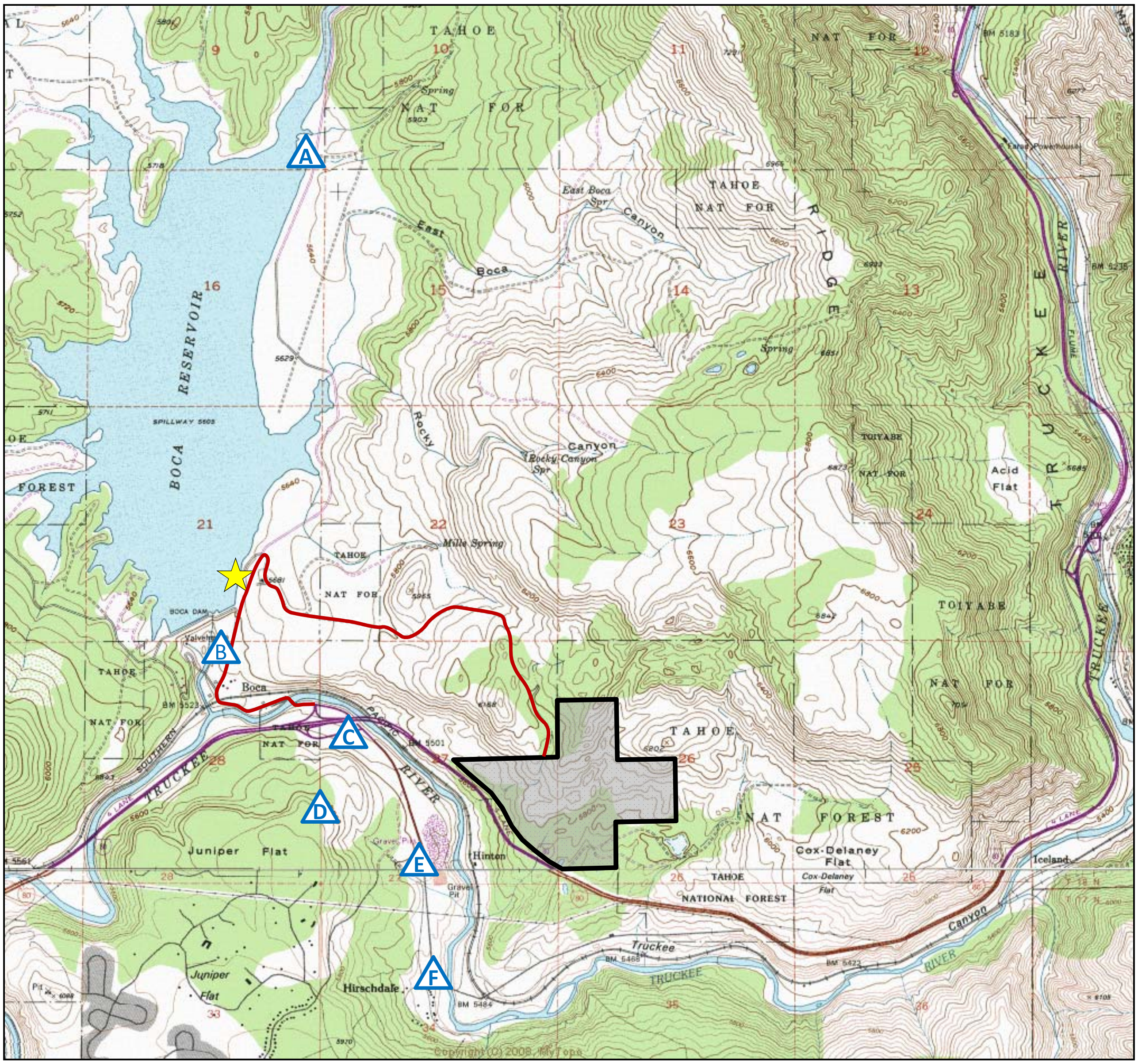
Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the noise level measurement survey. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4). The numerical summaries of the ambient noise level measurements are provided in Table 2. Table 2 also contains the arithmetic mean of the data collected on each day of the survey. A complete listing of ambient noise level results is provided numerically in Appendix B and graphically in Appendix C. Appendix D shows noise photographs of ambient noise measurement locations.

2017 Ambient Noise Survey

Because of the time that has elapsed since the 2013 ambient noise survey, a follow-up noise survey was conducted at the same six (6) noise monitoring locations on September 20-22, 2017. The same equipment was used for the 2017 measurements as the 2013 noise survey. Weather conditions present during the 2017 survey were also consistent with seasonal norms. The results of the 2017 noise monitoring survey are provided in Table 3, with the results shown graphically in Appendices B and C. Table 3 also contains the arithmetic mean of the data collected on each day of the survey.

It should be noted that the maximum noise levels reported in Tables 2 and 3 represent the highest, lowest, and average of the measured maximum noise levels at each location for each time period (day/evening/night). Individual maximum noise levels represent the highest measured instantaneous sound level present during any given hour of the noise surveys. As indicated in Appendix C, the measured maximum noise levels were frequently quite similar from hour to hour, indicating that the measured maximum noise levels were unlikely isolated or anomalous events. This is consistent with an ambient noise environment defined primarily by local traffic.

Figure 4
Noise and Vibration Monitoring Locations
Teichert Boca Quarry Project



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Continuous Noise & Vibration Survey Sites

Short-Term Noise Survey Site

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Table 2
Ambient Noise Measurement Results Summary
Teichert Boca Quarry Project Vicinity: May 14-15, 2013

		Daytime (7 am – 7 pm)						Evening (7 pm – 10 pm)						Nighttime (10 pm – 7 am)						
		Leq			Lmax			Leq			Lmax			Leq			Lmax			
Site	**Date**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**CNEL**
A	5/14/13	53	50	52	78	73	75	52	46	50	77	73	74	58	33	49	78	41	65	56
	5/15/13	57	51	54	79	74	76	49	44	48	74	73	73	52	29	44	77	38	57	54
	Mean	**55**	**51**	***53***	**79**	**74**	***76***	**51**	**45**	**49**	**76**	**73**	**74**	**55**	**31**	**47**	**78**	**40**	**61**	**55**
B	5/14/13	64	50	59	91	69	81	56	55	56	76	65	70	59	53	57	87	63	72	63
	5/15/13	59	53	57	86	67	77	60	54	57	87	66	76	60	53	57	87	63	76	64
	Mean	**62**	**52**	***58***	**89**	**68**	**79**	**58**	**55**	***57***	**82**	**66**	**73**	**60**	**53**	**57**	**87**	**63**	**74**	**64**
C	5/14/13	59	56	58	75	67	71	58	55	56	72	66	69	57	53	55	72	63	67	62
	5/15/13	59	55	57	76	66	70	58	55	57	71	64	68	57	52	55	76	63	69	62
	Mean	**59**	**56**	***58***	**76**	**67**	***71***	**58**	**55**	***57***	**72**	**65**	***69***	**57**	**53**	***55***	**74**	**63**	***68***	**62**
D	5/14/13	53	49	51	63	52	58	51	50	51	58	55	56	52	42	48	72	53	63	55
	5/15/13	59	55	57	71	60	65	58	54	56	73	63	67	56	52	54	68	60	63	61
	Mean	**56**	**52**	***54***	**67**	**56**	***62***	**55**	**52**	***54***	**66**	**59**	***62***	**54**	**47**	***51***	**70**	**57**	***63***	**58**
E	5/14/13	52	47	49	70	61	65	49	48	48	69	56	63	50	45	48	64	55	58	54
	5/15/13	51	47	49	70	61	64	49	47	48	63	57	61	49	45	47	64	52	60	54
	Mean	**52**	**47**	***49***	**70**	**61**	***65***	**49**	**48**	***48***	**66**	**57**	***62***	**50**	**45**	***48***	**64**	**54**	***59***	**54**
F	5/14/13	57	45	51	81	62	73	46	43	44	74	56	65	57	40	50	79	50	63	56
	5/15/13	58	43	51	88	61	71	48	43	46	73	61	65	58	40	53	83	47	69	59
	Mean	**58**	**44**	**51**	**85**	**62**	**72**	**47**	**43**	***45***	**74**	**59**	***65***	**58**	**40**	**52**	**81**	**49**	**66**	**58**

Source: Bollard Acoustical Consultants, Inc. (BAC)
Italicized numbers represent the values which were used to establish baseline ambient conditions for this project as they represent the lower of the Table 2 or Table 3 data for the three time periods.
Continuous noise measurement sites are shown on Figure 4

Table 3
Ambient Noise Measurement Results Summary
Teichert Boca Quarry Project Vicinity: September 20-22, 2017

		Daytime (7 am – 7 pm)						Evening (7 pm – 10 pm)						Nighttime (10 pm – 7 am)						
		Leq			Lmax			Leq			Lmax			Leq			Lmax			
Site	**Date**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**High**	**Low**	**Avg**	**CNEL**
A	9/20/2017	60	54	58	84	76	81	52	43	49	74	61	69	38	38	38	54	54	54	
	9/21/2017	61	50	57	83	74	80	47	37	44	73	57	67	56	29	49	78	41	62	57
	9/22/2017	59	55	58	83	80	81	-	-	-	-	-	-	56	20	38	79	32	63	
	Mean	**60**	**53**	**58**	**83**	**77**	**81**	**50**	**40**	***46***	**73**	**59**	***68***	**50**	**29**	***42***	**70**	**42**	***60***	**57**
B	9/20/2017	61	59	60	78	68	72	58	57	57	67	67	67	57	54	56	69	68	68	
	9/21/2017	61	58	60	85	65	74	58	57	57	70	68	69	59	53	56	70	64	67	63
	9/22/2017	61	58	59	79	64	70	-	-	-	-	-	-	59	52	55	71	61	66	
	Mean	**61**	**58**	**60**	**80**	**66**	***72***	**58**	**57**	***57***	**69**	**67**	***68***	**58**	**53**	***56***	**70**	**64**	***67***	**63**
C	9/20/2017	65	58	62	85	66	76	59	58	59	83	65	72	59	59	59	87	85	86	
	9/21/2017	63	55	60	89	66	79	62	59	60	87	65	77	60	55	57	84	63	70	65
	9/22/2017	60	59	60	86	70	77	-	-	-	-	-	-	61	54	57	88	62	69	
	Mean	**63**	**57**	**61**	**87**	**67**	**77**	**60**	**58**	**59**	**85**	**65**	**74**	**60**	**56**	**58**	**86**	**70**	**75**	**65**
D	9/20/2017	64	61	63	79	69	72	61	60	60	71	68	69	59	58	58	71	69	70	
	9/21/2017	65	60	63	82	67	73	62	61	62	78	69	74	62	57	59	71	66	68	67
	9/22/2017	64	63	64	81	69	75	-	-	-	-	-	-	63	57	59	71	68	69	
	Mean	**64**	**61**	**63**	**81**	**68**	**73**	**61**	**61**	**61**	**75**	**69**	**72**	**61**	**57**	**59**	**71**	**68**	**69**	**67**
E	9/20/2017	51	50	50	71	61	65	51	49	50	65	59	62	48	43	46	71	54	63	
	9/21/2017	54	48	51	74	61	67	50	50	50	70	60	64	52	46	49	70	57	61	55
	9/22/2017	51	50	51	70	65	67	-	-	-	-	-	-	-	-	-	-	-	-	
	Mean	**52**	**49**	**51**	**71**	**62**	**66**	**51**	**49**	**50**	**68**	**60**	**63**	**50**	**45**	***48***	**70**	**56**	**62**	**55**
F	9/20/2017	53	46	49	73	66	70	52	43	48	71	54	62	50	39	47	71	50	60	
	9/21/2017	54	43	50	84	62	71	60	46	56	91	70	78	51	40	47	76	54	65	56
	9/22/2017	53	45	50	78	64	70	-	-	-	-	-	-	53	36	46	75	48	59	
	Mean	**53**	**45**	***50***	**78**	**64**	***70***	**56**	**44**	**52**	**81**	**62**	**70**	**51**	**38**	***47***	**74**	**51**	***61***	**56**

Source: Bollard Acoustical Consultants, Inc. (BAC)
Italicized numbers represent the values which were used to establish baseline ambient conditions for this project as they represent the lower of the Table 2 or Table 3 data for the three time periods.
Continuous noise measurement sites are shown on Figure 4

With the exception of measurement Site D, overall 2017 noise exposure in terms of CNEL was within -2 to +3 dB relative to the 2013 monitoring period. At Site D, 2017 noise levels were measured to be 9 dB CNEL higher than levels measured during the 2013 average. This substantial increase cannot be readily explained but, given the relative consistency of the data collected at the other sites, it was likely cause by some local, noise-generating, activity in the immediate vicinity of Monitoring Site D. The overall average increase in CNEL noise levels across all of the noise monitoring sites, including the data from Site D, was 2 dB CNEL.

To provide the most conservative assessment of potential project noise impacts, the lower of the 2013 and 2017 ambient noise survey results were used to establish baseline ambient conditions.

Frequency Content of Existing Ambient Noise Environment

In addition to the continuous ambient noise monitoring program described above, short-term (20+minute) frequency spectra noise monitoring was conducted in the vicinity of each of the ambient noise measurement locations. The measurements were conducted during mid-day periods of May 14 and May 16, 2013. Figure 5 shows the frequency content measurements conducted near Site A.

Figure 5 – Frequency Content Measurements near Site A

A Larson Davis Laboratories (LDL) Model 824 precision sound level meter and frequency analyzer was used for the frequency content surveys. The meter was calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

The results of the frequency content surveys were normalized to equivalence with the average daytime noise levels for the long-term noise monitoring sites and plotted on Figure 6. In addition, average frequency spectra measured during multiple heavy truck passbys on Stampede Meadows Road (see Figure 5) was included in the Figure 6 plot. Those truck passby measurements are described in greater detail in a subsequent section of this report. Figure 6 illustrates that the shape of the ambient curves mirrors the spectral shape of the measured heavy truck passbys. This result is expected as the published heavy truck percentage for Interstate 80 is 13.9% (Caltrans 2015 Count Data). With 27,000 annual average daily vehicles, 13.9% heavy trucks equates to 3,753 daily heavy trucks passing the area at highway speeds. Because the existing noise environment in the immediate project vicinity is heavily influenced by heavy truck noise, project truck passbys would not introduce frequency content which is not already present in the project environment.

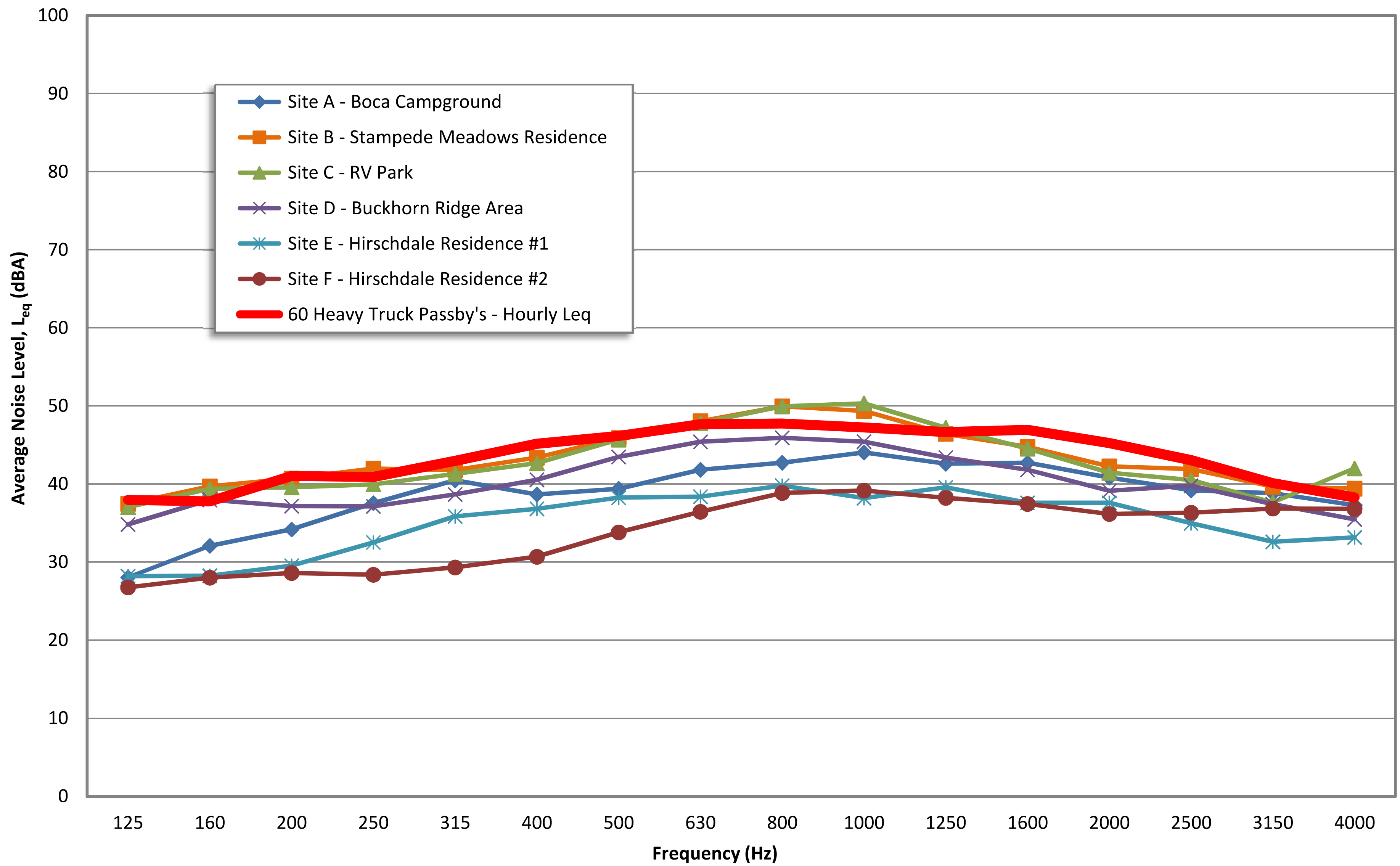
Existing Traffic Noise Environment

The existing general ambient noise environment in the project vicinity is substantially affected by existing traffic on Interstate 80, and to a lesser extent by local traffic on Hirschdale, Glenshire and Stampede Meadows Roads. According to published Caltrans traffic counts, the segment of I-80 located adjacent to the project area currently carries approximately 27,000 annual average daily trips (AADT). Of those trips, 13.9% are reported as being heavy (3 axles or more) trucks, and 4.7% are reported as being medium-duty trucks (2 axle trucks). As shown in the DEIR Transportation Section (Figure 4.5-1), existing traffic volumes on Stampede Meadows, Hirschdale and Glenshire Roads are considerably lower than traffic volumes on I-80.

The traffic noise environment along the roadways between the project site and Interstate 80 which would be utilized by project heavy truck traffic (Stampede Meadows and a portion of Hirschdale Road) is more significantly affected by Interstate 80 traffic noise than local traffic. In addition, at many locations in the immediate project vicinity, local topography significantly affects the propagation of traffic noise from both local roadways and I-80, potentially rendering the results of traffic modeling exercises unreliable. As a result, the previously described ambient noise measurement data collected at the nearest potentially affected sensitive-receptors, which includes traffic noise, is considered to be a more reliable indicator of overall ambient noise conditions than the results of traffic modeling efforts. A discussion of potential noise impacts associated with project heavy truck traffic is, however, provided in the Impacts and Mitigation Measures section of this report.

Figure 6

Measured Ambient & Heavy Truck Passby Noise Level Frequency Content
Teichert Boca Quarry Project Vicinity



BOLLARD
Acoustical Consultants

Existing Vibration Environment

No appreciable off-site sources of vibration were identified during BAC field surveys of the area and existing ambient vibration levels were subjectively evaluated as being below the threshold of perception. Nonetheless, to quantify baseline vibration levels at the nearest representative sensitive receptors to the project site and project haul route, BAC conducted vibration measurements on May 14 and 16, 2013.

The vibration measurements were conducted using a Larson-Davis Laboratories Model HVM-100 Vibration Analyzer with a PCB Electronics Model 353B51 ICP Vibration Transducer. The test system is a Type I instrument designed for use in assessing vibration as perceived by humans, and meets the full requirements of ISO 8041:1990(E). Atmospheric conditions present during the tests were within the operating parameters of the instrument. A photograph of the vibration measurement setup at Site B is provided in Figure 7. A summary of the vibration measurement results is provided in Table 4.

BAC revisited the vibration monitoring locations in September 2017 and confirmed that baseline vibration levels at each of the sites remain below the thresholds of perception. The 2017 vibration measurement results, which were conducted in terms of VdB RMS (Decibels Vibration – Root Mean Square), for subsequent comparison against FTA vibration criteria, are also shown in Table 4.

Figure 7 – Vibration Measurements near Site B

Table 4
Measured Ambient Vibration Levels
Teichert Boca Quarry Project Vicinity: May 2013 & September 2017

Site	May 2013 (ppv in/sec)	September 2017 (VdB, rms)
A	0.01 – 0.04	46
B	0.04 – 0.06	48
C	0.02	48
D	0.02	44
E	0.02 – 0.04	47
F	0.02 – 0.08	48

Source: Bollard Acoustical Consultants, Inc. (BAC)

Regulatory Setting

Nevada County

In California, cities and counties are required to adopt a Noise Element as part of their General Plan. Cities and counties can also adopt noise control requirements within their zoning ordinances or as a separate noise ordinance. The project site is located in Nevada County, which has both a General Plan Noise Element and a Zoning Ordinance which addresses noise. These standards represent the standards referenced in Item A of the CEQA Guidelines described above.

Nevada County Noise Element

Chapter 9 of the Nevada County General Plan contains the County's Noise Element. The Noise Element contains adopted Goals, Objectives and Policies pertaining to noise. The Noise Element Policies which are pertinent to this project are reproduced below (Table 5).

Policy 9.1.1 Determine the existing noise environment and continue to reassess this environment so that a realistic set of noise standards can be developed reflecting the varying nature of different land uses.

Policy 9.1.2 The following noise standards, contained in Table 5 below (General Plan Noise Element Table 9.1), as performance standards and land use compatibility standards, shall apply to all discretionary and ministerial projects excluding permitted residential (including tentative maps) land uses.

Table 5
Nevada County General Plan Noise Element Exterior Noise Limits

Land Use Category	Zoning Districts	Time Period	Noise Level, dBA Leq	Noise Level, dBA Lmax
Rural	"A1" "TPZ"	7 am - 7 pm	55	75
	"AE" "OS"	7 pm - 10 pm	50	65
	"FR" "IDR"	10 pm - 7 am	40	55
Residential and Public	"RA" "R2"	7 am - 7 pm	55	75
	"R1" "R3"	7 pm - 10 pm	50	65
	"P"	10 pm - 7 am	45	60
Commercial and Recreation	"C1" "CH" "CS"	7 am - 7 pm	70	90
	"C2" "C3" "OP" "REC"	7 pm - 7 am	65	75
Business Park	"BP"	7 am - 7 pm	65	85
		7 pm - 7 am	60	70
Industrial	"M1" "M2"	any time	80	90

A. Compliance with the above standards shall be determined by measuring the noise level based on the mean average of not less than three (3) 20 minute measurements for any given time period. Additional noise measurements may be necessary to ensure that the ambient noise level is adequately determined.

B. Where two different zoning districts abut, the standard applicable to the lower, or more restrictive, district plus 5 dBA shall apply.

C. The above standards shall be measured only on property containing a noise sensitive land use as defined in Policy 9.8 and may be measured anywhere on the property containing said land use. However, this measurement standard may be amended to provide for measurement at the boundary of a recorded noise easement or as determined in a recorded letter of agreement between all affected property owners and approved by the County.

D. If the measured ambient level exceeds that permitted, then the allowable noise exposure standard shall be set at 5 dBA above the ambient.

E. Because of the unique nature of sound, the County reserves the right to provide for a more restrictive standard than shown in the Exterior Noise Limits table contained in this policy. The maximum adjustment shall be limited to be not less than the current ambient noise levels and shall not exceed the standards of this policy or as they may be further adjusted by Policy 9.1.2.b. Imposition of a noise level adjustment shall only be considered if one or more of the following conditions are found to exist:

1. Unique characteristics of the noise source:

    a. The noise contains a very high or low frequency, is of a pure tone (a steady, audible tone such as a whine, screech, or hum), or contains a wide divergence in frequency spectra between the noise source and ambient level.

    b. The noise is impulsive in nature (such as hammering, riveting, or explosions), or contains music or speech.

    c. The noise source is of a long duration.

2. Unique characteristics of the noise receptor when the ambient noise level is determined to be 5 dBA or more below the Policy 9.1.2 standard for those projects requiring a General Plan amendment, rezoning, and/or conditional use permit. In such instances, the new standard shall not exceed 10 dBA above the ambient or the Policy 9.1.2 standard, whichever is more restrictive.

F. The above standards shall not apply to those activities associated with the actual construction of a project or to those projects associated with the provision of emergency services or functions.

G. The standards of this policy shall be enforced through compliance inspections and/or complaints.

H. Recognizing that this chapter must work toward the solution to existing noise problems, those land uses that are inconsistent with the above standards and are therefore non-conforming in nature, shall comply with said standards as these land uses are upgraded or intensified or after abandonment through the use permit or site plan process. Said standards shall apply only to that portion of the land use requiring approval. In any event, the use or portion subject to a land use permit must meet the standards in the Exterior Noise Limits table in this policy and cumulatively the noise generated from the entire site must be equal to or less than the pre-land use permit ambient noise level. All such projects will require a comprehensive noise analysis per Policy 9.1.12 and the Nevada County Noise Element Manual.

Policy 9.1.3 The Nevada County Planning Department shall be the lead agency responsible for coordination of all local noise control activities and intergovernmental group activities and subsequent enforcement efforts.

Policy 9.1.4 The County will continue an ongoing County-wide noise monitoring program. The purpose of this program is to assess the changing noise environment in the County in terms of the existing ambient noise level for typical rural, residential, commercial and industrial areas and to ensure that the Policy 9.1.1 standards realistically reflect the current needs of the County.

Policy 9.1.5 This chapter of the General Plan shall be implemented, in part, through the incorporation of the Policy 9.1.1 noise standards within the Land Use and Development Code and the adoption of the Noise Element Manual providing detailed direction and implementation measures. This Manual is adopted as a part of the Plan and can be found in Volume 2, Section 3-Noise Analysis, Appendix A.

Policy 9.1.6 Encourage public awareness of noise and its hazards and means to minimize its existing and future impacts.

Policy 9.1.7 Encourage heavy truck traffic to those routes outside residential areas.

Policy 9.1.8 Encourage cities within Nevada County to adopt noise control programs compatible with County efforts.

Policy 9.1.9 Develop a realistic policy framework designed to function as a guide to planning for appropriate land uses in relation to hazardous and annoying noise.

Policy 9.1.10 Strongly discourage those General Plan amendments and zone changes that would likely create land use conflicts relative to noise.

Policy 9.1.11 Strongly encourage future noise sensitive land uses, including residences, schools, hospitals, nursing homes, churches, and libraries, to those location of the County where the impact of noise generators is limited so that compliance with standards found in Policy 9.1.2 will be maintained. This policy shall apply to the approval of all tentative maps for residentially zoned parcels. As an additional guide in evaluating land use compatibility, those standards as found in Figure 1 shall be used.

Policy 9.1.12 Limit future noise generating land use to those location of the County where their impacts on noise sensitive land uses will be minimized, consistent with the standards found in Program 9.1.

Policy 9.1.13 Require the preparation of a comprehensive noise study for all land use projects determined to have a potential to create noise levels inconsistent with those standards found in Program 9.1, and in accordance with the methodology identified in the Noise Element Manual contained in General Plan Volume 2, Section 3 - Noise Analysis Appendix A.

Policy 9.1.14 Provide for adequate design controls to assist in mitigating on-site the significant adverse impacts of future noise generating land uses through increased setbacks, landscaping, earthen berms, and solid fencing.

Policy 9.1.15 Strictly enforce the noise insulation standards for new construction as required by Title 24 of the California Administrative Code.

Policy 9.1.16 Minimize the noise impact from automobiles, trucks, motorcycles, and off-road vehicles by continuing to request enforcement of those sections of the California Vehicle Code relative to vehicle exhaust system maintenance by the County Sheriff and State Highway Patrol.

Policy 9.1.17 Where realistically possible, encourage noise sensitive land uses away from railroad operations.

Policy 9.1.18 The routing and design of new or expanded transportation facilities by the County shall incorporate feasible measures necessary to mitigate increases in noise levels.

Policy 9.1.19 Encourage the minimization of noise emission from all County-controlled activities consistent with Policy 9.1.1 standards.

Policy 9.1.20 Protect the safety and general welfare of people in the vicinity of the Nevada County Airport and the Truckee Tahoe Airport port by implementing the appropriate noise compatibility policies to avoid the establishment of noise-sensitive land uses in the portion of the airport environs that are exposed to significant levels of aircraft noise.

Policy 9.1.21 Ensure the development of compatible land uses adjacent to the Nevada County Airport by enforcing the noise criteria as found in the Nevada County Airport Land Use Compatibility Plan as adopted by the Nevada County Airport Land Use Commission on September 21, 2011, as those standards are in effect and may be hereafter amended. (See Figure 9.1 of the General Plan Noise Element – Incorporated by reference).

Policy 9.1.22 Ensure the development of compatible land uses adjacent to the Truckee Tahoe Airport by implementing the noise criteria as found in the Truckee Tahoe Airport Land Use Compatibility Plan as adopted by the Truckee Tahoe Airport Land Use Commission on October 19, 2010, as those standards are in effect and may be hereafter amended.

Policy 9.1.23 The County shall continue to enforce noise criteria standards consistent with the airport noise policies adopted by the Nevada County Airport Land Use Commission and the Truckee Tahoe Airport Land use Commission based on the considerations of the following factors:

a. Established federal and state regulations and guidelines.
b. The ambient noise levels in the community. Ambient noise levels influence the potential intrusiveness of aircraft noise upon a particular land use and vary greatly between Community Regions and Rural Regions.
c. The extent to which noise would intrude upon and interrupt the activity associated with a particular use.
d. The extent to which the activity itself generates noise.
e. The extent which the activity itself generates itself generates noise.
f. The extent of outdoor activity associated with a particular land use.
e. The extent to which indoor uses associated with a particular land use may be made compatible with application of sound attenuation in accordance with the policies set forth for maximum acceptable interior noise levels.

Nevada County Zoning Ordinance

Section L-22 4.1.7 of the Nevada County Land Use and Development Code (LUDC) pertains to noise. The adopted noise standards contained in this section are identical to those contained in the General Plan Noise Element, specifically Table 5 above. Because the noise standards are identical, the Zoning Ordinance standards are not reproduced below.

Adjustments to Nevada County Noise Standards

As noted above in the footnotes to Table 5, there are various adjustments to the County's noise limits which are to be applied if certain conditions are satisfied. The footnotes most applicable to this project are A, D and E.

Footnote A provides the methodology by which ambient conditions are established. Specifically, compliance with the Table 5 standards shall be determined by measuring the noise level based on the ***mean average*** (emphasis added) of not less than three (3) 20 minute measurements for any given time period. Additional noise measurements may be necessary to ensure that the ambient noise level is adequately determined.

Footnote D of Table 5 states that if the measured ambient level exceeds that permitted in Table 5, then the allowable noise exposure standard shall be set at 5 dBA above the ambient. A discussion of the applicability of the Footnote D provisions follows the Footnote E discussion.

Footnote E states that the County reserves the right to provide for a more restrictive standard under certain conditions. However, the standard cannot be set below current ambient noise levels. Imposition of a noise level adjustment is only considered if one or more of the following conditions are found to exist:

- *The noise source contains a very high or low frequency, is of a pure tone (a steady, audible tone such as a whine, screech, or hum), or contains a wide divergence in frequency spectra between the noise source and ambient level.*

  With the exception of warning devices on mobile equipment (back-up beepers), the project does not propose any sources of noise which contain pure tones. Additional support for this assertion in the form of frequency spectra for both heavy truck traffic and on-site crushing/screening operations is provided later in this report. As a result, the noise standard applicable to emergency warning devices would be set equal to the measured ambient noise level.

- *The noise is impulsive in nature (such as hammering, riveting, or explosions), or contains music or speech.*

  With the exception of periodic blasting activities, the project does not propose any sources of noise which would be considered impulsive. In addition, no sources of noise containing speech or music are proposed. As a result, the appropriate noise standard for blasting would be the measured ambient condition.

- *The noise source is of a long duration.*

  On busy days, the noise generation of proposed excavation and materials processing operations would be fairly constant. As a result, those project noise sources are assumed to be of long duration and subject to the provision stating the noise standard applied to these sources shall be set to current ambient noise levels. Because material load-out is intermittent (i.e. not of continuous or long duration), load-out operations and heavy truck traffic noise generated by the project would not be subject to this provision.

- *Unique characteristics of the noise receptor when the ambient noise level is determined to be 5 dBA or more below the Policy 9.1 standard for those projects requiring a General Plan amendment, rezoning, and/or conditional use permit. In such instances, the new standard shall not exceed 10 dBA above the ambient or the Policy 9.1 standard, whichever is more restrictive.*

  The relationship of measured ambient noise levels to the Table 5 standards is described in greater detail below. However, with the exception of Receptor 5 (RV Park), which is subject to the higher noise level standards applicable to the Commercial and Recreation noise standards, in no case were measured ambient noise levels more than 10 dB below the Table 5 noise standards. As a result, with the exception of Receptor 5, no *downward* offset to the Table 5 standards was warranted based on measured ambient conditions.

As noted previously, to define ambient conditions for this study continuous noise monitoring was performed for 48-hour periods at five (5) locations with the results presented in Table 2. The duration of the noise monitoring program considerably exceeds the requirement of Footnote A (minimum of three 20-minute samples). The Table 2 data indicate that existing ambient noise levels exceeded the Table 5 noise standards in most categories at most locations. Pursuant to Footnote D of Table 5, County noise standards are to be adjusted upward to 5 dB *above* ambient conditions to account for the elevated ambient noise environment in the project vicinity.

As described previously, some of the noise sources associated with the project would be subject to more restrictive noise standards due to the source being impulsive in nature (blasting), tonal (back-up beepers), of long duration (excavation and processing operations), or ambient conditions being 10 dB or more below the applicable noise standard (RV Park). Conversely, the measured ambient noise conditions exceeded the applicable noise standards at monitoring sites representing 9 of the 14 sensitive receptors evaluated in this study. Therefore, County policy dictates that the County's noise standards be adjusted upward to a point 5 dB above the measured ambient conditions at those locations.

At Receptor 11, where ambient noise monitoring could not be conducted, the County noise standards are applied as provided in Table 5 with no upward adjustment for elevated ambient noise levels as allowed under Footnote D of that table.

To reconcile these adjustments at all receptors except 11, this assessment of project noise impacts conservatively establishes the lower of the measured 2013 and 2017 ambient noise conditions as the project threshold of significance for on-site processing, excavation (including blasting), and material load-out. For the heavy truck traffic noise impact evaluation, which is not subject to the Footnote E provisions, the project threshold of significance is set at the ambient plus 5 dB level required under Footnote D.

For Receptor 11, the County noise standards shown in Table 5 were applied without adjustment to the analysis of heavy truck traffic noise impacts. For on-site processing, excavation (including blasting), and material load-out, the Table 5 standards were adjusted downward by 5 dB due to these sources being impulsive in nature (blasting), tonal (back-up beepers), and of long duration (excavation & processing operations).

At Receptors 12 – 13, the ambient conditions would depend on the location where a future residence would theoretically be constructed. Given the proximity to I-80, ambient conditions at these properties are likely elevated. Based on data collected at other sites with similar I-80 exposure, a +10 dB upward adjustment to the County's nighttime noise level standard would be appropriate for these parcels. However, to provide a conservative assessment of potential noise impacts at future residences constructed on these properties, BAC applied the daytime and evening Nevada County General Plan Noise Element standards without upward adjustment for ambient conditions.

The ambient noise measurement results shown in Tables 2 & 3 are summarized below in Table 6. With the exception of Receptor 11, the Table 6 levels would be the project standards of significance for all sources of project-generated noise other than truck traffic. Truck traffic would be subject to the ambient plus 5 dB standard.

To provide the most conservative assessment of potential project noise impacts, the lower of the 2013 and 2017 ambient noise survey results were used to establish baseline ambient conditions and the corresponding adjusted noise level limits are shown in Table 6.

Table 6
Nevada County Exterior Noise Limits Adjusted to Ambient Conditions[4]

Receptor[1]	Category[2]	Monitoring Site[3]	Time Period	Unadjusted Standards (Table 5) Leq	Unadjusted Standards (Table 5) Lmax	Offsets for Ambient Leq	Offsets for Ambient Lmax	Adjusted Standards Leq	Adjusted Standards Lmax
1, 2	Rural	A	7 am – 7 pm	55	75	-2	1	53	76
			7 pm – 10 pm	50	65	-4	3	46	68
			10 pm – 7 am	40	55	2	5	42	60
3, 4	Rural	B	7 am – 7 pm	55	75	3	-3	58	72
			7 pm – 10 pm	50	65	7	3	57	68
			10 pm – 7 am	40	55	16	12	56	67
5	Recreation	C	7 am – 7 pm	55	75	3	-4	58	71
			7 pm – 10 pm	50	65	7	4	57	69
			10 pm – 7 am	45	60	10	8	55	68
6	Rural	D	7 am – 7 pm	55	75	-1	-13	54	62
			7 pm – 10 pm	50	65	4	-3	54	62
			10 pm – 7 am	40	55	11	8	51	63
7, 8	Rural	E	7 am – 7 pm	55	75	-6	-10	49	65
			7 pm – 10 pm	50	65	-2	-3	48	62
			10 pm – 7 am	40	55	8	4	48	59
9, 10	Rural	F	7 am – 7 pm	55	75	-5	-5	50	70
			7 pm – 10 pm	50	65	-5	0	45	65
			10 pm – 7 am	40	55	7	6	47	61
11	Rural	None	7 am – 7 pm	55	75	-5	-5	50	70
			7 pm – 10 pm	50	65	-5	-5	45	60
			10 pm – 7 am	40	55	-5	-5	35	50
12, 13	Rural	None	7 am – 7 pm	55	75	0	0	55	75
			7 pm – 10 pm	50	65	0	0	50	65
			10 pm – 7 am	40	55	10	5	50	60

Notes:
1. Receptor locations are shown on Figure 3.
2. Land use designations were obtained from Nevada County Zoning Maps.
3. This column indicates the noise monitoring site (Figure 4) which is most representative of ambient conditions at the receiver location (Figure 3).
4. The adjusted noise level standards are the lower of the average Leq and Lmax values for each time period between the Table 2 (2013) and the Table 3 (2017) data. The italicized data contained in those tables reflect the data shown in Table 6 for each noise metric and time period.
5. These standards are applicable to all project noise sources other than heavy truck traffic. Pursuant to Footnote D of Table 5, the noise standards applicable to heavy truck traffic would be the ambient noise levels shown above plus 5 dB.
6. For Receptor 11, where ambient data is not available, this analysis conservatively applies the County noise standards shown in Table 5, adjusted downward by 5 dB, to all sources of project-generated noise other than truck traffic. For truck traffic noise, the standards of Table 5 are conservatively applied to Receptor 11 without adjustment.
7. No adjustment to the County daytime or evening standards were applied to potential future residential receptors 12-13. However, a 50 dB nighttime standard was applied due to the proximity of these parcels to I-80..

Nevada County General Plan Volume 2, Section 3 - Noise Analysis Appendix A.

Appendix A of the Nevada County General Plan Volume 2, Section 3, contains noise prediction methodologies which are approved for use in acoustical analyses submitted to Nevada County. Other methodologies may be used if approved by the County Planning Department after review of supporting technical justification. The requirements for an acoustical analysis contained in that Appendix is reproduced below.

Requirements for an Acoustical Analysis

Acoustical analyses prepared pursuant to the Noise Element shall:

A. Be the responsibility of the applicant.

B. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.

C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources. Noise measurement procedures must be consistent with the ASTM Standard Guide for Measurement of Outdoor Sound Levels (ASTM E1014-84).

D. Estimate existing and projected (20 years) noise levels in terms of L_{dn} or CNEL and/or the standards of Table 5, and compare those levels to the adopted policies of the Noise Element. Noise prediction methodology must be consistent with the appendix to the Noise Element.

E. Recommend appropriate mitigation to achieve compliance with the adopted 'policies and standards of the Noise Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms in terms of possible sleep disturbance.

F. Estimate noise exposure after the prescribed mitigation measures have been implemented.

G. Describe a post-project assessment program which could be used to evaluate the effectiveness of the proposed mitigation measures.

The requirements for an acoustical analysis cited above were followed for this analysis. Specifically, the applicant has initiated and paid for this analysis, with the County providing oversight and peer review at the applicant’s expense.

This study was prepared by Paul Bollard, a Mechanical Engineer and Board Certified member of the Institute of Noise Control Engineers (INCE Bd. Certified) with 26-years’ experience as a noise consultant.

This study includes representative noise monitoring at multiple locations for extended durations, with the ASTM standards of outdoor noise monitoring followed.

With the exception of changing excavation areas, the project noise generation will not change over time (i.e. 20 year horizon), and the locations of the closest proposed excavation areas to existing residences have been evaluated in this analysis, so the project noise generation has been quantified in terms of both existing and projected 20-year horizons. Because ambient noise conditions will increase over this 20 year horizon, while project noise generation predictions will not change, this report represents the worst-case evaluation of project impacts relative to ambient conditions.

Because no adverse noise impacts were identified for this project, no mitigation measures were required. Although impacts were not identified, this study does include an assessment of single-event noise associated with individual passages of heavy trucks on the private and public haul route between the project site and Interstate 80. Because no mitigation measures are warranted for this project, conditions F and G of the acoustical analysis requirements are not applicable.

Noise Standards of Other Jurisdictions

Appendix G of the CEQA Guidelines, Section XII (Noise) states that a project would result in a significant noise impact if it resulted 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.

As noted previously, Nevada County has adopted both a Noise Element and Noise Ordinance. The Noise Element contains reasonable numeric standards for the assessment of noise impacts, and the Noise Ordinance standards are consistent with the Noise Element. Because the County's noise standards have been developed specifically for Nevada County, and because those standards provide thresholds in terms of hourly average, and single-event maximum noise levels, they are also comprehensive. As a result, the use of standards developed for other jurisdictions in lieu of the adopted Nevada County noise standards is unnecessary.

Three areas where consideration of noise standards beyond those adopted by Nevada is warranted are with respect to project-related noise level increases, vibration impact assessment, and sleep disturbance. Recommendations for appropriate thresholds relative to these areas follow.

Noise Level Increase Criteria

It is generally recognized that an increase of at least 3 dB for similar noise sources is usually required before most people will perceive a change in noise levels, and an increase of 6 dB is required before the change will be clearly noticeable (Egan, Architectural Acoustics, page 21, 1988, McGraw Hill).

The Federal Interagency Commission on Noise (FICON) has developed a graduated scale for use in the assessment of project-related noise level increases. Table 7 was developed by FICON as a means of developing thresholds for impact identification for project-related noise level increases. The FICON standards have been used extensively in recent years by the authors of this section in the preparation of the noise sections of Environmental Impact Reports that have been certified in many California Cities and Counties.

The rationale for the graduated scale used in the FICON standards is that test subjects' reactions to increases in noise levels varied depending on the starting level of noise. Specifically, with lower ambient noise environments, such as those below 60 dB L_{dn}, a larger increase in noise levels was required to achieve a negative reaction than was necessary in more elevated noise environments.

The use of the FICON standards are considered conservative relative to thresholds used by other agencies in the State of California. For example, the California Department of Transportation (Caltrans) requires a project-related traffic noise level increase of 12 dB for a finding of significance, and the California Energy Commission (CEC) considers project-related noise level increases between 5-10 dB significant, depending on local factors. Therefore, the use of the FICON standards, which set the threshold for finding of significant noise impacts as low as 1.5 dB, provides a very conservative approach to impact assessment for this project.

Table 7
Significance of Changes in Cumulative Noise Exposure

Ambient Noise Level Without Project, L_{dn}	Increase Required for Significant Impact
<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)

Based on the FICON research, as shown in Table 7, a 5 dB increase in noise levels due to a project is required for a finding of significant noise impact where ambient noise levels without the project are less than 60 dB L_{dn}. Where pre-project ambient conditions are between 60 and 65 dB L_{dn}, a 3 dB increase is applied as the standard of significance. Finally, in areas already exposed to higher noise levels, specifically pre-project noise levels in excess of 65 dB L_{dn}, a 1.5 dB increase is considered by FICON as the threshold of significance.

This graduated scale indicates that in quieter noise environments, test subjects tolerated a higher increase in noise levels due to a project before the onset of adverse noise impacts than did test subjects in louder environments.

According to the FICON study, if screening analysis shows that noise-sensitive areas will be at or above DNL 65 dB and will have an increase of DNL 1.5 or more, further analysis should be conducted. The FICON study also reported the following: Every change in the noise environment does not necessarily impact public health and welfare.

Audibility is not a test of significance according to CEQA. If this were the case, any project which added any audible amount of noise to the environment would be considered unacceptable according to CEQA. Because every physical process creates noise, whether by the addition of a single vehicle on a roadway, or a tractor in an agricultural field, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change.

Sleep Disturbance Criteria

Since a court case in Berkeley, California (*Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners of the City of Oakland* (2001) 91 Cal.App.4th 1344), which pertained to increased aircraft overflights of the City of Berkeley, there has been increased attention to the evaluation of single-event noise levels during the preparation of noise analyses. The Berkeley case ruling required that single-event noise be considered, but it did not recommend an appropriate single event noise level standard.

The Federal Interagency Committee on Aviation Noise (FICAN) has provided estimates of the percentage of people expected to be awakened when exposed to specific SELs inside a home (FICAN 1997). However, FICAN did not recommend a threshold of significance based on the percent of people awakened. According to the FICAN study, 10% of the population is estimated to be awakened when the SEL interior noise level of 81 dBA. An estimated 5 to 10 percent of the population is affected when the SEL interior noise level is between 65 and 81 dBA, and few sleep awakenings (less than 5 percent) are predicted if the interior SEL is less than 65 dBA.

The threshold for sleep disturbance is not absolute because there is a high degree of variability from one person to another. Thus, the means of applying such research to land use decisions is not yet clear. As a result, no government agency has suggested what frequencies of awakenings are acceptable (California Division of Aeronautics 2002). For these reasons, the Federal Interagency Committee on Noise (FICON) and the California Airport and Land Use Planning Handbook continue to use CNEL as the primary tool for the purpose of land use compatibility planning (California Division of Aeronautics 2002). Note that CNEL and L_{dn} are often used interchangeably, as there is only a subtle difference in noise level penalties between the two metrics during evening hours. In fact, the L_{dn} represents the cumulative exposure to all single events; that is, the exposure of all SELs taken together, weighed to add penalties for nighttime occurrences, and averaged over a 24-hour period. Thus, it can be argued that the L_{dn}-based standards already account for the individual impacts associated with the SELs.

This analysis uses 65 dB SEL within residences as the threshold at which sleep disturbance impacts could occur. Based on the FICAN test results on aviation noise, less than 5% of the population experiences sleep disturbance if interior noise is less than 65 dB SEL. Thus, for the purposes of this analysis, noise from truck passages associated with the Project would be considered significant if it exceeds 65 dB SEL at the interior of residences.

Vibration Criteria

Nevada County has no adopted vibration standards. As a result, Caltrans-recommended criteria are applied for this project, as described below. Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. The Caltrans publication, *Transportation-and Construction-Induced Vibration Guidance Manual*, written for Caltrans by Jones & Stokes in June 2004, provides guidelines for acceptable vibration limits for transportation and construction projects in terms of the induced peak particle velocity (PPV). Those standards are reproduced below in Table 8.

Table 8
Vibration Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources[1]	Continuous or Frequent Intermittent Sources[2]
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

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

Current Caltrans research illustrates that there are different thresholds of perception for different types of vibration sources. Section XI(b) of Appendix G of the CEQA guidelines requires that a project result in exposure of persons to, or generation of, *excessive* groundborne vibration levels or groundborne noise levels, for the finding of a significant impact. The CEQA guidelines specifically mention “excessive” vibration, rather than just perceptible vibration.

The general range at which vibration becomes distinctly to strongly perceptible is noted in Table 1 as being 0.1 – 0.50 in/sec ppv. Because blasting events are proposed to occur during daytime hours only, the 0.5 threshold is considered to be appropriate for this evaluation.

Standards of Significance Applied to this Project

The following standards of significance, which are based on the California Environmental Quality Act Guidelines (State CEQA Guidelines) in conjunction with adopted local noise policy and appropriate noise standards as described above, are applied to this project:

a) 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.

For noise generated by on-site activities, including project excavation, processing, and load-out, the noise standards of Table 6 are applied.

For heavy truck traffic on the private haul route as well as local roadways, the noise standards of Table 6 plus 5 dB are applied.

For the evaluation of sleep disturbance impacts at the single residence located along the project haul route, the maximum (L_{max}) standards of Table 6 are used in addition to an interior SEL value of 65 dB. As noted above, the Table 6 standards are adjusted to equal existing ambient conditions.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

For this assessment, a vibration level of 1 in/sec ppv is considered a criterion that would protect against significant architectural or structural damage. The general range at which vibration becomes distinctly to strongly perceptible is noted in Table 1 as being 0.1 – 0.50 in/sec ppv. Because blasting events are proposed to occur during daytime hours only, the 0.5 threshold is considered to be appropriate for this evaluation.

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Substantial increases are defined using the FICON guidelines shown in Table 7. Specifically, project-related noise level increases ranging from 1.5 dB or greater are considered significant for this assessment, depending on the existing ambient conditions without the project.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above level existing without the project.

As with Item C above, substantial increases are defined using the FICON guidelines shown in Table 7. Specifically, project-related noise level increases ranging from 1.5 dB or greater are considered significant for this assessment, depending on the existing ambient conditions without the project.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project to excessive noise levels.

The Truckee-Tahoe Airport, which is the nearest public airport, is located approximately 5 miles from the project site so an evaluation of aircraft noise impacts associated with public airports is not warranted for this project.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

No private airstrips were identified in the project vicinity so an evaluation of aircraft noise impacts associated with such facilities is not warranted for this project.

Sound Propagation Characteristics

Effects of Distance on Sound Propagation

As a general rule, sound from a localized source spreads out as it travels away from the source, and the sound pressure levels drop off with distance according to fundamental relationships. Sound from a localized source (i.e., point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (i.e., decreases) at a rate of 6 dB for each doubling of distance from a point source. For this project, processing equipment is treated as a point source in the noise propagation calculations. Although excavation locations will change over the life of the mining activities, during any particular hour of operations, excavation activities would generally be limited to a fixed location. As a result, excavation activities are also treated as point sources in the propagation calculations. Truck traffic, both on-site and off, consists of individual and localized noise sources moving on a defined path. As a result, project truck traffic is treated as a moving point source in the propagation calculations, with a sound level decay rate of 4.5 dB per doubling of distance from the noise source.

The important factors that affect sound propagation are sound absorption in the air, presence of barriers and ground cover, the effect of wind and temperature gradients, and the acoustic effect of the presence of the ground. These factors tend to be interrelated in that the effect of one will be dependent on the presence of the others.

Atmospheric (Molecular) Absorption and Anomalous Excess Attenuation

Air absorbs sound energy. The amount of absorption is dependent on the temperature and humidity of the air, as well as the frequency of the sound. Families of curves have been developed which relate these variables to molecular absorption coefficients, frequently expressed in terms of dB per thousand feet. For standard day atmospheric conditions, defined as 59 degrees Fahrenheit and 70% relative humidity, the molecular absorption coefficient at 1000 hertz is 1.5 dB per thousand feet. Molecular absorption is greater at higher frequencies, and reduced at lower frequencies. In addition, for drier conditions, which are common in the Truckee area, the molecular absorption coefficients generally increase. Similarly, at temperature increases, molecular absorption coefficients typically increase as well.

Anomalous excess attenuation caused by variations in wind speed, wind direction, and thermal gradients in the air can typically be estimated using an attenuation rate of 1.5 dB per thousand feet for a noise source generating a 1000 hertz signal. As with molecular absorption, anomalous excess attenuation typically decrease with lower frequencies and increases with higher frequencies.

For a conservative assessment of sound propagation for this evaluation, a single attenuation factor of 1.5 dB per thousand feet of distance was used. Because noise generated by aggregate processing operations typically contains the majority of sound energy in frequencies above 1000 hertz, the 1.5 dB per thousand feet attenuation rate is appropriate for this assessment.

Effects of Barriers and Ground Cover

A noise barrier is any impediment which intercepts the path of sound as it travels from source to receiver. Such impediments can be natural, such as a hill or other naturally occurring topographic feature which blocks the receiver's view of the source, vegetative, such as heavy tree cover which similarly blocks the source from view of the receiver, or man-made, such as a solid wall, earthen berm, or structure constructed between the noise source and receiver. Regardless of the type of impediment, the physical properties of sound are such that, at the point where the line-of-sight between the source and receiver is interrupted by a barrier, a 5 dB reduction in sound occurs.

The effectiveness of a barrier is a function of the difference in distance sound travels on a straight-line path from source to receiver versus the distance it must travel from source to barrier, then barrier to receiver. This difference is referred to as the "path length difference", and is used to calculate the Fresnel Number. A barrier's effectiveness is a function of the Fresnel number and frequency content of the source. In general, the more acute the angle of the sound path created by the introduction of a barrier, the greater the noise reduction provided by the barrier.

For this project some receptors are shielded from view of various noise-generating components of the project, including excavation, processing, and load-out. Where such shielding would occur, the level of noise reaching the receiver would be lower than at unshielded receivers located the same distances from the source. Because shielding of the various components of the project varies both by source and receiver location, this analysis takes the conservative approach of not applying any downward adjustments to predicted noise levels generated by the project at any receiver locations, regardless of whether or not those receivers would be shielded.

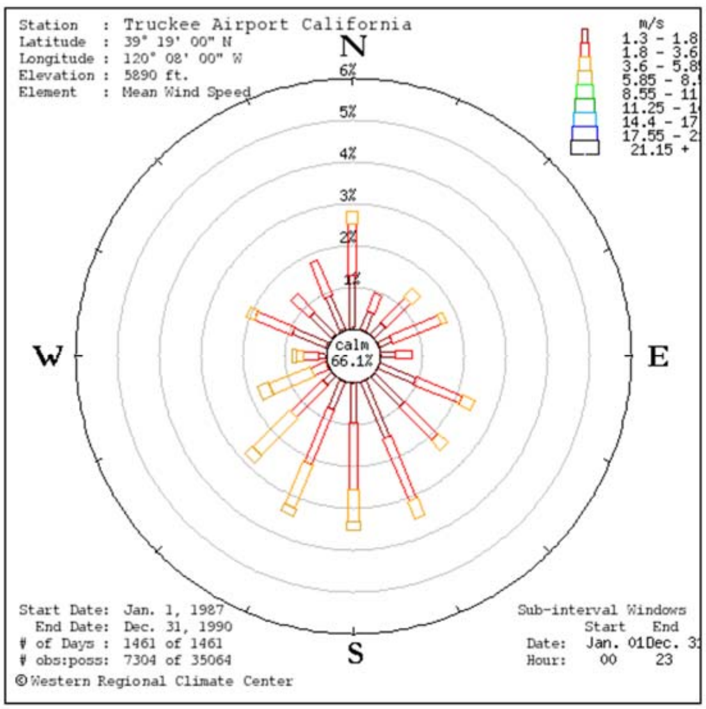
Effects of Wind Gradients on Sound Propagation

During windy conditions over open level ground, wind gradients almost always exist. This is due to the friction between the moving air and the ground. Due to these gradients, the speed of sound varies with height above ground. This condition tends to refract, or bend, sound waves upward or downward, depending on whether the receiver is upwind or downwind from the source.

At locations upwind from the sound source, wind gradients bend sound rays upward, thereby reducing sound levels at the receiver. Conversely, downwind locations will experience higher sound levels due to wind gradients bending sound rays downward.

Figure 4.7-1 of the project DEIR contains the wind rose for the Truckee Airport Atmospheric Monitoring Station. That figure, which is reproduced below as Figure 8, indicates that wind speeds and directions are highly variable in the region, with no clear prevailing wind direction or speed. As indicated on Figure 8, wind conditions are reported as being calm 66.1% of the time.

Figure 8 – Truckee Airport Wind Rose



The figure 8 data indicate that 66% of the time the calm wind conditions will have no effect on sound propagation. The remaining 34% of the time the winds are variable, but with south winds present a higher percentage of time than winds from the north. Because the nearest residences are located generally south of the project site, the majority of time when winds are present those residents would be upwind of the project site, thereby experiencing lower noise levels than even during calm conditions. But because winds are predominately calm, and variable when not calm, the net effect of the wind conditions on the propagation of project noise to the nearest receptors is negligible.

Effects of Temperature Inversions on Sound Propagation

Temperature gradients exist due to heat exchange between the ground and the atmosphere. As with wind gradients, temperature gradients tend to refract, or bend, sound waves upward or downward, depending on whether the gradient is positive or negative.

During normal temperature lapses, air temperature decreases with increasing elevation. During these conditions, such as would typically be present on a clear, calm day, warmer air near the ground can cause sound waves to bend upward, thus decreasing sound levels over distance. Conversely, on a clear calm night, air temperatures can become inverted, and sound will tend to focus and bend toward the ground.

It is widely recognized that temperature gradients can have a substantial effect on the propagation of sound over large distances, causing difference in sound levels of as much as 10 dB at distances in excess of 1,000 feet from the noise source.

Critical factors in estimating the effects of temperature inversions on sound propagation include the elevation of the top of the inversion (the point at which a normal temperature lapse resumes) and the intensity of the gradient (the change in temperatures between the ceiling of the inversion and the ground).

The elevation of the top, or ceiling, of the temperature inversion is important in that it is this boundary layer which is believed to be responsible for the reflection of sound back towards the ground. As the elevation of the inversion ceiling increases, the intensity of the sound incident upon the inversion boundary decreases (due to normal spherical spreading), and the angle of sound incidence is increased. As the angle of incidence is increased, a larger percentage of the sound is transmitted through the boundary layer, thus resulting in a smaller percentage being reflected back towards the ground.

The intensity of the temperature inversion is as important to the propagation of sound as the ceiling of the inversion. Inversions with greater differentials between the ground and the inversion ceiling will result in higher noise levels at larger distances from the sound source. This is because the intensity of the temperature gradient essentially defines the strength of the sound reflecting layer.

On page 4.7-1 of the DEIR, it is noted that periods of calm winds and clear skies in fall and winter often result in strong, ground based inversions forming in mountain valleys. During such conditions, sound propagating from the project site could be expected to reach nearby sensitive receptors at higher levels than during non-inversion conditions. However, inversions cannot selectively affect noise generated by the project while ignoring noise generated by other sources, such as railroad passages and traffic on Interstate 80. As a result, when inversion conditions are present, background ambient noise levels generated by sources of noise other than project would be expected to increase as well. Because the project standards of significance are tied to ambient conditions, any increase in project noise levels resulting from such inversions would be masked by the increase in ambient noise levels (i.e. I-80 traffic), present during inversion conditions, and the net effect relative to County noise standards would be negligible.

Impacts & Mitigation Measures

Project Noise Generation – Excavation, Processing & Load-out

The proposed project would expand existing mining into an area just west of current mining activities. In addition, the project would allow for an increase in the facility's maximum production from a historical high of approximately 300,000 tons per year to a requested maximum of 1 million tons per year, as needed to meet market demand. This project could affect the ambient noise environment by the creation of mining areas to the west of existing mining areas, longer mining, processing and material load-out/backfill import hours, and the use of a new project haul route. BAC used a combination of existing acoustic literature, BAC file data for similar equipment, noise measurements and accepted noise modeling algorithms to quantify the noise generation of the various project components at representative noise-sensitive land uses in the project vicinity.

Crushing and Screening Facility Noise Generation

Bollard Acoustical Consultants, Inc. has conducted noise level measurements of a numerous aggregate processing plants over the years. A specific example of reference noise level measurements recently conducted by BAC staff (February 27, 2013) is the Vulcan Aggregates Facility in Sanger California. Reference noise level measurements conducted at a distance of 200 feet from this facility resulted in measured average and maximum noise levels of 76 dBA L_{eq} and 78 dBA L_{max}, respectively. These data included crushers, screen decks, conveyors, and mobile equipment. Because the Vulcan plant is larger than that proposed for use at the Teichert Boca site, the reference noise emission data collected at that site are believed to be higher than those which will be generated at the Boca site. Figure 9 shows a graph of the frequency spectra of the Vulcan Plant. The Figure 9 data indicate that most of the sound energy associated with the crushing screening operations was contained within the 1000 to 4000 hertz frequency range.

Another example of reference noise measurements recently conducted by BAC staff of an aggregate crushing-screening operation is Teichert's Bear River Aggregates facility located in Placer County, California. Those measurements, which were conducted in June of 2012, resulted in reference levels of 72 dB L_{eq} and 76 dB L_{max} at a reference distance of 300 feet. Assuming spherical spreading of sound from the processing plant equipment, the noise levels described above would compute to reference levels of 88 dBA L_{eq} and 90-92 dBA L_{max} at a distance of 50 feet. To provide a conservative estimate of project noise generation for the Teichert Boca quarry, BAC used reference noise levels of 90 dBA L_{eq} and 100 dBA L_{max} at a reference distance of 50 feet from the processing plant equipment to predict processing area noise impacts.

The reference levels described above were projected from the location of the processing plant area shown on Figure 2 to the nearest representative sensitive land uses shown in Figure 3 using a sound level decay rate of 6 dB per doubling of distance (consistent with propagation from a point source), with an additional attenuation of 1.5 dB per thousand feet to account for atmospheric absorption and excess anomalous attenuation. Sound propagation characteristics are described in a previous section of this report. No shielding by intervening topography was assumed in the projection of noise from the processing area to the representative receptors to provide a worst-case estimate of project noise exposure at those locations. Table 9 shows the predicted processing plant noise levels at the representative receptor locations.

It should be noted that the location of the processing plant area equipment shown on Figure 2 is not proposed to change over the life of the project. As a result, the noise level forecasts shown in Table 9 are considered to be representative of project noise generation for the life of the project.

The DEIR Project Description indicates that processing operations could occur between the hours of 6 am and 9 pm, which includes daytime, evening, and nighttime periods. Therefore, the Table 9 evaluation of processing equipment noise level projections covers all three time periods.

Figure 9
Crushing and Screening Spectra - 200 Foot Reference Distance
Vulcan Sanger Aggregate Processing Plant

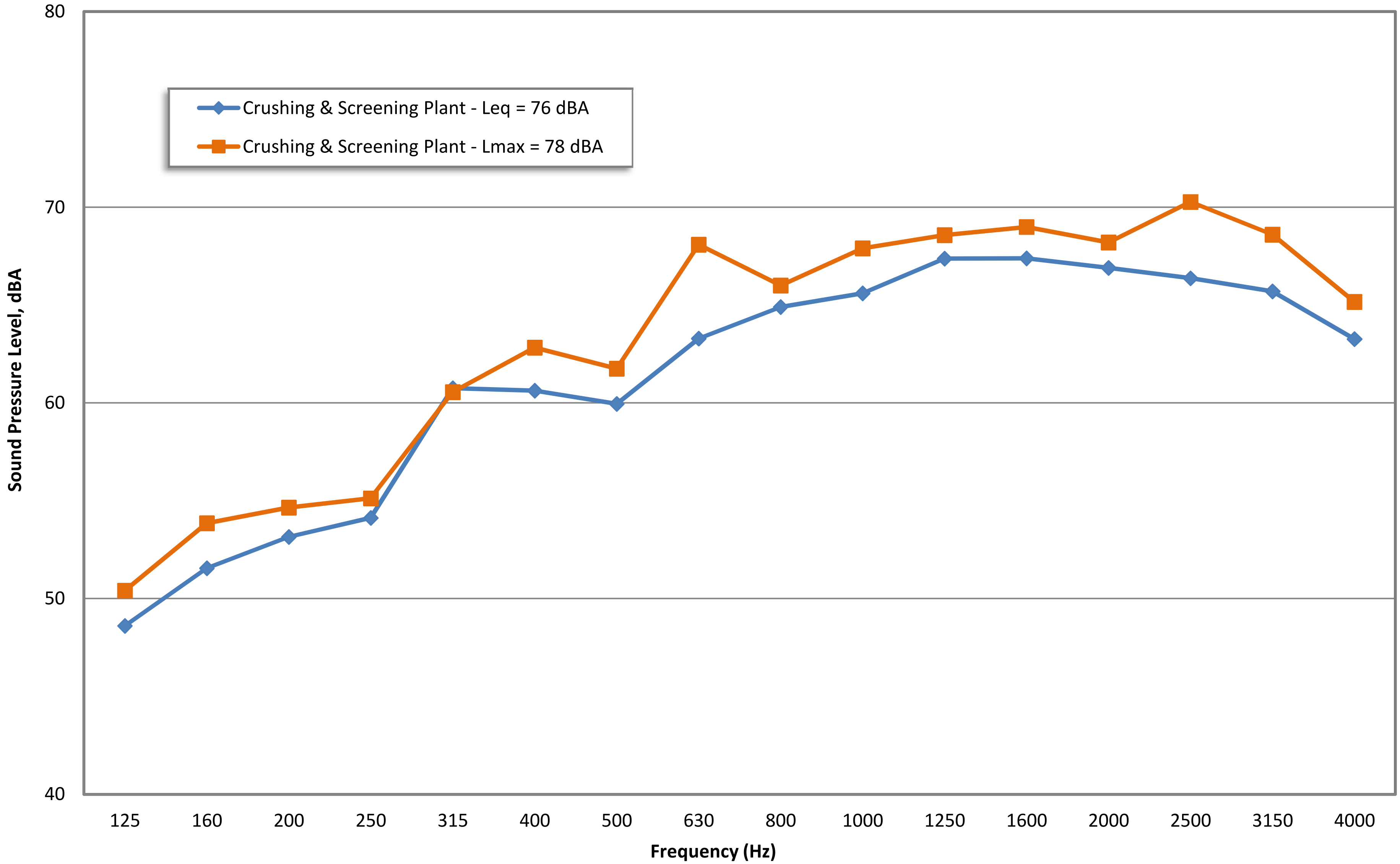


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Table 9
Crushing and Screening Facility Noise Levels at the Nearest Receptors
Boca Quarry Project: Nevada County

		Average Noise Level (Leq) Evaluation					Maximum Noise Level (Lmax) Evaluation				
Receiver[1]	Dist. (feet)[2]	Daytime Leq Standard[3]	Evening Leq Standard[3]	Nighttime Leq Standard[3]	Predicted Project Leq[4]	Leq Impact?	Daytime Lmax Standard[3]	Evening Lmax Standard[3]	Nighttime Lmax Standard[3]	Predicted Project Lmax[4]	Lmax Impact?
1	16000	53	46	42	16	N	76	68	60	26	N
2	15000	53	46	42	18	N	76	68	60	28	N
3	10500	58	57	56	28	N	72	68	67	38	N
4	10000	58	57	56	29	N	72	68	67	39	N
5	6800	58	57	55	37	N	71	69	68	47	N
6	7000	54	54	51	37	N	55	62	63	47	N
7	3800	49	48	48	47	Y	65	62	59	57	N
8	7500	49	48	48	35	N	65	62	59	45	N
9	5000	50	45	47	43	N	70	65	61	53	N
10	10000	50	45	47	29	N	70	65	61	39	N
11	4000	50	45	35	46	Y	70	60	50	56	Y
12	6000	55	50	50	39	N	75	65	60	54	N
13	4600	55	50	50	44	N	75	65	60	49	N

1. Figure 3 shows locations of the potentially affected receptors.
2. Distances are measured in feet from the nearest receptors to the processing area.
3. Pursuant to Footnote E of Table 5, noise standards applied to the aggregate processing activities are set at ambient noise levels.
4. Noise level predictions are based on reference levels (90 dB Leq and 100 dB Lmax at 50 feet) with a 6 dB attenuation rate per each doubling of distance and a 1.5 dB offset per 1000 feet for atmospheric and excess attenuation. The predicted noise levels do not include shielding of processing area equipment by intervening topography, which provides further attenuation at some receptor locations.

The Table 9 data indicate that project processing equipment average and maximum noise levels are predicted to be below the applicable noise standards at all receptors except the future theoretical receptor #11. This conclusion is reached even without accounting for the additional shielding which would occur at some receptor locations due to intervening topography, which would serve to further reduce processing area noise levels at those shielded receptors. After consideration of such shielding, noise levels at potential future Receptor #11 is similarly expected to be below the project standards of significance. As a result, no adverse noise impacts are identified for either average project-generated processing noise or maximum processing noise levels caused by single loud events. As a result, no consideration of additional noise mitigation measures for project processing activities is warranted.

Excavation Noise Generation

As with the evaluation of processing plant noise generation, Bollard Acoustical Consultants utilized file data for similar quarries to quantify reference noise levels associated with the proposed excavation operations. Based on those measurements, it was assumed that the Teichert Boca facility mining operations would generate average and maximum noise levels of 80 and 90 dBA at a reference distance of 50 feet, respectively.

The reference levels described above were projected to the nearest representative sensitive land uses shown in Figure 3 using a sound level decay rate of 6 dB per doubling of distance (consistent with propagation from a point source), with an additional attenuation of 1.5 dB per thousand feet to account for atmospheric absorption and excess anomalous attenuation. Sound propagation characteristics are described in a previous section of this report. No shielding by intervening topography was assumed in the projection of noise from the excavation areas to the representative receptors to provide a worst-case estimate of project noise exposure at those locations. Table 10 shows the predicted processing plant noise levels at the representative receptor locations.

The DEIR Project Description indicates that excavation operations could occur between the hours of 6 am and 9 pm, which includes daytime, evening, and nighttime periods. Therefore, the Table 10 evaluation of excavation equipment noise level projections covers all three time periods.

Table 10
Excavation Noise Levels at the Nearest Receptors
Boca Quarry Project: Nevada County

		Average Noise Level (Leq) Evaluation					Maximum Noise Level (Lmax) Evaluation				
Receiver[1]	Dist. (feet)[2]	Daytime Leq Standard[3]	Evening Leq Standard[3]	Nighttime Leq Standard[3]	Predicted Project Leq[4]	Leq Impact?	Daytime Lmax Standard[3]	Evening Lmax Standard[3]	Nighttime Lmax Standard[3]	Predicted Project Lmax[4]	Lmax Impact?
1	13000	53	46	42	12	N	76	68	60	22	N
2	12500	53	46	42	13	N	76	68	60	23	N
3	8400	58	57	56	23	N	72	68	67	33	N
4	7500	58	57	56	25	N	72	68	67	35	N
5	4000	58	57	55	36	N	71	69	68	46	N
6	4700	54	54	51	33	N	55	62	63	43	N
7	2300	49	48	48	43	N	65	62	59	53	N
8	5300	49	48	48	32	N	65	62	59	42	N
9	3500	50	45	47	38	N	70	65	61	48	N
10	8000	50	45	47	24	N	70	65	61	34	N
11	13000	50	45	35	36	Y	70	60	50	46	N
12	3700	55	50	50	37	N	75	65	60	47	N
13	2300	55	50	50	43	N	75	65	60	53	N

1. Figure 3 shows locations of the potentially affected receptors.
2. Distances are measured in feet from the nearest receptors to the excavation area.
3. Pursuant to Footnote E of Table 5, noise standards applied to the aggregate excavation activities are set at ambient noise levels.
4. Noise level predictions are based on the reported reference levels (80 dB Leq and 90 dB Lmax at 50 feet) with a 6 dB attenuation rate per each doubling of distance and a 1.5 dB offset per 1000 feet for atmospheric and excess attenuation. The predicted noise levels do not include shielding of excavation area equipment by intervening topography, which provides further attenuation at some receptor locations.

The Table 10 data indicate that project excavation-generated average and maximum noise levels are predicted to be well below the project noise standards at all receptors with the exception of a 1 dB exceedance at future Receptor 11. This conclusion is reached even without accounting for the additional shielding which would occur at some receptor locations due to intervening topography, which would serve to further reduce excavation noise levels at those shielded receptors. After consideration of such shielding, noise levels at potential future Receptor #11 are similarly expected to be below the project standards of significance. As a result, no adverse noise impacts are identified for either average project-generated excavation noise or maximum excavation noise levels caused by single loud events. As a result, no consideration of additional noise mitigation measures for project excavation is warranted.

Backfill Import and Material Load-Out Noise Generation

The only on-site activity associated with the project which is proposed to occur during some nighttime hours is material load-out and backfill import. According to the project description, these activities could start during the 5 am hour. In addition, when emergencies or nighttime paving projects require aggregate materials to be delivered to the job site at night, material load-out could occur during any nighttime hour. As a result, the analysis of on-site activities associated with backfill import and material load-out is assessed separately in this report to account for the greater degree of noise-sensitivity at sensitive receptor locations during nighttime hours.

Material load-out basically consists of an empty haul truck arriving at the stockpile area of the site, being loaded with aggregate material by a front-end loader, and departing the site. Backfill import is essentially the reverse operation, except that no front-loader is required for the haul trucks to dump their loads at the project site. Both of these operations generate less noise than aggregate excavation and processing operations. It was assumed for this analysis that backfill import and load-out operations would generate average and maximum noise levels of 75 dBA L_{eq} and 90 dBA Max at a reference distance of 50 feet, respectively.

The reference levels described above were projected to the nearest representative sensitive land uses shown in Figure 3 using a sound level decay rate of 6 dB per doubling of distance (consistent with propagation from a point source), with an additional attenuation of 1.5 dB per thousand feet to account for atmospheric absorption and excess anomalous attenuation. Sound propagation characteristics are described in a previous section of this report. No shielding by intervening topography was assumed in the projection of noise from these sources to the representative receptors to provide a worst-case estimate of project noise exposure at those locations. Table 11 shows the predicted backfill import and load-out noise levels at the representative receptor locations.

The DEIR Project Description indicates that backfill and load-out operations could occur between the hours of 6 am and 9 pm, or anytime nighttime delivery of materials is required, which includes daytime, evening, and nighttime periods. Therefore, the Table 11 evaluation of load-out and backfill import noise level projections covers all three time periods.

Table 11
Load-Out and Backfill Import Noise Levels at the Nearest Receptors
Boca Quarry Project: Nevada County

		Average Noise Level (Leq) Evaluation					Maximum Noise Level (Lmax) Evaluation				
Receiver[1]	Dist. (feet)[2]	Daytime Leq Standard[3]	Evening Leq Standard[3]	Nighttime Leq Standard[3]	Predicted Project Leq[4]	Leq Impact?	Daytime Lmax Standard[3]	Evening Lmax Standard[3]	Nighttime Lmax Standard[3]	Predicted Project Lmax[4]	Lmax Impact?
1	16000	53	46	42	1	N	76	68	60	16	N
2	15000	53	46	42	3	N	76	68	60	18	N
3	10500	58	57	56	13	N	72	68	67	28	N
4	10000	58	57	56	14	N	72	68	67	29	N
5	6800	58	57	55	22	N	71	69	68	37	N
6	7000	54	54	51	22	N	55	62	63	37	N
7	3800	49	48	48	32	N	65	62	59	47	N
8	7500	49	48	48	20	N	65	62	59	35	N
9	5000	50	45	47	28	N	70	65	61	43	N
10	10000	50	45	47	14	N	70	65	61	29	N
11	4000	50	45	35	31	N	70	60	50	46	N
12	6000	55	50	50	24	N	75	65	60	39	N
13	4600	55	50	50	29	N	75	65	60	44	N

1. Figure 3 shows locations of the potentially affected receptors.
2. Distances are measured in feet from the nearest receptors to the load-out area.
3. Pursuant to Footnote E of Table 5, noise standards applied to the aggregate load-out and backfill activities are set at ambient noise levels.
4. Noise level predictions are based on the reported reference levels (75 dB Leq and 90 dB Lmax at 50 feet) with a 6 dB attenuation rate per each doubling of distance and a 1.5 dB offset per 1000 feet for atmospheric and excess attenuation. The predicted noise levels do not include shielding of load-out operations by intervening topography, which provides further attenuation at some receptor locations.

The Table 11 data indicate that project load-out and backfill delivery operations average and maximum noise levels are predicted to be well below the applicable noise standards at each of the 11 nearest representative receptor locations evaluated in this study. This conclusion is reached even without accounting for the additional shielding which would occur at some receptor locations due to intervening topography, which would serve to further reduce backfill and load-out noise levels at those shielded receptors. As a result, no adverse noise impacts are identified for either average or maximum noise levels caused by single loud events. As a result, no consideration of additional noise mitigation measures for project load-out or backfill activities is warranted.

Project Noise Generation – Heavy Truck Traffic

The proposed project is intended to provide for future aggregate reserves through increased mining area. The project proposes to increase the possible maximum production from 300,000 tons per year to a maximum of 1 million tons per year. According to the project's transportation analysis, the theoretical worst-case, daily maximum project heavy truck trip generation would be approximately 1,402 truck trips. On an hourly basis, the theoretical maximum capacity project heavy truck trip generation would be 150 heavy truck trips per hour. This number of daily and hourly heavy truck trips is considered to be extremely conservative. Nonetheless, for a conservative assessment of potential noise impacts associated with heavy truck traffic, the theoretical worst-case projections were used.

Teichert has constructed a new access road to the project site which has eliminated the requirement that trucks pass through the community of Hirschdale. The specific access route is identified on Figure 3. Sensitive receptors which would be potentially affected by heavy truck traffic include the single Boca Reservoir caretaker residence located south of the dam (Receptor 4 on Figure 3), and recreational uses of the Boca Reservoir. Because project traffic would not pass other sensitive receptor locations during normal operations, the analysis of heavy truck traffic noise impacts focuses on these receptors.

To quantify the noise generation of heavy truck traffic resulting from the project, traffic noise modeling, traffic noise measurements, or a combination of the two can be used. Traffic noise modeling is commonly used when noise measurements are not feasible or are unnecessary. Given the variable topography of the haul route, potential use of Jake brakes, particularly as it passes the lone residence (receptor 4) and recreational uses of the Boca Reservoir, noise measurements of representative heavy truck passbys were concluded to be the most appropriate, and accurate, means of quantifying project noise generation. Because the project haul truck route on Hinton Road has been completed, BAC was able to monitor the noise generation of aggregate truck passbys on this roadway. That monitoring program is described below.

Noise Generation of Individual (Single-Event) Truck Passbys

To quantify the noise generation of individual passages of heavy trucks on the Hinton and Stampede Meadows Roads portion of the project haul route, BAC conducted single-event noise monitoring at the most potentially affected sensitive receptor location (Receptor 4) on the morning of May 14, 2013. The measurements, which were conducted between 8:30 a.m. and 10 a.m., were intended to specifically quantify noise levels generated by individual truck passages on the project access route. The passby test noise measurement location at Receptor 4 is shown by Figures 10a & 10b.

Larson Davis Laboratories Model 820 and 824 sound level meters were used for the single-event truck passby noise surveys. The meters were calibrated before use to ensure the accuracy of the measurements, and fitted with manufacturer's windscreens. The microphones were located on tripods at a height of 5 feet above ground. Weather conditions were typical for the period, consisting of cool morning temperatures, moderate relative humidity, light (<5mph) winds, and clear skies.

Figure 10a – Heavy Truck Passby Test Monitoring Site at Receptor 4.

Figure 10b – Heavy Truck Passby Test Monitoring Site at Receptor 4.

In addition to the measurements conducted at Receptor 4, single-event monitoring was also conducted at the location indicated by a star on Figure 4 to quantify the truck passby noise generation at the embankment of the reservoir frequented by fishermen. That noise monitoring location, illustrated by Figure 11 below, represents the closest point between recreational uses of the lake (fishermen and/or boaters) to the project access route (approximately 170 feet).

Because of the depressed location of the reservoir relative to the portion of Stampede Meadows Road utilized by project truck traffic, the shoreline monitoring site was partially shielded from view of the trucks during the passby tests. Further north along the shoreline the effects of this shielding are less pronounced but the distance between the shoreline and Stampede Meadows Road increases. The net effect of the decreased shielding and increased distance is considered to be negligible. As a result, the monitoring location shown in Figure 10a is believed to be reasonably representative of heavy truck passby noise exposure along the shoreline of Boca Reservoir.

Figure 11 – Heavy Truck Passby Test Monitoring Site at Boca Reservoir.

A 1990 Kenworth T800 with a Cummins 88NT350 Diesel engine with an 18-speed gear box was used for the heavy truck passby tests. The truck was fully loaded with aggregate materials at the beginning of the passby testing program. After multiple uphill and downhill passbys of the fully loaded aggregate truck, the truck's load was dumped and the testing program was repeated with the empty trailer. The driver was instructed to operate the truck normally during the passby tests. According to the driver, 8^{th} gear was used on the uphill sections at 1700 rpm. On the downhill passbys, gears 7-8 were used at engine rpm ranging from 1800-1900.

The test route extended from the I-80 / Hirschdale Road ramps approximately 2,500 feet southeast of the measurement site, to the Teichert Boca quarry site, approximately 9,000 feet east of the noise measurement sites. Traffic on Stampede Meadows Road was light during the passby testing, so clean noise readings of the aggregate truck passbys were obtained. Each passby was monitored for the duration of time the truck was audible, including approach, passby, and departure. During the truck passby tests, speed surveys were conducted using a Bushnell radar Velocity Speed gun (Model # CBV00 - See Figure 12). The speed surveys indicated that downhill speeds slowed from 30 mph on approach to 20 mph on the downhill (southbound) slope in front of the noise monitoring site for both loaded and empty truck passbys. Uphill speeds ranged from 15-20 mph in the uphill (northbound) direction.

Figure 12 – Heavy Truck Passby Test Speed Monitoring.

A total of 10 uphill and 10 downhill passbys were monitored. Half of the passbys occurred with the trailer loaded and the other half empty. In addition, the driver was instructed to utilize engine brakes (Jake Brakes) on the downhill slopes of the private haul route (Hinton Road) and for the first three downhill passbys on Stampede Meadows Road.

The results of the heavy truck passby tests conducted at Receptor 4 are provided in Table 12.

During the each hour of the single-event passby noise monitoring test, minimum (L_{min}) noise levels at the test location were recorded to be 42 dB, and background (L90) values were recorded to be 45-46 dB (see Appendix B-3 during 8-10 am hours). Because the Table 11 test results indicate that maximum noise levels generated during the aggregate truck passbys were in excess of 20 dB above background noise levels, there was no contamination of the heavy truck passby test results by other noise sources.

Table 12
Heavy Truck Single-Event Passby Test Noise Measurement Results
Teichert Boca Project – Receptor 4 – 85 feet from Stampede Meadows Road Centerline

Passby	Duration (Seconds)	Measured Levels (dBA) Leq	Lmax	SEL	Uphill/ Downhill?	Truck Load	Jake Brakes?
1	16	65	70	77	D	Loaded	Yes, max
2	19	63	68	76	U	Loaded	No
3	13	65	69	76	D	Loaded	Yes, max
4	22	63	68	76	U	Loaded	No
5	35	60	70	76	D	Loaded	Yes, half
6	20	63	68	76	U	Loaded	No
7	18	62	66	74	D	Loaded	No
8	18	64	68	76	U	Loaded	No
9	20	62	67	75	D	Loaded	No
10	23	63	68	76	U	Loaded	No
11	13	62	65	73	D	Empty	No
12	17	62	67	74	U	Empty	No
13	13	63	67	74	D	Empty	No
14	17	61	66	74	U	Empty	No
15	15	60	65	72	D	Empty	No
16	18	61	66	74	U	Empty	No
17	20	61	65	74	D	Empty	No
18	17	62	67	75	U	Empty	No
19	14	61	65	72	D	Empty	No
20	16	61	66	73	U	Empty	No

Source: Bollard Acoustical Consultants, Inc.

The Table 12 results generally indicate that the passby noise levels were higher for the loaded truck than for the empty trucks. In addition, passby levels were only marginally louder when Jake brakes were used to slow the truck. Because heavy truck passbys will consist of a combination of uphill and downhill, loaded and empty trucks with some Jake brake usage, the average sound exposure level of 74 dB SEL at the 85 foot reference distance is considered to be representative of typical passby noise levels for 10-wheel aggregate trucks (12-ton capacity). Double trailer (18-wheel) trucks are predicted to make up approximately 50% of the heavy truck traffic generated by the project.

Single versus Double-Trailer Truck Noise Generation

Although an 18-wheel (double-trailer) truck was not available for the passby noise tests, it is reasonable to assume that a fully loaded double trailer truck would generate more noise than a loaded 10-wheel (single-trailer) truck, as least on the uphill segments when greater engine output is required. On downhill segments, such as would be the case with loaded trucks departing the Teichert Boca quarry and heading south on Stampede Meadows Road, the difference in noise levels would be less pronounced.

Two identical single-trailer truck passbys would be 3 dB louder than one single-trailer truck passby because a doubling of sound energy equates to a 3 dB increase. Because both the single and double trailer trucks would typically be empty when travelling in the northbound direction on Stampede Meadows Road toward the plant, it is not logical to conclude that one empty double trailer truck would generate as much sound energy as two empty single-trailer trucks. As a result, it follows that that the noise generation of a double-trailer truck passby would be less than 3 dB louder than a single-trailer truck. For a conservative assessment of heavy truck passby noise levels, it was nonetheless assumed that the noise levels of a double trailer truck passby could be 3 dB higher than that of a single-trailer passby.

The conservative assumptions used to develop the project truck trip projections are based on an equal number of single and double-trailer trucks. Because the single-trailer truck passby noise tests resulted in a mean SEL of 74 dB at the 85 foot test location, a mean SEL of 77 dB was used as a reference noise level for the double-trailer truck passbys. The mean SEL for heavy truck passbys at the reference distance of 85 feet is 76 dB (after rounding upward).

To check this assumption, BAC reviewed aggregate truck passby noise test results conducted by BAC staff in Hallwood, California in 2001. A total of 33 heavy truck passbys, consisting of empty and loaded, single and double trailer trucks, were monitored during that survey. According to Teichert representatives, the Hallwood site generates predominately double-trailer trucks, and this information is consistent with BAC field observations conducted during the Hallwood heavy truck single-event passby measurements. The average passby speeds of the trucks during the Hallwood survey was 35 mph, which is approximately 10-15 mph higher than the trucks speeds during the Boca Quarry truck passby tests described above. The mean Sound Exposure Level for the Hallwood heavy truck passby survey computed to 77 dB SEL at a reference distance of 85 feet. This level compares favorably with the level of 76 dB assumed for the Boca Quarry trucks at the same 85 foot reference distance. The higher speeds of the Hallwood trucks undoubtedly accounted for the 1 dB higher measured SEL values at that location. The Hallwood data validate the assumptions pertaining to double-trailer heavy truck passby noise levels applied to the Teichert Boca Quarry project.

The Table 12 results also indicate that maximum noise levels generated by truck passbys were similarly higher for the loaded truck than for the empty trucks. In addition, maximum passby levels were only marginally louder when Jake brakes were used to slow the truck. Because heavy truck passbys will consist of a combination of uphill and downhill, loaded and empty trucks with some Jake brake usage, the mean of the measured maximum sound levels of 67 dB Lmax at the 85 foot reference distance is considered to representative of typical passby noise levels for 10-wheel aggregate trucks (12-ton capacity). As with the discussion of SEL, double trailer (18-wheel) trucks are predicted to generate maximum noise levels approximately 3 dB higher than single-trailer trucks, or 70 dB Lmax at the 85-foot reference distance.

Worst-Case Hourly Average Haul Route Heavy Truck Noise Levels (L_{eq})

Although Table 12 includes the average noise level (L_{eq}) of each heavy truck passby, it is important to note that those averages pertain only to the duration of the individual truck passby (13-20 seconds). This point is important because the Nevada County noise standards are based on the average noise level over a one-hour period. To compute hourly noise levels associated with project heavy truck passbys, the following formula is used:

$$Leq(h) = SEL + 10*Log (N) – 10*Log(3600), \text{ where…}$$

Leq(h):	Hourly average noise level resulting from all truck passbys.
SEL:	Mean Sound Exposure Level of an individual truck passby.
N:	The number of truck passbys which occur in a given hour.
3600:	The number of seconds in an hour.

Using the formula presented above with the worst-case projection of 150 heavy truck passbys in an hour with the mean SEL for combined single and double-trailer trucks of 76 dB yields an hourly average noise level of 62 dB Leq at the reference measurement distance of 85 feet from the centerline of Stampede Meadows Road. Using this information with the maximum noise levels reported in Table 12, project truck traffic noise exposure was quantified at the nearest potentially affected receptors to the project haul routes of Hinton and Stampede Meadows Roads, as reported in Table 13.

Table 13
Heavy Truck Traffic Noise Levels at the Nearest Receptors
Boca Quarry Project: Nevada County

		Average Noise Level (Leq) Evaluation					Maximum Noise Level (Lmax) Evaluation				
Receiver[1]	Dist. (feet)[2]	Daytime Leq Standard[3]	Evening Leq Standard[3]	Nighttime Leq Standard[3]	Predicted Project Leq[4]	Leq Impact?	Daytime Lmax Standard[3]	Evening Lmax Standard[3]	Nighttime Lmax Standard[3]	Predicted Project Lmax[4]	Lmax Impact?
1	9000	58	51	47	31	N	81	73	65	29	N
2	5000	58	51	47	35	N	81	73	65	34	N
3	500	63	62	61	50	N	77	73	72	54	N
4	120	63	62	61	59	N	77	73	72	66	N
5	650	63	62	60	48	N	76	74	73	51	N
6	2000	59	59	56	41	N	60	67	68	42	N
7	3800	54	53	53	36	N	70	67	64	36	N
8	4800	54	53	53	35	N	70	67	64	34	N
9	3700	55	50	52	37	N	75	70	66	36	N
10	8000	55	50	52	32	N	75	70	66	30	N
11	4500	55	50	40	35	N	75	65	55	35	N
12	100	55	50	50	58	Y	75	65	60	68	Y
13	100	55	50	50	58	Y	75	65	60	68	Y

1. Figure 3 shows locations of the potentially affected receptors.
2. Distances are measured in feet from the receptor to the nearest point of the project haul route.
3. Pursuant to Footnote D of Table 5, noise standards applied to the off-site traffic processing activities are set at ambient noise levels + 5 dB.
4. Noise level predictions are based on the reported reference levels (61 dB Leq and 69 dB Lmax at 85 feet) with 4.5 dB and 6 dB attenuation rates per each doubling of distance for Leq and Lmax projections, respectively, and a 1.5 dB offset per 1000 feet for atmospheric and excess attenuation. The predicted noise levels do not include shielding of heavy truck noise by intervening topography, which would provide further attenuation at some receptor locations.

The Table 13 data indicate that, with the exception of theoretical future residential receptors 12 and 13, project heavy truck traffic on both the private (Hinton Road) and public (Stampede Meadows Road) haul route would generate average noise levels below the project daytime, evening, and nighttime noise level standards. This conclusion is reached even without accounting for the additional shielding which would occur at some receptor locations due to intervening topography, which would serve to further reduce heavy truck traffic noise levels at those shielded receptors. As a result, no adverse noise impacts are identified for worst-case average noise levels generated by project heavy truck traffic, regardless of whether the trucks are on the private haul route or public roadways. This conclusion applies to single and double-trailer trucks travelling uphill or downhill, empty or loaded, with or without Jake brake usage, during both daytime and nighttime hours. And because the predicted average hourly noise levels shown in Table 13 are based on the extremely conservative assumption of 150 heavy truck passbys in any given hour, actual noise levels generated by project heavy truck traffic during typical operations are predicted to be considerably lower.

Regarding potential future residences constructed on the parcels represented by receptors 12 and 13, the Table 13 data indicates that the appropriate average and maximum noise level standards could be exceeded for worst-case receptors constructed 100 feet from the centerline of the haul route. It should be noted that, if residences are ultimately constructed on these two parcels, it is highly unlikely that the property owners would choose to construct the residences as close as 100 feet from the haul route. Nonetheless, if residences were constructed on these parcels within 300 feet of the proposed haul route, the project standards of significance could be exceeded at those residences. Provided a minimum setback of 300 feet is maintained from the proposed haul route, no exceedance of the project standards of significance would be identified for these theoretical future residences.

Single-Event & Sleep Disturbance Evaluation (Lmax & SEL)

With respect to the issue of sleep disturbance at the nearest potentially-affected receptor (the residence represented by Receptor 4), during nighttime material load-out operations, the Table 13 data indicate that maximum passby noise levels at that location would be 6 dB below the applicable single-event (L_{max}) threshold. In addition, the predicted heavy truck passby sound exposure level at the exterior of that residence (135 feet from the centerline of Stampede Meadows road) is 72 dB SEL. Even with windows in the open position, interior noise levels would be 10 dB below exterior noise levels, thereby resulting in an interior SEL of 62 dB. With windows closed, the exterior to interior noise reduction of the building façade would reduce single-event heavy truck passby noise levels to approximately 47 dB SEL. Nevada County assesses interior noise impacts at residential uses with windows in the closed position. Nonetheless, with windows in either the open or closed position, single-events associated with nighttime heavy truck passbys on Stampede Meadows Road would be below both the County's Lmax threshold as well as below the additional 65 dB SEL threshold at this residence,

The evaluation of single-event noise and sleep disturbance have been focused on the lone residence on Stampede Meadows Road due to its sensitivity and proximity to the project haul route. However, Table 13 indicates that maximum noise levels generated by project truck traffic would also be well below the applicable Nevada County noise standards at the other sensitive receptors located in the project vicinity, including recreational users of Boca Reservoir (campers at Receptor 1, the boat launch area at Receptor 2, and boaters and fishermen at Receptor 3).

Evaluation of Heavy Truck Passby Noise on Cyclists

In addition to the sensitive receptors shown on Figure 3, an analysis of heavy truck passby noise impacts upon bicyclists riding on Stampede Meadows Road was conducted. The distance along Stampede Meadows Road between the private Hinton Road haul route and the Interstate 80 access ramps is approximately 1.3 miles. This distance corresponds to the distance cyclists would theoretically be sharing the road with project heavy truck traffic. Even at a leisurely cycling pace of 10 mph, a cyclist would cover this distance in less than 8 minutes.

During absolute worst-case hourly project heavy truck trip generation (150 passbys per hour), approximately 20 trucks could pass this route during an 8 minute interval. Table 12 indicates that the average duration the heavy truck noise was clearly audible during the passby tests was approximately 18 seconds. As a result, the total time of exposure of a cyclist on Stampede Meadows Road to project heavy truck traffic during absolute worst-case conditions would be approximately six (6) minutes. Due to the relatively brief level of heavy truck traffic noise cyclists would be exposed to, this impact is considered less than significant.

Project Noise and Vibration Generation – Blasting

In addition to the aforementioned mining and processing noise sources, it will be necessary to conduct blasting to free the aggregate resources for subsequent excavation. Noise sources associated with blasting consist of rock drills and the shot itself. The noise levels generated by the rock drills depend on drill type, but are predicted to be generally similar to the noise levels generated by excavation equipment, and are included in the levels described in the previous section pertaining to mining noise sources.

Noise generated by aggregate shots are more variable, depending on the amount of charge-material used, the number of holes and the depth of those holes, timing delays, and other factors. There tends to be misconceptions regarding what an aggregate blast looks and sounds like, due in part to the types of explosions which are frequently seen in movies. In reality, aggregate shots are designed to transfer the energy of the shot into the ground, rather than have it vent into the atmosphere.

Based on Bollard Acoustical Consultants, Inc. observations of various aggregate shots in recent years, it is our opinion that aggregate shots are characteristic of muffled thunder. Using noise level data collected during those blasts, blasting levels at the nearest receptors are predicted to be below existing ambient noise levels at the nearest residences due to the considerable distances between the blasting areas and those receptors.

As a representative example, BAC conducted noise and vibration monitoring during a typical aggregate shot (blast) at a northern California Quarry on May 20, 2009. The monitoring was conducted from a distance of approximately 1500 feet with direct line of site to the shot area. Weather conditions present during the shot were as follows: 70 degrees Fahrenheit, clear sky, 5

-10mph north winds. Table 14 summarizes the noise and vibration data collected during the shot. Figure 13 shows a photograph of the ambient noise and vibration monitoring location.

Figure 13 – Blast Monitoring Location

Table 14
Blast Monitoring Results
May 20, 2009

Variable	Value
A-Weighted Maximum	67.0 dBA
Vmax-peak: Shot	0.1280 inches/second
Vmax-peak: Ambient	0.0018 inches/second
Distance	1,500 ft.
Holes Fired	36
Total Charge Weight	33,457 lbs.

Source: Bollard Acoustical Consultants

According to Table 10, the nearest representative sensitive receptors to the project site range from 2,300 to over 13,000 feet from the proposed excavation areas of the Boca Quarry. At those distances, maximum noise levels due to blasting would be approximately 48 to 63 dB L_{max}. As noted previously, project blasting is proposed to occur only during daytime hours. Daytime noise levels in this range would be well within compliance with the applicable project standards of significance, so no adverse noise impacts are identified for project blasting activities based on the conservative blast data cited above.

With respect to blast-induced vibration, the Table 14 data indicate that the measured peak particle velocity of the reference shot was 0.13 inches per second at a distance of 1500 feet from the shot. Because vibration decreases with distance, blast induced vibration levels would be even lower at the nearest potentially affected sensitive receptors, likely at or below 0.1 inches per second. This level is well below the 0.5 inch per second threshold for annoyance and well below thresholds for damage to structures. As a result, no adverse vibration impacts are identified for project blasting activities.

Project Vibration Generation

This section focuses in the assessment of potential impacts associated with project-generated vibration. With the exception of blasting activities, the project does not propose the introduction of appreciable sources of vibration into areas where such vibration is not being generated currently. Nonetheless, vibration generated by heavy earthmoving equipment is evaluated in this section. Blast-induced vibration is discussed in the previous section of this report.

Heavy Earthmoving Equipment Vibration Levels

To quantify reference vibration levels generated by heavy equipment typically utilized by the aggregate industry, vibration measurement results conducted by BAC staff at a northern California quarry were used. As with the blasting measurements, a Larson Davis Laboratories Model HVM vibration meter and a PCB Piezotronics Model 356B08 vibration transducer were used for the reference vibration measurements. Peak particle velocities representing the sum of all peak vibration levels along the x, y and z axes, were measured during the survey. Table 15 summarizes the noise and vibration data collected at the aggregate quarry.

Table 15
Reference Heavy Equipment Vibration Levels

Vibration Source	Measurement Distance, ft.	Peak Particle Velocity (in/sec)
Bulldozers	35	0.0209
Front-Loaders	100	0.0047
Haul Truck	100	0.0062
Water Truck	100	0.0070
Rock Drill	50	0.0187

The vibration measurement results shown in Table 15 indicate that heavy equipment-generated vibration levels were below the thresholds for annoyance and damage to structures even at the very close measurement locations of 35-100 feet from the operating equipment. As a result, at receptors located thousands of feet from the proposed operations, project vibration levels generated by heavy earthmoving equipment are expected to be well below the threshold of perception, and no adverse vibration impacts are identified.

Combined Noise from All Project Sources

The noise generation of each component of the project has been evaluated separately above. Table 16 combines the average noise exposure of each source and compares those levels against the project's standards of significance. Blasting noise is not included in Table 16 as onsite traffic and excavation operations cease during blasting activities so the brief maximum noise level generated during blasting would not combine appreciably with other on-site noise sources (blasting noise is evaluated separately in this analysis). The Table 16 data is limited to hourly average noise levels as the County's hourly noise level standards are more restrictive for this project than the County's maximum noise standards. As a result, compliance with the average noise level standards would indicate compliance with the County's maximum noise level standards as well. In addition, unless maximum noise levels generated by one component of the project occur at precisely the same instant as maximum noise levels generated by another project component, their maximum noise levels would not be additive.

Table 16
Combined Average Noise Levels from All Project Noise Sources (L_{eq})
Boca Quarry Project: Nevada County

Receiver[1]	Processing	Excavation	Load-Out/ backfill	Truck Traffic	Total (combined)	Daytime Standard (Non-Trucks / Trucks)	Evening Standard (Non-Trucks / Trucks)	Nighttime Standard (Non-Trucks / Trucks)	Impact?
1	16	12	1	31	31	53 / 58	46 / 51	42 / 47	N
2	18	13	3	35	35	53 / 58	46 / 51	42 / 47	N
3	28	23	13	50	50	58 / 63	57 / 62	56 / 61	N
4	29	25	14	59	59[3]	58 / 63	57 / 62	56 / 61	N
5	37	36	22	48	49	58 / 63	57 / 62	55 / 60	N
6	37	33	22	41	43	54 / 59	54 / 59	51 / 56	N
7	47	43	32	36	49	49 / 54	48 / 53	48 / 53	Y
8	35	32	20	35	39	49 / 54	48 / 53	48 / 53	N
9	43	38	28	37	45	50 / 55	45 / 50	47 / 52	N
10	29	24	14	32	34	50 / 55	45 / 50	47 / 52	N
11	46	36	31	35	47	50 / 55	45 / 50	35 / 40	Y
12	39	37	24	58	58	55/55	50 / 50	50 / 50	Y
13	44	43	29	58	58	55/55	50 / 50	50 / 50	Y

1. Figure 3 shows locations of the potentially affected receptors.
   Noise from processing, excavation, load-out/backfill, and truck traffic were obtained from Tables 9, 10, 11 & 13, respectively.
2. The noise standards applicable to project truck traffic are different (5 dB higher) than those applicable to on-site activities, so the range of applicable noise standards is given.
3. Because the 59 dB Leq value predicted at receiver 4 is due to truck traffic noise, it is compared against the 63 dB threshold, rather than the 58 dB threshold, and no impact is identified.

With the exception of Receptor 7, and potential future receptors 11-13, the Table 16 data indicate that combined noise exposure from all project noise sources would satisfy the applicable average noise level standards of Nevada County during daytime, evening and nighttime periods. As a result, no adverse noise impacts are identified for combined project noise exposure at receptors 1-6, and 8-10, and no additional consideration of noise mitigation measures is warranted.

At receptor 7, combined noise from processing and excavation could result in exceedance of the 48 dB L_{eq} exterior noise level standard during nighttime periods. As a result, a potentially significant noise impact is identified for this receptor.

At potential future receptor 11, noise from processing activities could result in exceedance of the County's evening and nighttime noise level standards should a residence be constructed at this location in the future. As a result, a potentially significant noise impact is identified for this receptor.

At potential future receptors 12 & 13, noise from project truck traffic could result in exceedance of the County's daytime, evening and nighttime noise level standards should residences be constructed on these parcels in close proximity to the proposed haul route. As a result, a potentially significant noise impact is identified for these receptors.

Noise Mitigation Measures

The following specific noise mitigation measures would reduce identified potentially significant noise impacts of this project to a level of insignificance.

MM1 Restrictions on Nighttime Operations
Aggregate processing activities should be limited to daytime and evening hours of 7 am to 10 pm unless it can be determined through noise level measurements that processing plant operations do not result in exceedance of the nighttime noise level standard at Receiver 7.

MM2 Restrictions on Evening and Nighttime Operations
At such a time as a residence is constructed in the vicinity of Receptor 11, excavation and processing activities should be limited to the daytime hours of 7 am to 7 pm unless it can be determined through noise level measurements that processing and excavation operations do not result in exceedance of the evening and nighttime noise level standards at Receiver 11.

MM3 Site-Specific Analysis and Mitigation of Proposed Residences
At such a time as residences are proposed on the parcels represented by Receptors 12 and 13 within 300 feet of the project haul road, an ambient noise survey should be conducted to quantify baseline conditions at those receptors. That ambient data should be used to develop offsets to the Nevada County noise standards, if appropriate. In addition, heavy truck passby noise level measurements should be conducted from the location(s) of the proposed residence(s) to determine if haul truck noise levels would exceed the adjusted

noise level standards. If exceedances are identified, additional noise control measures should be incorporated into the project operations at that time. Such measures could include the use of sound berms or barriers, relocation of the haul road to create additional setbacks from the proposed residences, or other feasible measures.

Cumulative Setting, Impacts & Mitigation Measures

Ambient noise conditions in the general project area will increase over time due primarily to increased traffic on Interstate 80 and, to a lesser extent, local roadways. Although future levels of aircraft and railroad activity cannot precisely be predicted at this time, it is reasonable to assume that some increase in these activities will occur over time. Because the decibel scale is logarithmic, a doubling in traffic on Interstate 80 over time would only result in a 3 dB increase in I-80 traffic noise levels. As a result, it is likely that future ambient conditions considering cumulative development in the region would likely be within 3-5 dB of existing ambient conditions shown in Tables 2 and 3.

With the exception of changing excavation areas, the noise generation of the project will not change over time (i.e. 20 year cumulative horizon), and the locations of the closest proposed excavation areas to existing residences have been used in this analysis to evaluate worst-case impacts. As a result, the project noise generation has been quantified in terms of both existing and projected 20-year, cumulative, horizons.

Because ambient conditions are likely to increase over time, whereas the project noise generation predicted in this analysis will not, the ratio of project noise to ambient noise will decrease with time, and the project's contribution to cumulative ambient noise and vibration conditions will be less than significant, and no additional mitigation measures beyond those identified above would be require for cumulative conditions.

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-1
Site A - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	43	73	32	29
1:00	33	41	32	28
2:00	35	55	34	31
3:00	34	56	33	30
4:00	40	69	34	31
5:00	58	78	38	35
6:00	49	77	37	35
7:00	52	77	37	34
8:00	50	73	35	30
9:00	51	76	32	27
10:00	51	75	30	25
11:00	50	75	28	24
12:00	52	73	29	25
13:00	52	76	33	28
14:00	53	74	35	28
15:00	53	77	36	29
16:00	53	76	41	32
17:00	53	75	42	38
18:00	53	78	42	35
19:00	50	74	36	27
20:00	52	77	32	29
21:00	46	73	35	30
22:00	43	70	35	33
23:00	39	67	36	31

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	53	50	52	52	46	50	58	33	49
Lmax (Maximum)	78	73	75	77	73	74	78	41	65
L50 (Median)	42	28	35	36	32	34	38	32	35
L90 (Background)	38	24	30	30	27	28	35	28	31

Computed CNEL, dB	56
% Daytime Energy	66%
% Evening Energy	10%
% Nighttime Energy	24%

BOLLARD
Acoustical Consultants

Appendix B-2

Site A - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	46	77	34	30
1:00	35	57	32	28
2:00	32	41	31	27
3:00	35	43	34	31
4:00	44	74	36	33
5:00	40	59	39	37
6:00	52	76	40	38
7:00	52	79	42	40
8:00	52	77	41	39
9:00	53	79	39	33
10:00	52	74	42	32
11:00	53	76	46	41
12:00	56	74	52	46
13:00	57	75	53	49
14:00	56	74	52	45
15:00	55	75	50	45
16:00	52	75	45	39
17:00	53	74	46	40
18:00	51	74	43	39
19:00	49	73	37	34
20:00	49	74	35	32
21:00	44	73	31	29
22:00	33	49	32	28
23:00	29	38	28	25

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	57	51	54	49	44	48	52	29	44
Lmax (Maximum)	79	74	76	74	73	73	77	38	57
L50 (Median)	53	39	46	37	31	34	40	28	34
L90 (Background)	49	32	41	34	29	32	38	25	31

Computed CNEL, dB	54
% Daytime Energy	88%
% Evening Energy	5%
% Nighttime Energy	7%

BOLLARD
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Appendix B-3
Site B - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	59	87	51	47
1:00	53	63	51	47
2:00	59	87	51	46
3:00	57	82	54	48
4:00	55	64	54	48
5:00	56	70	55	51
6:00	59	67	58	55
7:00	60	90	52	49
8:00	64	91	49	45
9:00	53	79	48	46
10:00	52	75	47	45
11:00	50	71	45	43
12:00	59	89	51	47
13:00	61	82	53	49
14:00	55	74	49	46
15:00	59	85	56	53
16:00	57	69	56	53
17:00	61	86	54	52
18:00	59	86	55	52
19:00	56	76	55	52
20:00	55	69	54	50
21:00	55	65	54	50
22:00	54	66	54	50
23:00	53	63	52	48

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	64	50	59	56	55	56	59	53	57
Lmax (Maximum)	91	69	81	76	65	70	87	63	72
L50 (Median)	56	45	51	55	54	54	58	51	53
L90 (Background)	53	43	48	52	50	51	55	46	49

Computed CNEL, dB	64
% Daytime Energy	65%
% Evening Energy	7%
% Nighttime Energy	28%

BOLLARD
Acoustical Consultants

Appendix B-4

Site B - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	58	87	51	48
1:00	58	85	50	46
2:00	54	64	52	47
3:00	53	63	52	47
4:00	58	86	53	47
5:00	57	84	53	49
6:00	57	69	56	52
7:00	55	67	53	49
8:00	53	76	50	48
9:00	56	72	52	49
10:00	58	85	55	52
11:00	55	70	54	50
12:00	57	80	55	51
13:00	57	81	55	52
14:00	59	86	54	51
15:00	57	79	55	51
16:00	56	68	54	51
17:00	56	72	54	52
18:00	59	83	55	51
19:00	56	74	54	51
20:00	60	87	54	50
21:00	54	66	53	49
22:00	60	85	53	49
23:00	54	64	53	48

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	59	53	57	60	54	57	60	53	57
Lmax (Maximum)	86	67	77	87	66	76	87	63	76
L50 (Median)	55	50	54	54	53	54	56	50	53
L90 (Background)	52	48	51	51	49	50	52	46	48

Computed CNEL, dB	64
% Daytime Energy	48%
% Evening Energy	13%
% Nighttime Energy	39%

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Appendix B-5

Site C - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	54	67	50	39
1:00	53	63	49	38
2:00	53	72	49	37
3:00	54	67	51	40
4:00	54	67	52	41
5:00	57	71	55	48
6:00	57	68	56	51
7:00	57	70	56	51
8:00	57	74	55	50
9:00	56	67	55	51
10:00	56	69	55	50
11:00	57	70	55	50
12:00	58	75	56	50
13:00	59	72	58	51
14:00	59	75	58	53
15:00	57	71	57	52
16:00	57	73	56	53
17:00	58	74	57	53
18:00	58	69	57	53
19:00	58	72	57	52
20:00	56	66	55	50
21:00	55	69	54	49
22:00	54	64	53	47
23:00	55	64	53	45

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	59	56	58	58	55	56	57	53	55
Lmax (Maximum)	75	67	71	72	66	69	72	63	67
L50 (Median)	58	55	56	57	54	55	56	49	52
L90 (Background)	53	50	52	52	49	50	51	37	43

Computed CNEL, dB	62
% Daytime Energy	63%
% Evening Energy	12%
% Nighttime Energy	25%

BOLLARD
Acoustical Consultants

Appendix B-6

Site C - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	55	76	51	42
1:00	54	73	50	38
2:00	52	63	49	38
3:00	54	68	50	39
4:00	54	65	52	43
5:00	56	68	53	47
6:00	57	72	55	50
7:00	57	71	56	51
8:00	57	70	55	51
9:00	57	76	55	50
10:00	55	68	54	50
11:00	55	69	54	50
12:00	57	67	56	51
13:00	58	66	57	53
14:00	58	70	57	53
15:00	58	71	57	53
16:00	56	69	55	52
17:00	57	70	56	52
18:00	59	71	58	53
19:00	58	69	57	52
20:00	57	71	55	50
21:00	55	64	54	49
22:00	54	67	53	47
23:00	54	66	53	46

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	59	55	57	58	55	57	57	52	55
Lmax (Maximum)	76	66	70	71	64	68	76	63	69
L50 (Median)	58	54	56	57	54	55	55	49	52
L90 (Background)	53	50	52	52	49	50	50	38	43

Computed CNEL, dB	62
% Daytime Energy	61%
% Evening Energy	14%
% Nighttime Energy	26%

BOLLARD
Acoustical Consultants

Appendix B-7

Site D - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	47	72	41	36
1:00	42	53	41	36
2:00	45	72	40	36
3:00	45	67	43	38
4:00	47	63	47	45
5:00	48	54	47	46
6:00	49	63	48	45
7:00	49	52	49	48
8:00	50	54	50	48
9:00	53	59	52	51
10:00	53	56	53	51
11:00	52	57	52	51
12:00	51	59	51	50
13:00	52	61	51	50
14:00	52	58	52	51
15:00	51	57	51	50
16:00	50	55	50	49
17:00	51	63	51	50
18:00	51	63	51	50
19:00	50	55	50	49
20:00	51	58	50	49
21:00	51	56	50	49
22:00	50	55	50	49
23:00	52	58	51	49

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	53	49	51	51	50	51	52	42	48
Lmax (Maximum)	63	52	58	58	55	56	72	53	62
L50 (Median)	53	49	51	50	50	50	51	40	45
L90 (Background)	51	48	50	49	49	49	49	36	42

Computed CNEL, dB	56
% Daytime Energy	65%
% Evening Energy	13%
% Nighttime Energy	22%

BOLLARD

Acoustical Consultants

Appendix B-8

Site D - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	53	61	53	51
1:00	53	60	52	50
2:00	52	60	52	50
3:00	53	61	52	50
4:00	54	67	54	51
5:00	56	68	55	52
6:00	55	66	55	53
7:00	55	62	55	53
8:00	56	60	55	54
9:00	55	62	55	54
10:00	55	63	55	53
11:00	57	66	57	54
12:00	59	70	58	55
13:00	57	65	57	55
14:00	57	63	56	54
15:00	57	64	56	54
16:00	57	66	57	54
17:00	58	71	58	55
18:00	57	66	57	54
19:00	58	73	57	54
20:00	56	64	56	54
21:00	54	63	54	52
22:00	56	64	56	54
23:00	55	62	54	52

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	59	55	57	58	54	56	56	52	54
Lmax (Maximum)	71	60	65	73	63	67	68	60	63
L50 (Median)	58	55	56	57	54	55	56	52	54
L90 (Background)	55	53	54	54	52	53	54	50	51

Computed CNEL, dB	62
% Daytime Energy	61%
% Evening Energy	13%
% Nighttime Energy	26%

BOLLARD
Acoustical Consultants

Appendix B-9

Site E - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	47	64	45	38
1:00	45	57	44	36
2:00	45	55	43	35
3:00	47	58	47	40
4:00	48	55	47	40
5:00	49	58	48	44
6:00	50	60	50	47
7:00	50	67	49	46
8:00	49	63	48	44
9:00	48	66	47	44
10:00	48	66	46	43
11:00	47	61	46	42
12:00	49	70	47	43
13:00	48	63	46	43
14:00	51	65	49	45
15:00	52	67	50	47
16:00	50	70	48	45
17:00	49	66	47	45
18:00	47	61	46	43
19:00	48	63	47	44
20:00	48	69	46	42
21:00	49	56	48	45
22:00	48	56	47	41
23:00	47	57	47	42

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	52	47	49	49	48	48	50	45	48
Lmax (Maximum)	70	61	65	69	56	63	64	55	58
L50 (Median)	50	46	48	48	46	47	50	43	46
L90 (Background)	47	42	44	45	42	44	47	35	41

Computed CNEL, dB	55
% Daytime Energy	57%
% Evening Energy	12%
% Nighttime Energy	31%

BOLLARD
Acoustical Consultants

Appendix B-10

Site E - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	48	64	46	41
1:00	46	64	44	38
2:00	45	52	44	36
3:00	47	59	45	39
4:00	48	59	47	42
5:00	48	56	47	43
6:00	49	62	48	45
7:00	49	67	48	45
8:00	49	62	48	45
9:00	49	67	47	44
10:00	47	65	44	41
11:00	51	64	48	43
12:00	50	64	46	42
13:00	47	62	46	43
14:00	49	61	46	43
15:00	49	70	46	43
16:00	47	61	45	43
17:00	49	64	46	43
18:00	49	67	47	44
19:00	47	62	46	43
20:00	48	57	47	43
21:00	49	63	48	43
22:00	47	61	46	41
23:00	47	62	46	41

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	51	47	49	49	47	48	49	45	47
Lmax (Maximum)	70	61	64	63	57	61	64	52	60
L50 (Median)	48	44	46	48	46	47	48	44	46
L90 (Background)	45	41	43	43	43	43	45	36	41

Computed CNEL, dB	54
% Daytime Energy	57%
% Evening Energy	12%
% Nighttime Energy	31%

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Appendix B-11

Site F - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Tuesday, May 14, 2013

Hour	Leq	Lmax	L50	L90
0:00	57	79	40	38
1:00	40	57	39	37
2:00	48	72	39	37
3:00	53	76	41	38
4:00	43	50	42	38
5:00	46	58	45	42
6:00	46	64	44	42
7:00	51	76	43	40
8:00	45	65	41	38
9:00	45	69	40	37
10:00	46	72	39	36
11:00	46	62	42	37
12:00	54	74	39	35
13:00	49	77	40	36
14:00	57	77	43	39
15:00	53	81	43	40
16:00	47	74	40	36
17:00	54	76	40	37
18:00	47	69	38	36
19:00	43	65	39	36
20:00	46	74	39	38
21:00	43	56	42	39
22:00	42	53	41	38
23:00	42	56	40	38

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	57	45	51	46	43	44	57	40	50
Lmax (Maximum)	81	62	73	74	56	65	79	50	63
L50 (Median)	43	38	41	42	39	40	45	39	41
L90 (Background)	40	35	37	39	36	38	42	37	39

Computed CNEL, dB	56
% Daytime Energy	63%
% Evening Energy	3%
% Nighttime Energy	34%

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Appendix B-12

Site F - Continuous Noise Measurement Results

Boca Quarry Project - Nevada County, CA

Wednesday, May 15, 2013

Hour	Leq	Lmax	L50	L90
0:00	58	83	41	38
1:00	52	76	39	37
2:00	40	47	39	37
3:00	41	54	40	37
4:00	57	77	42	39
5:00	46	61	44	41
6:00	45	69	43	40
7:00	48	75	42	40
8:00	46	68	42	38
9:00	53	78	40	36
10:00	52	74	38	35
11:00	43	66	40	37
12:00	44	66	39	36
13:00	46	72	39	37
14:00	46	66	41	38
15:00	46	73	41	39
16:00	45	61	42	39
17:00	46	71	39	37
18:00	58	88	40	38
19:00	44	63	39	37
20:00	48	73	40	37
21:00	43	61	40	38
22:00	49	74	39	37
23:00	54	76	39	38

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	58	43	51	48	43	46	58	40	53
Lmax (Maximum)	88	61	71	73	61	65	83	47	69
L50 (Median)	42	38	40	40	39	40	44	39	41
L90 (Background)	40	35	38	38	37	37	41	37	38

Computed CNEL, dB	59
% Daytime Energy	42%
% Evening Energy	3%
% Nighttime Energy	54%

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Appendix B-13

Site A - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Wednesday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00	57	79	54	49
12:00	60	84	54	50
13:00	58	82	53	47
14:00	59	83	54	48
15:00	57	79	52	46
16:00	57	79	50	44
17:00	59	84	43	38
18:00	54	76	42	38
19:00	52	73	44	35
20:00	43	61	37	34
21:00	48	74	37	35
22:00	38	54	37	34
23:00	38	54	36	32

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	60	54	58	52	43	49	38	38	38
Lmax (Maximum)	84	76	81	74	61	69	54	54	54
L50 (Median)	54	42	50	44	37	40	37	36	36
L90 (Background)	50	38	45	35	34	35	34	32	33

Computed CNEL, dB	54
% Daytime Energy	95%
% Evening Energy	5%
% Nighttime Energy	0%

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Appendix B-14

Site A - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Thursday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	48	64	42	36
1:00	46	59	41	35
2:00	47	73	43	37
3:00	35	48	32	25
4:00	32	41	30	25
5:00	51	77	28	23
6:00	56	78	36	30
7:00	58	81	35	33
8:00	57	82	35	31
9:00	53	74	36	34
10:00	60	83	38	32
11:00	54	82	38	29
12:00	56	81	32	26
13:00	61	83	41	31
14:00	55	81	30	27
15:00	57	82	35	29
16:00	57	82	37	33
17:00	51	78	32	27
18:00	50	74	30	27
19:00	47	71	35	31
20:00	37	57	35	25
21:00	42	73	25	21
22:00	29	46	26	22
23:00	45	76	27	22

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	61	50	57	47	37	44	56	29	49
Lmax (Maximum)	83	74	80	73	57	67	78	41	62
L50 (Median)	41	30	35	35	25	32	43	26	34
L90 (Background)	34	26	30	31	21	25	37	22	28

Computed CNEL, dB	57
% Daytime Energy	88%
% Evening Energy	1%
% Nighttime Energy	11%

BOLLARD
Acoustical Consultants

Appendix B-15

Site A - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00	32	54	22	20
1:00	40	71	20	19
2:00	20	32	20	19
3:00	33	62	25	21
4:00	38	70	26	24
5:00	47	74	25	23
6:00	56	79	32	21
7:00	56	82	34	24
8:00	56	83	34	26
9:00	55	80	31	30
10:00	59	80	36	26
11:00				
12:00				
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	59	55	58				56	20	38
Lmax (Maximum)	83	80	81				79	32	63
L50 (Median)	36	31	34				32	20	24
L90 (Background)	30	24	26				24	19	21

Computed CNEL, dB	55
% Daytime Energy	79%
% Evening Energy	0%
% Nighttime Energy	21%

BOLLARD
Acoustical Consultants

Appendix B-16

Site B - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Wednesday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00				
12:00	60	75	59	56
13:00	59	72	58	55
14:00	60	78	59	56
15:00	61	72	60	57
16:00	60	68	60	57
17:00	60	68	59	57
18:00	59	74	58	54
19:00	57	67	56	51
20:00	58	67	57	53
21:00	57	67	56	52
22:00	57	69	56	51
23:00	54	68	53	46

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	61	59	60	58	57	57	57	54	56
Lmax (Maximum)	78	68	72	67	67	67	69	68	68
L50 (Median)	60	58	59	57	56	56	56	53	54
L90 (Background)	57	54	56	53	51	52	51	46	48

Computed CNEL, dB	59
% Daytime Energy	74%
% Evening Energy	17%
% Nighttime Energy	9%

BOLLARD
Acoustical Consultants

Appendix B-17

Site B - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Thursday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	53	64	51	42
1:00	54	66	52	43
2:00	54	66	51	40
3:00	54	64	53	44
4:00	56	69	55	48
5:00	57	66	56	52
6:00	59	70	58	55
7:00	59	74	59	56
8:00	58	66	58	54
9:00	58	74	57	54
10:00	59	73	58	55
11:00	61	83	59	55
12:00	60	78	58	55
13:00	60	72	60	56
14:00	58	65	57	54
15:00	60	78	59	56
16:00	60	67	60	57
17:00	61	85	60	57
18:00	59	74	58	55
19:00	58	70	57	53
20:00	57	69	56	52
21:00	57	68	56	51
22:00	55	67	54	48
23:00	55	68	53	48

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	61	58	60	58	57	57	59	53	56
Lmax (Maximum)	85	65	74	70	68	69	70	64	67
L50 (Median)	60	57	59	57	56	56	58	51	54
L90 (Background)	57	54	55	53	51	52	55	40	47

Computed CNEL, dB	63
% Daytime Energy	69%
% Evening Energy	10%
% Nighttime Energy	21%

BOLLARD
Acoustical Consultants

Appendix B-18

Site B - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00	53	64	52	44
1:00	52	61	50	40
2:00	52	64	50	40
3:00	53	65	50	41
4:00	54	71	52	44
5:00	56	67	55	49
6:00	59	68	58	54
7:00	58	64	58	54
8:00	58	72	58	54
9:00	59	67	58	55
10:00	59	79	58	55
11:00	59	76	58	55
12:00	61	64	60	56
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	61	58	59				59	52	55
Lmax (Maximum)	79	64	70				71	61	66
L50 (Median)	60	58	58				58	50	52
L90 (Background)	56	54	55				54	40	44

Computed CNEL, dB	60
% Daytime Energy	69%
% Evening Energy	0%
% Nighttime Energy	31%

BOLLARD
Acoustical Consultants

Appendix B-19
Site C - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Wednesday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00	61	81	60	57
12:00	59	71	58	56
13:00	61	73	60	58
14:00	62	82	60	57
15:00	65	85	62	58
16:00	64	83	61	58
17:00	59	71	59	57
18:00	58	66	57	54
19:00	58	83	56	53
20:00	58	65	58	55
21:00	59	67	58	55
22:00	59	85	57	53
23:00	59	87	55	50

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	65	58	62	59	58	59	59	59	59
Lmax (Maximum)	85	66	76	83	65	72	87	85	86
L50 (Median)	62	57	59	58	56	57	57	55	56
L90 (Background)	58	54	57	55	53	54	53	50	52

Computed CNEL, dB	62
% Daytime Energy	73%
% Evening Energy	15%
% Nighttime Energy	12%

BOLLARD
Acoustical Consultants

Appendix B-20

Site C - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Thursday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	55	63	54	50
1:00	59	84	54	49
2:00	56	84	52	47
3:00	56	66	54	48
4:00	56	66	55	51
5:00	58	71	57	54
6:00	60	71	60	57
7:00	61	85	59	56
8:00	63	89	59	57
9:00	60	72	59	57
10:00	62	83	60	57
11:00	60	85	57	54
12:00	60	88	57	53
13:00	61	88	57	53
14:00	55	73	54	51
15:00	58	72	57	54
16:00	60	70	59	57
17:00	60	66	60	57
18:00	60	77	59	56
19:00	59	65	58	55
20:00	59	80	57	53
21:00	62	87	57	53
22:00	56	64	55	52
23:00	56	64	55	51

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	63	55	60	62	59	60	60	55	57
Lmax (Maximum)	89	66	79	87	65	77	84	63	70
L50 (Median)	60	54	58	58	57	57	60	52	55
L90 (Background)	57	51	55	55	53	54	57	47	51

Computed CNEL, dB	65
% Daytime Energy	62%
% Evening Energy	15%
% Nighttime Energy	23%

BOLLARD
Acoustical Consultants

Appendix B-21

Site C - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00	54	62	53	49
1:00	54	62	53	47
2:00	54	62	53	48
3:00	61	88	53	48
4:00	54	63	53	50
5:00	56	67	55	51
6:00	60	83	59	56
7:00	60	72	60	58
8:00	59	81	58	56
9:00	60	79	59	55
10:00	60	86	56	53
11:00	60	70	59	57
12:00				
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	60	59	60				61	54	57
Lmax (Maximum)	86	70	77				88	62	69
L50 (Median)	60	56	58				59	53	54
L90 (Background)	58	53	56				56	47	50

Computed CNEL, dB	62
% Daytime Energy	58%
% Evening Energy	0%
% Nighttime Energy	42%

BOLLARD
Acoustical Consultants

Appendix B-22

Site D - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00				
12:00	62	70	62	58
13:00	63	70	62	57
14:00	63	72	63	58
15:00	64	79	63	59
16:00	64	71	63	59
17:00	63	71	63	59
18:00	61	69	60	55
19:00	60	71	59	52
20:00	61	68	60	54
21:00	60	68	59	52
22:00	59	69	58	49
23:00	58	71	56	45

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	64	61	63	61	60	60	59	58	58
Lmax (Maximum)	79	69	72	71	68	69	71	69	70
L50 (Median)	63	60	62	60	59	59	58	56	57
L90 (Background)	59	55	58	54	52	53	49	45	47

Computed CNEL, dB	62
% Daytime Energy	74%
% Evening Energy	18%
% Nighttime Energy	8%

BOLLARD
Acoustical Consultants

Appendix B-23

Site D - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	57	66	54	42
1:00	57	70	54	40
2:00	57	71	53	36
3:00	57	68	54	41
4:00	58	67	56	46
5:00	60	68	59	51
6:00	62	69	62	57
7:00	65	80	64	60
8:00	63	72	62	57
9:00	62	69	61	56
10:00	62	73	62	58
11:00	62	81	61	57
12:00	63	73	62	58
13:00	64	82	63	59
14:00	60	68	60	56
15:00	60	67	60	56
16:00	63	68	63	59
17:00	65	70	64	60
18:00	63	71	62	57
19:00	62	69	61	55
20:00	62	78	60	52
21:00	61	74	60	54
22:00	59	68	58	49
23:00	60	67	58	48

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	65	60	63	62	61	62	62	57	59
Lmax (Maximum)	82	67	73	78	69	74	71	66	68
L50 (Median)	64	60	62	61	60	60	62	53	56
L90 (Background)	60	56	58	55	52	54	57	36	45

Computed CNEL, dB	67
% Daytime Energy	67%
% Evening Energy	12%
% Nighttime Energy	21%

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Acoustical Consultants

Appendix B-24

Site D - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00	59	69	56	41
1:00	57	68	52	36
2:00	57	68	53	36
3:00	58	69	53	36
4:00	58	68	56	43
5:00	60	68	59	49
6:00	63	71	62	56
7:00	63	70	62	58
8:00	63	69	63	58
9:00	64	71	63	58
10:00	64	81	63	58
11:00	64	80	63	58
12:00	64	81	63	60
13:00				
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	64	63	64				63	57	59
Lmax (Maximum)	81	69	75				71	68	69
L50 (Median)	63	62	63				62	52	56
L90 (Background)	60	58	58				56	36	42

Computed CNEL, dB	65
% Daytime Energy	69%
% Evening Energy	0%
% Nighttime Energy	31%

BOLLARD
Acoustical Consultants

Appendix B-25

Site E - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00				
12:00				
13:00	51	71	49	47
14:00	50	61	49	46
15:00	50	65	49	47
16:00	50	66	49	47
17:00	51	65	49	47
18:00	50	64	48	46
19:00	49	65	47	43
20:00	51	62	50	47
21:00	50	59	50	46
22:00	48	71	46	42
23:00	43	54	42	37

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	51	50	50	51	49	50	48	43	46
Lmax (Maximum)	71	61	65	65	59	62	71	54	63
L50 (Median)	49	48	49	50	47	49	46	42	44
L90 (Background)	47	46	47	47	43	45	42	37	39

Computed CNEL, dB	50
% Daytime Energy	62%
% Evening Energy	30%
% Nighttime Energy	8%

BOLLARD

Acoustical Consultants

Appendix B-26
Site E - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	46	58	45	38
1:00	46	57	46	39
2:00	46	66	44	38
3:00	48	57	47	38
4:00	49	61	47	41
5:00	50	57	50	46
6:00	52	70	52	49
7:00	51	66	50	47
8:00	52	64	50	47
9:00	49	64	47	45
10:00	48	61	47	45
11:00	51	67	49	46
12:00	51	68	50	47
13:00	51	69	50	47
14:00	51	70	48	45
15:00	51	67	48	45
16:00	54	74	52	49
17:00	53	67	52	49
18:00	50	65	49	46
19:00	50	64	49	46
20:00	50	60	50	46
21:00	50	70	49	45
22:00	46	66	45	41
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	54	48	51	50	50	50	52	46	49
Lmax (Maximum)	74	61	67	70	60	64	70	57	61
L50 (Median)	52	47	49	50	49	49	52	44	47
L90 (Background)	49	45	46	46	45	46	49	38	41

Computed CNEL, dB	55
% Daytime Energy	64%
% Evening Energy	12%
% Nighttime Energy	23%

BOLLARD
Acoustical Consultants

Appendix B-27
Site E - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00	51	68	49	47
11:00	50	70	49	46
12:00	51	65	50	46
13:00	51	65	50	47
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

Statistical Summary									
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	51	50	51						
Lmax (Maximum)	70	65	67						
L50 (Median)	50	49	50						
L90 (Background)	47	46	46						

Computed CNEL, dB	43
% Daytime Energy	100%
% Evening Energy	0%
% Nighttime Energy	0%

BOLLARD
Acoustical Consultants

Appendix B-28

Site F - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 20, 2017

Hour	Leq	Lmax	L50	L90
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00				
7:00				
8:00				
9:00				
10:00				
11:00				
12:00				
13:00	49	73	45	42
14:00	46	66	43	41
15:00	53	73	42	40
16:00	46	68	42	40
17:00	48	72	43	41
18:00	50	71	48	40
19:00	52	71	40	37
20:00	44	61	41	38
21:00	43	54	41	37
22:00	50	71	37	35
23:00	39	50	36	33

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	53	46	49	52	43	48	50	39	47
Lmax (Maximum)	73	66	70	71	54	62	71	50	60
L50 (Median)	48	42	44	41	40	40	37	36	36
L90 (Background)	42	40	41	38	37	37	35	33	34

Computed CNEL, dB	49
% Daytime Energy	64%
% Evening Energy	24%
% Nighttime Energy	12%

BOLLARD
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Appendix B-29

Site F - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 21, 2017

Hour	Leq	Lmax	L50	L90
0:00	51	71	38	33
1:00	50	71	37	34
2:00	50	70	37	33
3:00	41	55	39	34
4:00	42	54	40	35
5:00	44	57	42	38
6:00	48	76	43	40
7:00	46	64	40	36
8:00	50	71	39	36
9:00	43	66	37	34
10:00	49	70	36	35
11:00	53	73	45	40
12:00	49	73	42	38
13:00	54	75	45	38
14:00	46	62	43	38
15:00	53	76	40	38
16:00	47	70	45	42
17:00	47	71	43	39
18:00	54	84	37	35
19:00	46	73	40	37
20:00	48	70	41	38
21:00	60	91	41	37
22:00	43	72	36	33
23:00	40	57	38	34

Statistical Summary

	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	54	43	50	60	46	56	51	40	47
Lmax (Maximum)	84	62	71	91	70	78	76	54	65
L50 (Median)	45	36	41	41	40	41	43	36	39
L90 (Background)	42	34	37	38	37	37	40	33	35

Computed CNEL, dB	56
% Daytime Energy	44%
% Evening Energy	40%
% Nighttime Energy	16%

BOLLARD
Acoustical Consultants

Appendix B-30

Site F - Ambient Noise Monitoring Results

Boca Quarry Project - Nevada County, CA

Friday, September 22, 2017

Hour	Leq	Lmax	L50	L90
0:00	38	50	37	32
1:00	36	48	35	31
2:00	41	62	35	32
3:00	37	54	35	31
4:00	49	71	37	33
5:00	40	54	38	34
6:00	53	75	40	36
7:00	45	68	41	38
8:00	53	78	41	38
9:00	46	64	39	37
10:00	52	76	39	37
11:00	49	72	40	38
12:00	47	68	44	38
13:00	51	64	49	40
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				
22:00				
23:00				

	Statistical Summary								
	Daytime (7 a.m. - 7 p.m.)			Evening (7 p.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average	High	Low	Average
Leq (Average)	53	45	50				53	36	46
Lmax (Maximum)	78	64	70				75	48	59
L50 (Median)	49	39	42				40	35	37
L90 (Background)	40	37	38				36	31	33

Computed CNEL, dB	52
% Daytime Energy	70%
% Evening Energy	0%
% Nighttime Energy	30%

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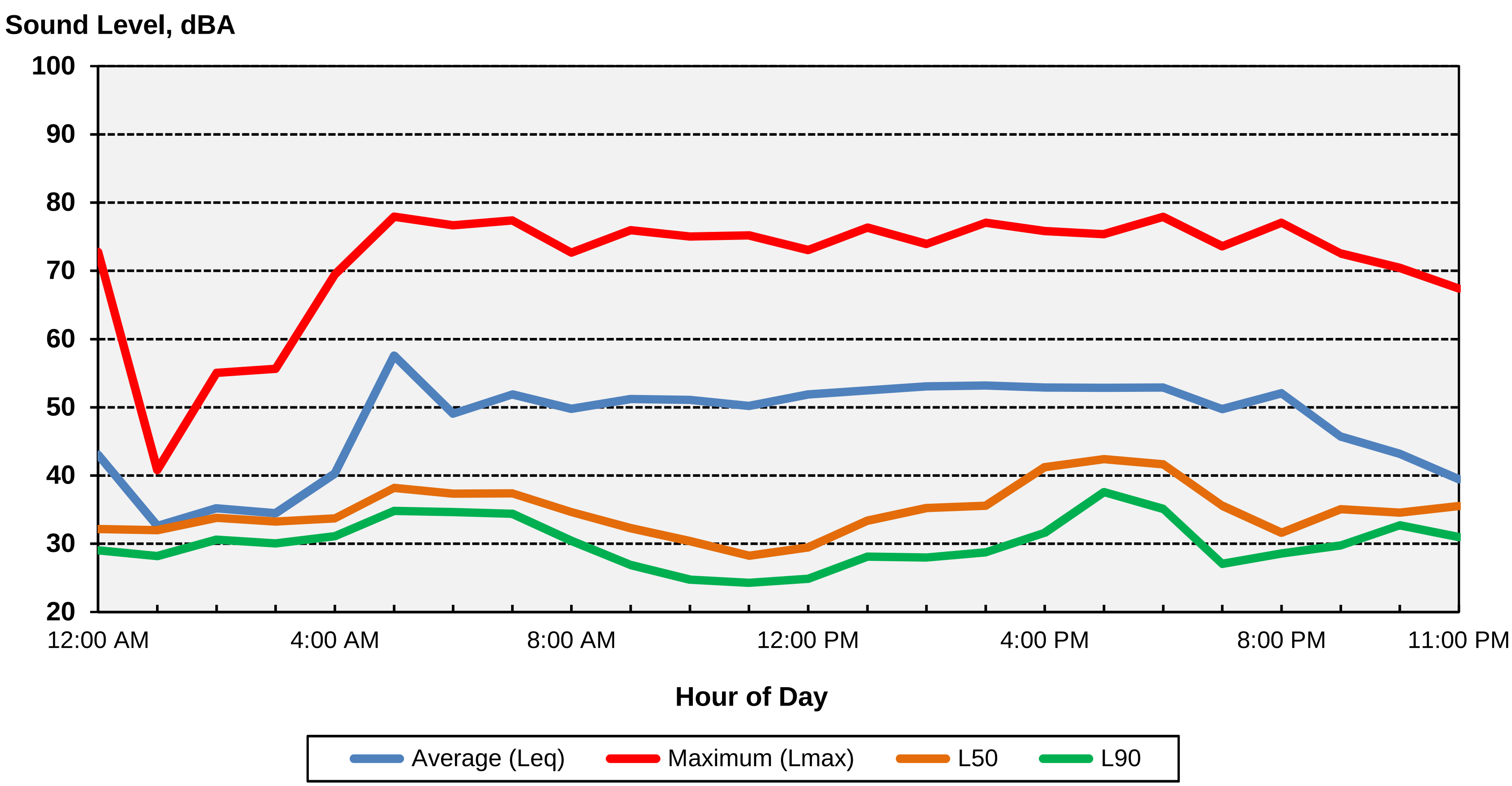
Appendix C-1
Site A - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 56 dB

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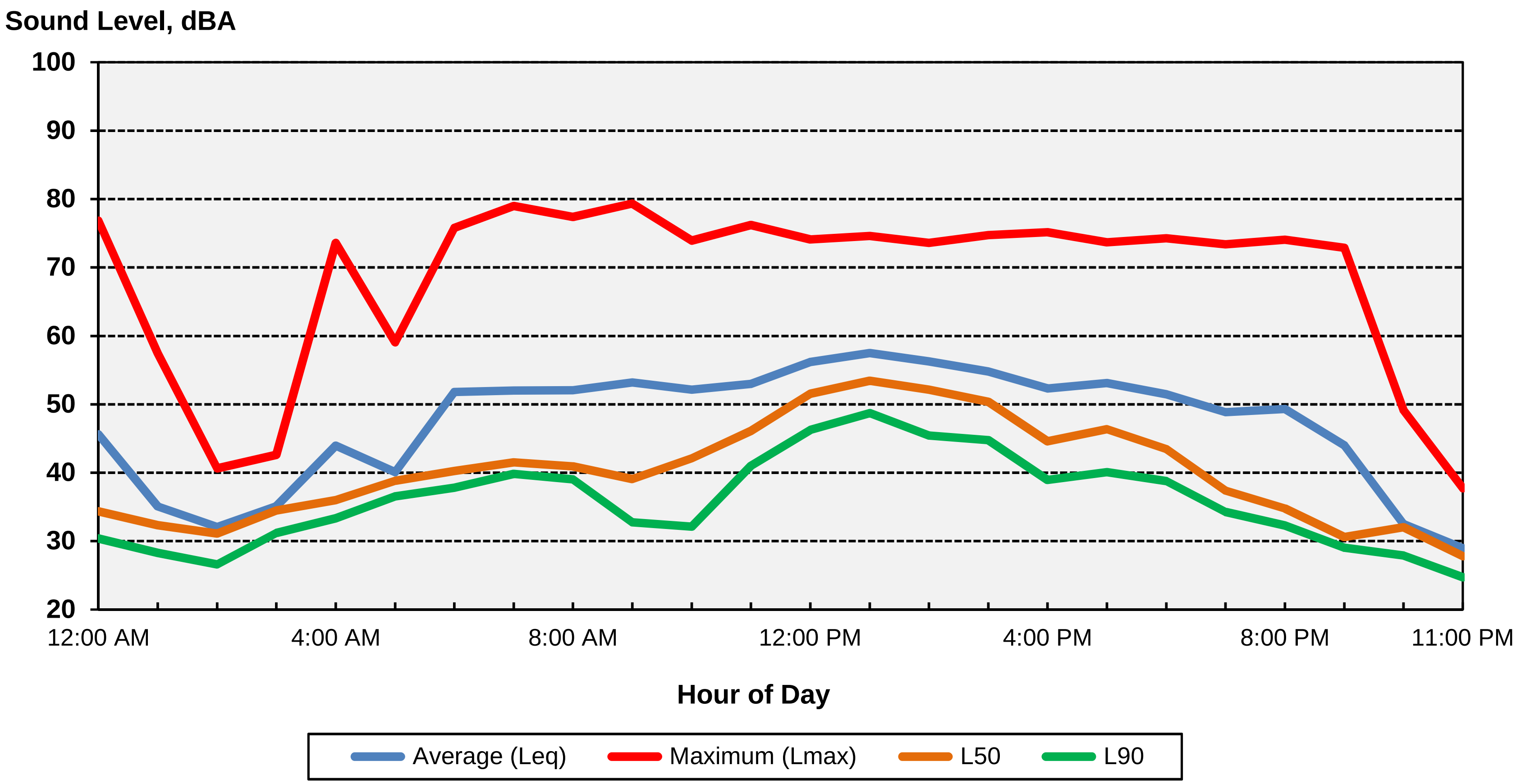
Appendix C-2
Site A - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 54 dB

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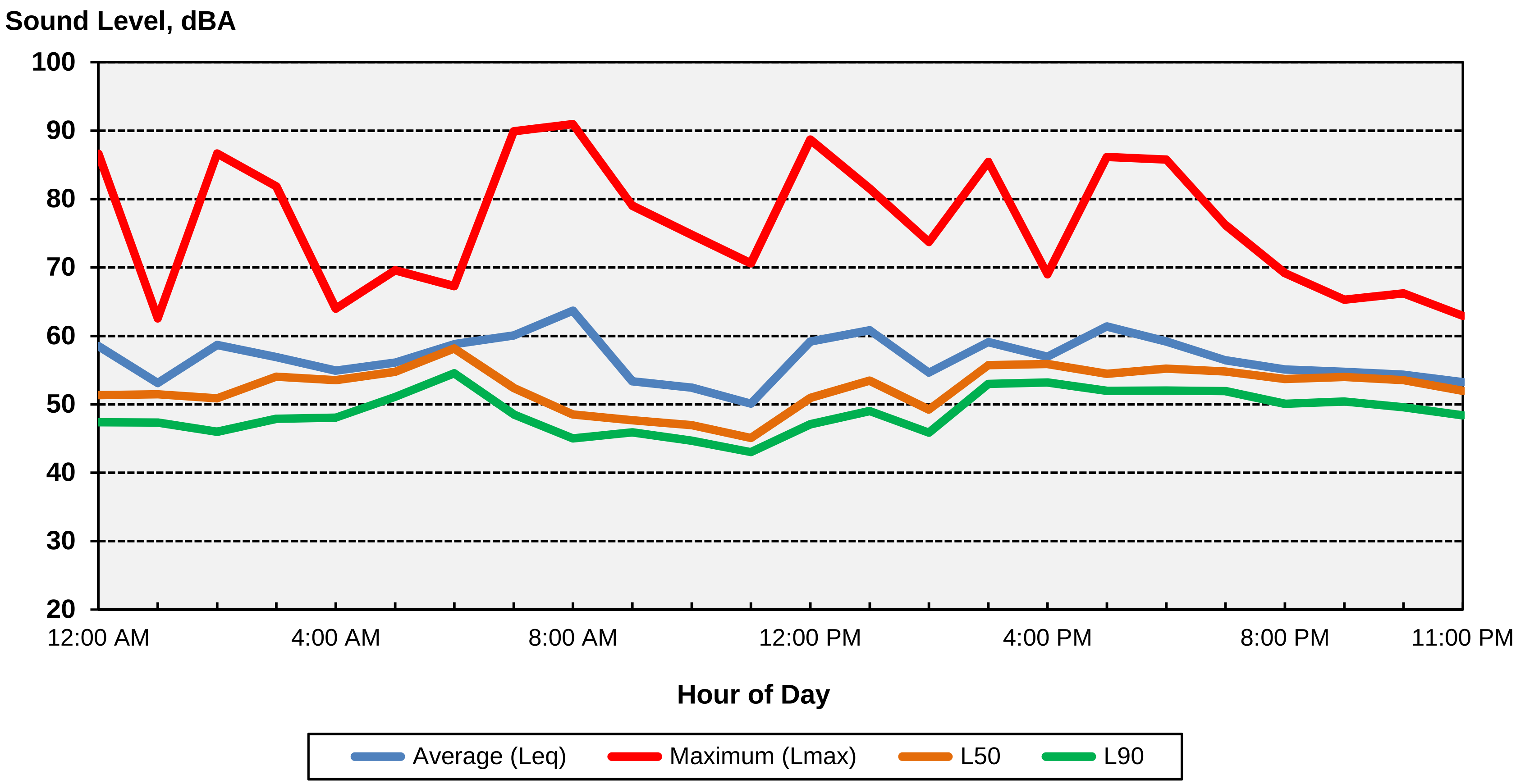
Appendix C-3
Site B - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 64 dB

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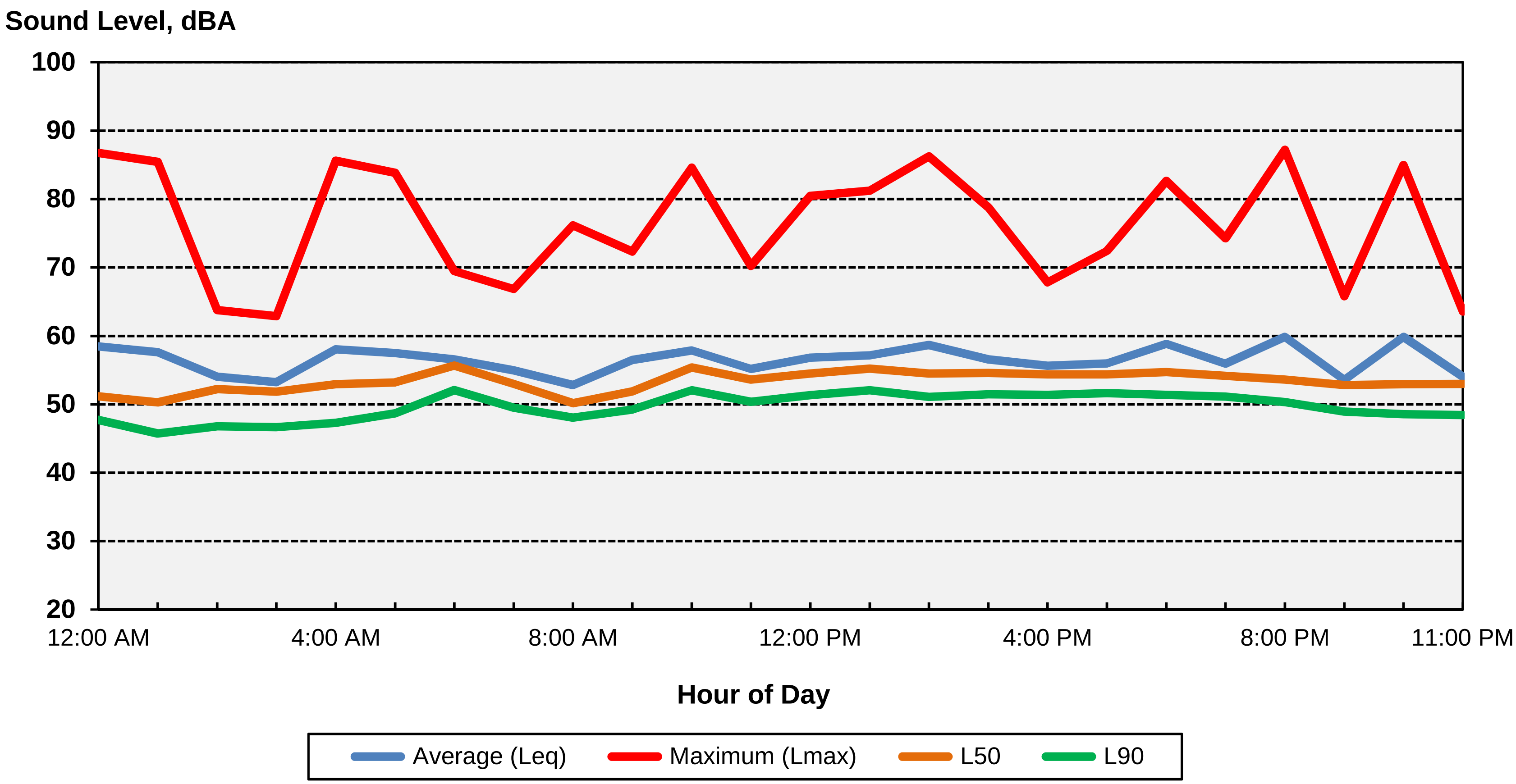
Appendix C-4
Site B - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 64 dB

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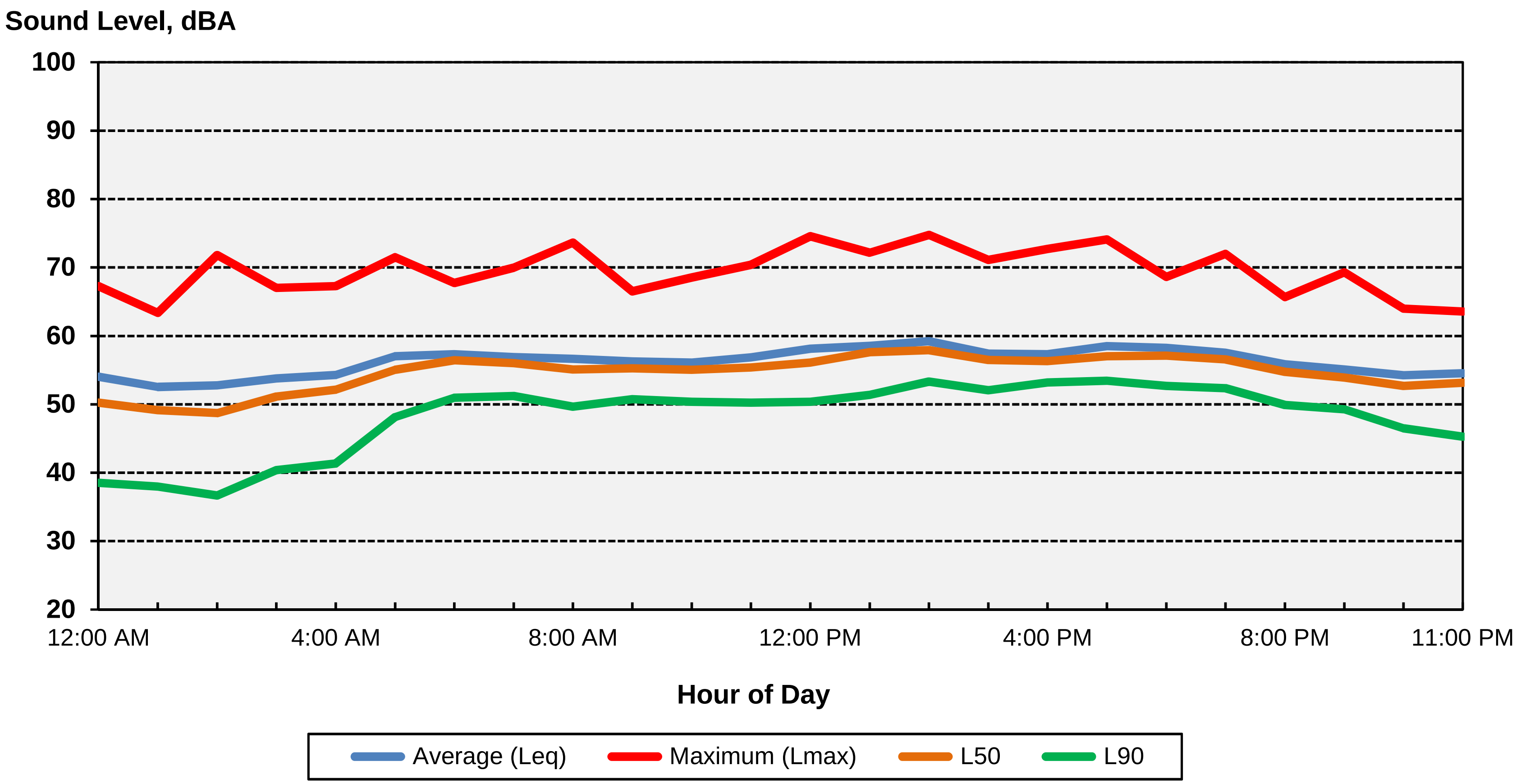
Appendix C-5
Site C - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 62 dB

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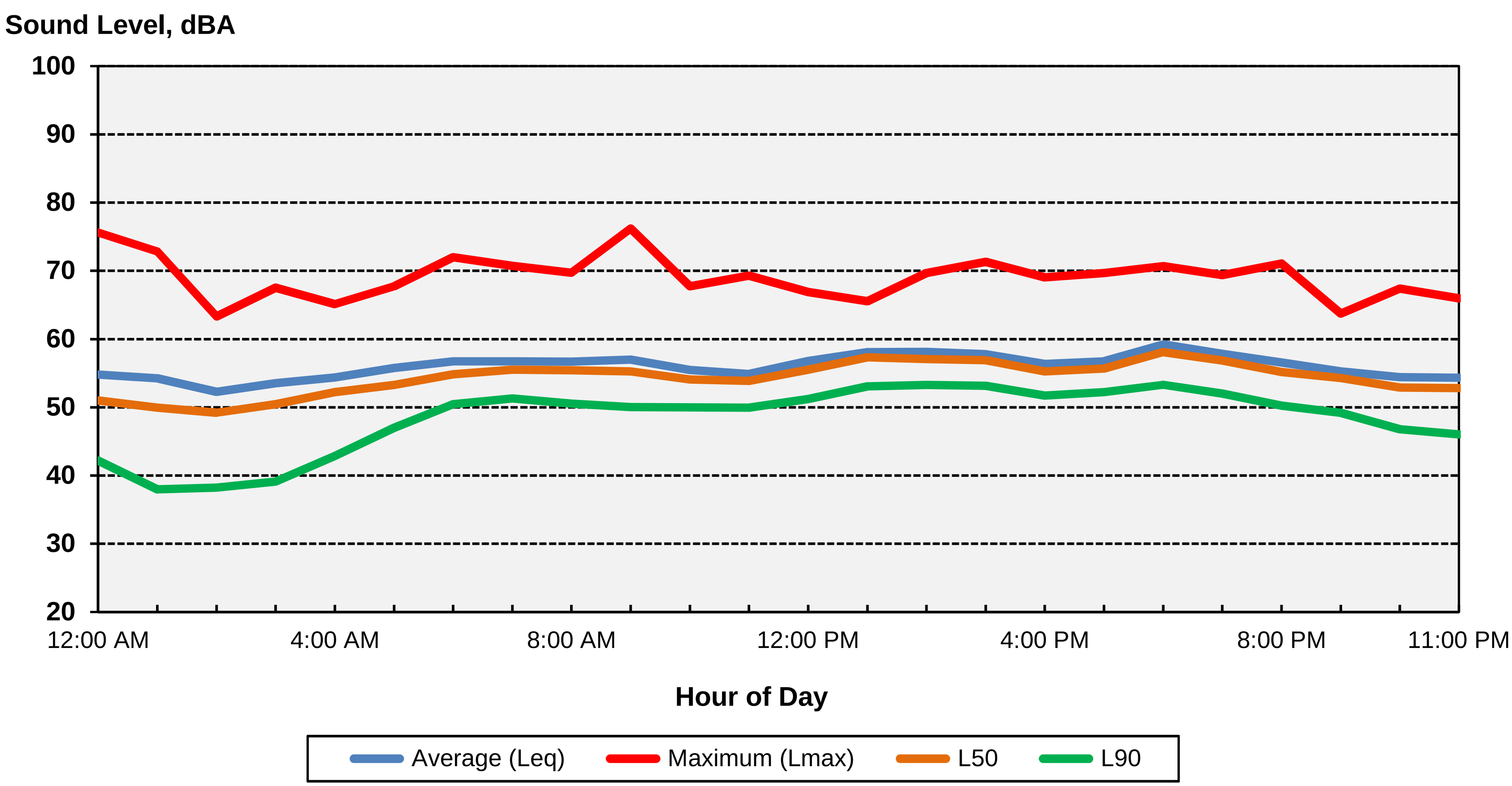
Appendix C-6
Site C - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 62 dB

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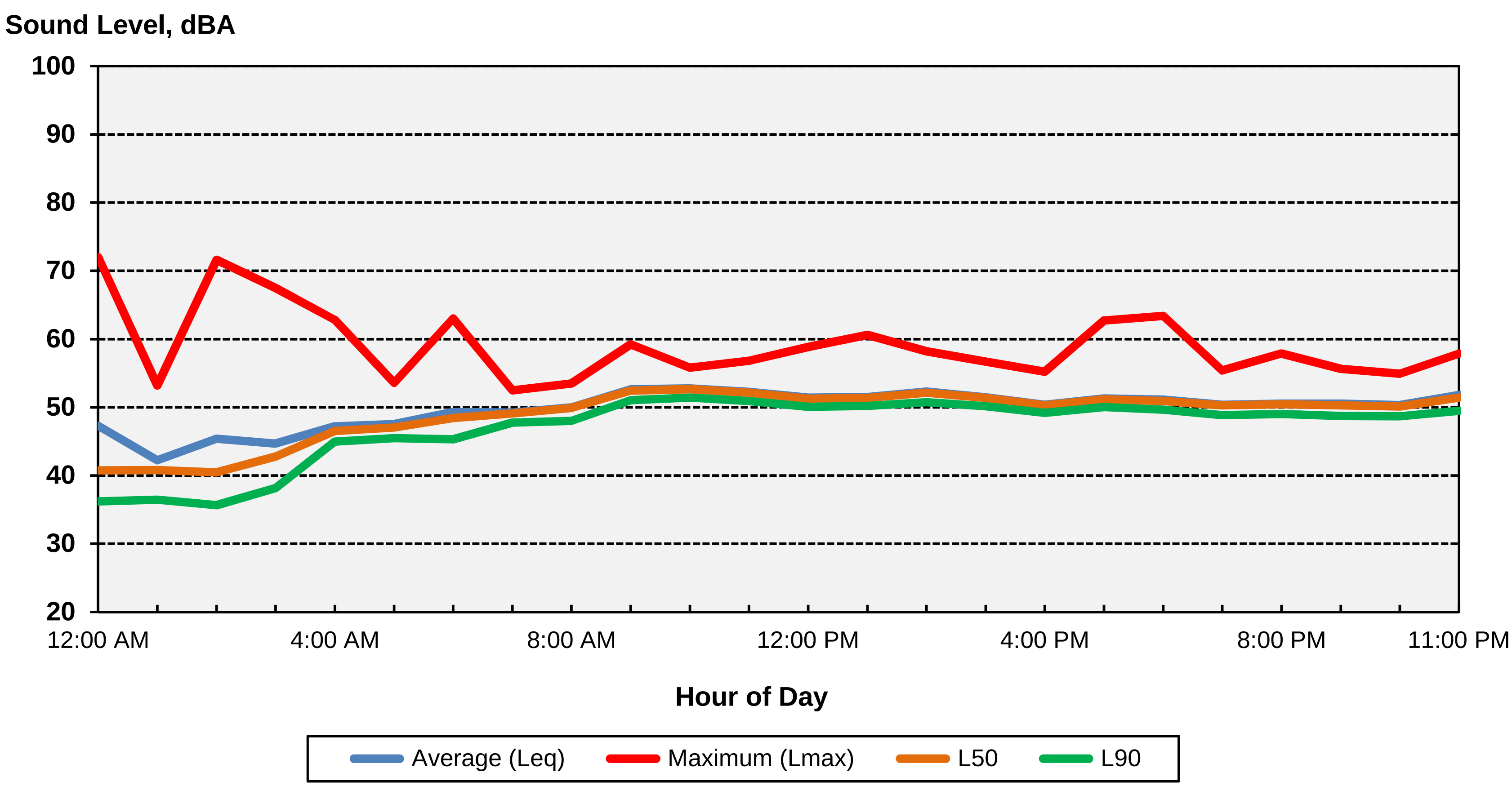
Appendix C-7
Site D - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 56 dB

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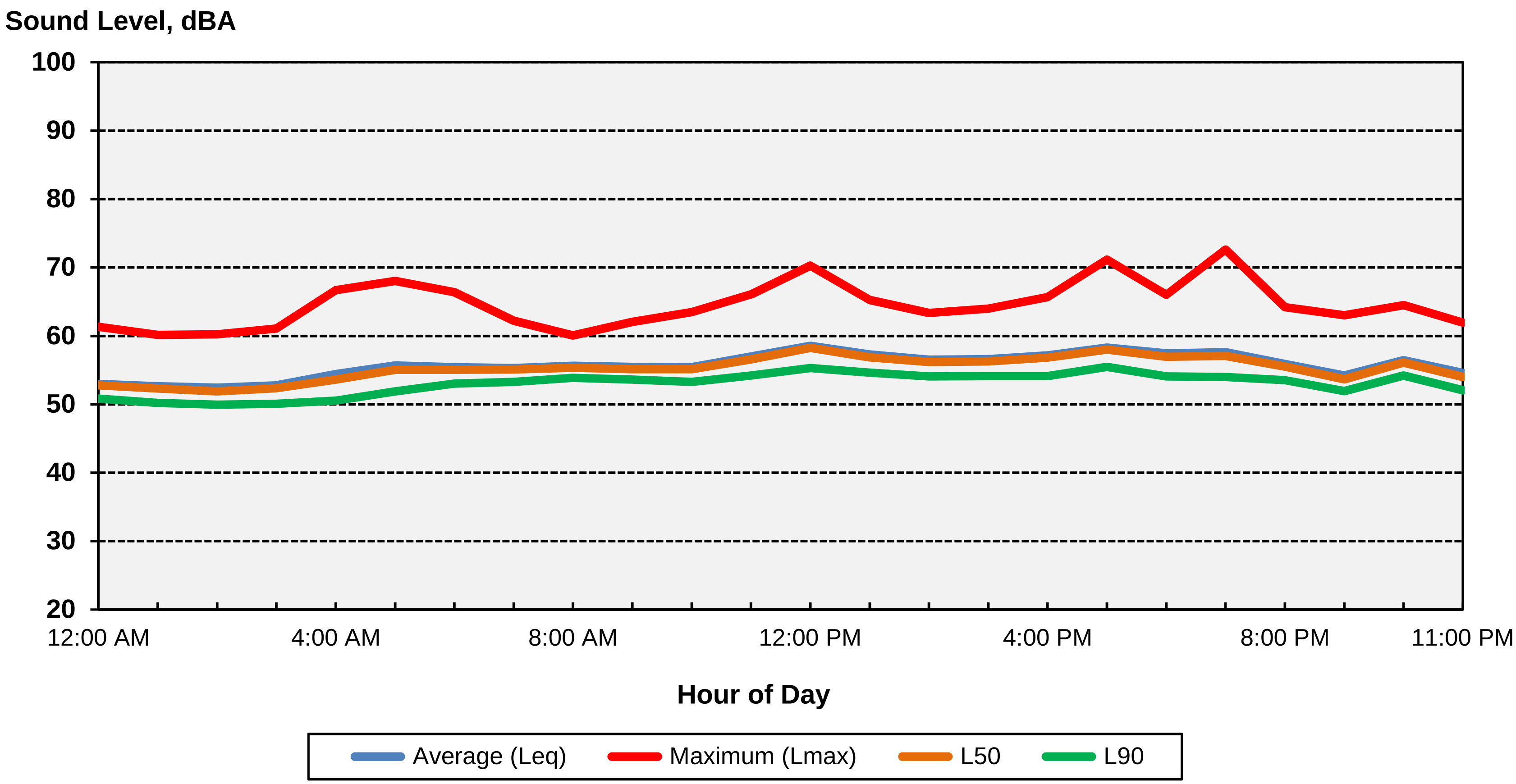
Appendix C-8
Site D - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 62 dB

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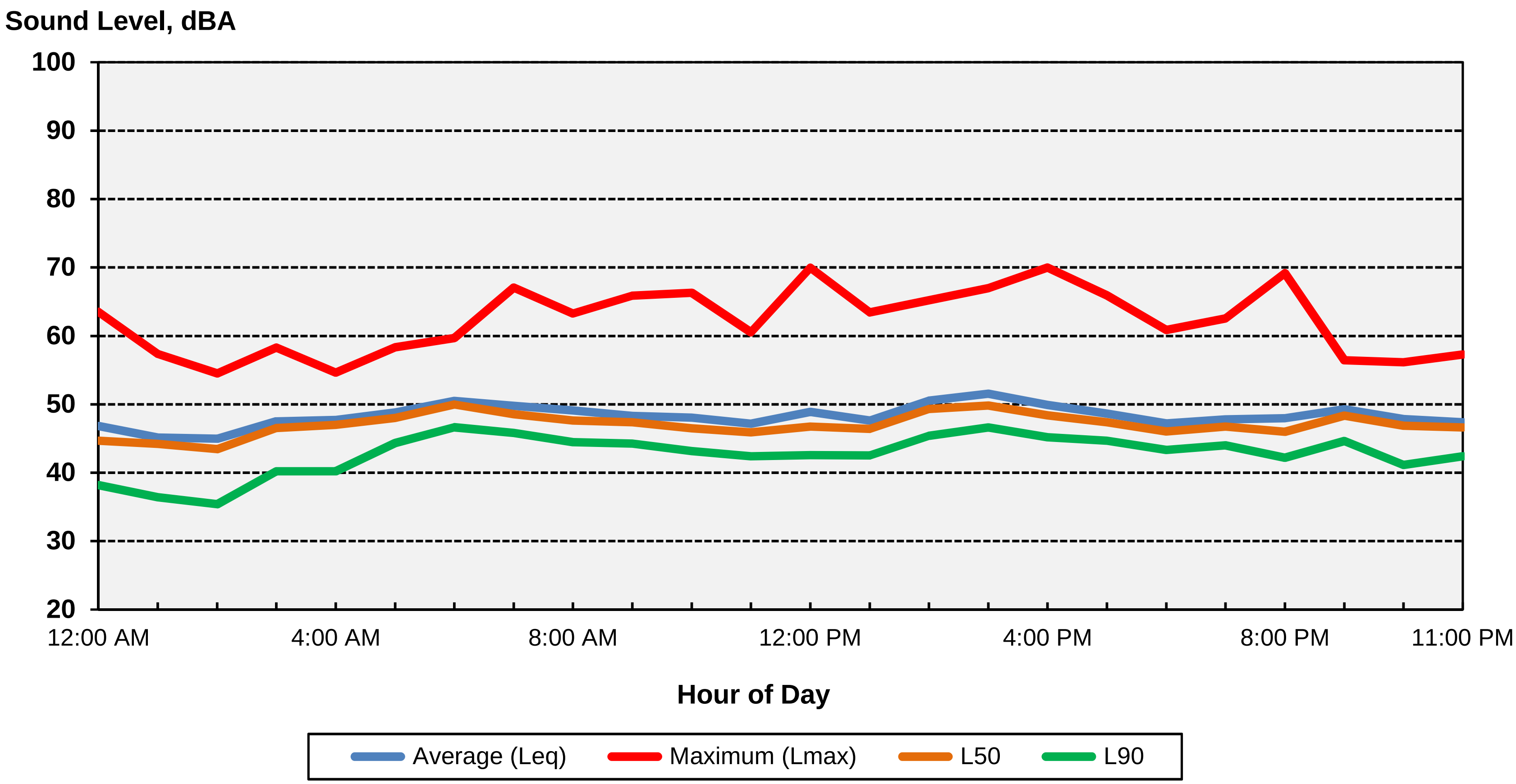
Appendix C-9
Site E - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 55 dB

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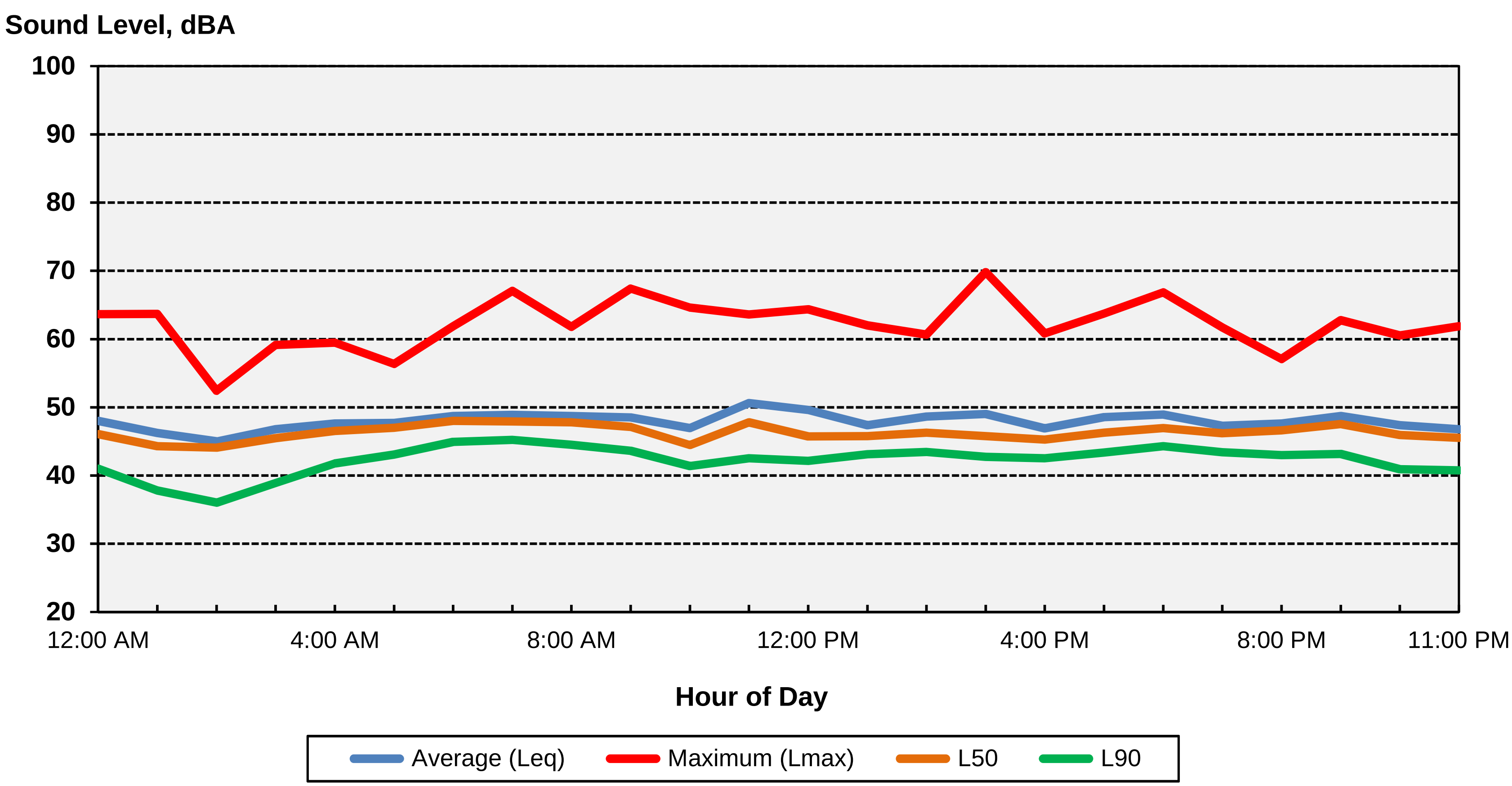
Appendix C-10
Site E - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 54 dB

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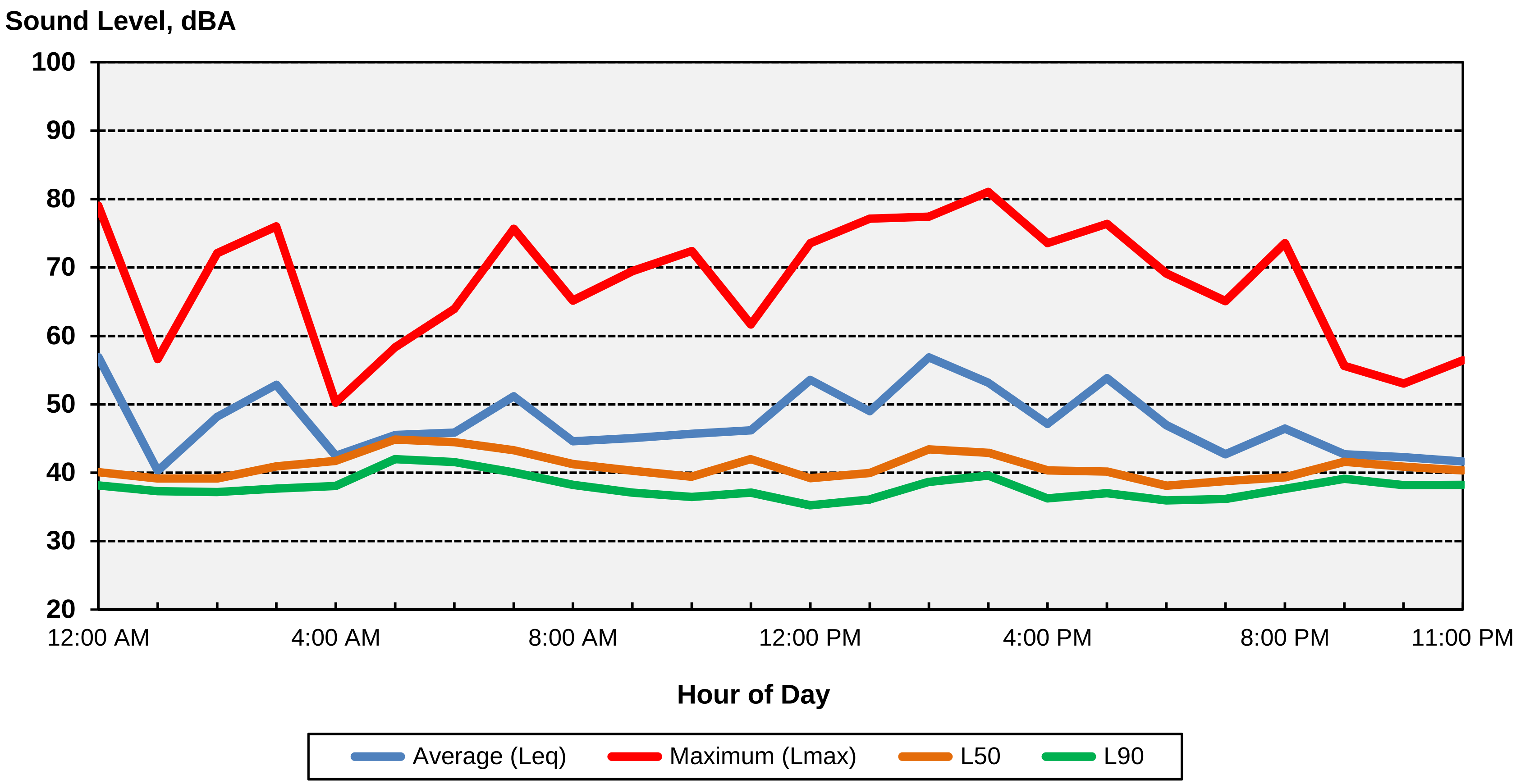
Appendix C-11
Site F - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Tuesday, May 14, 2013



CNEL: 56 dB

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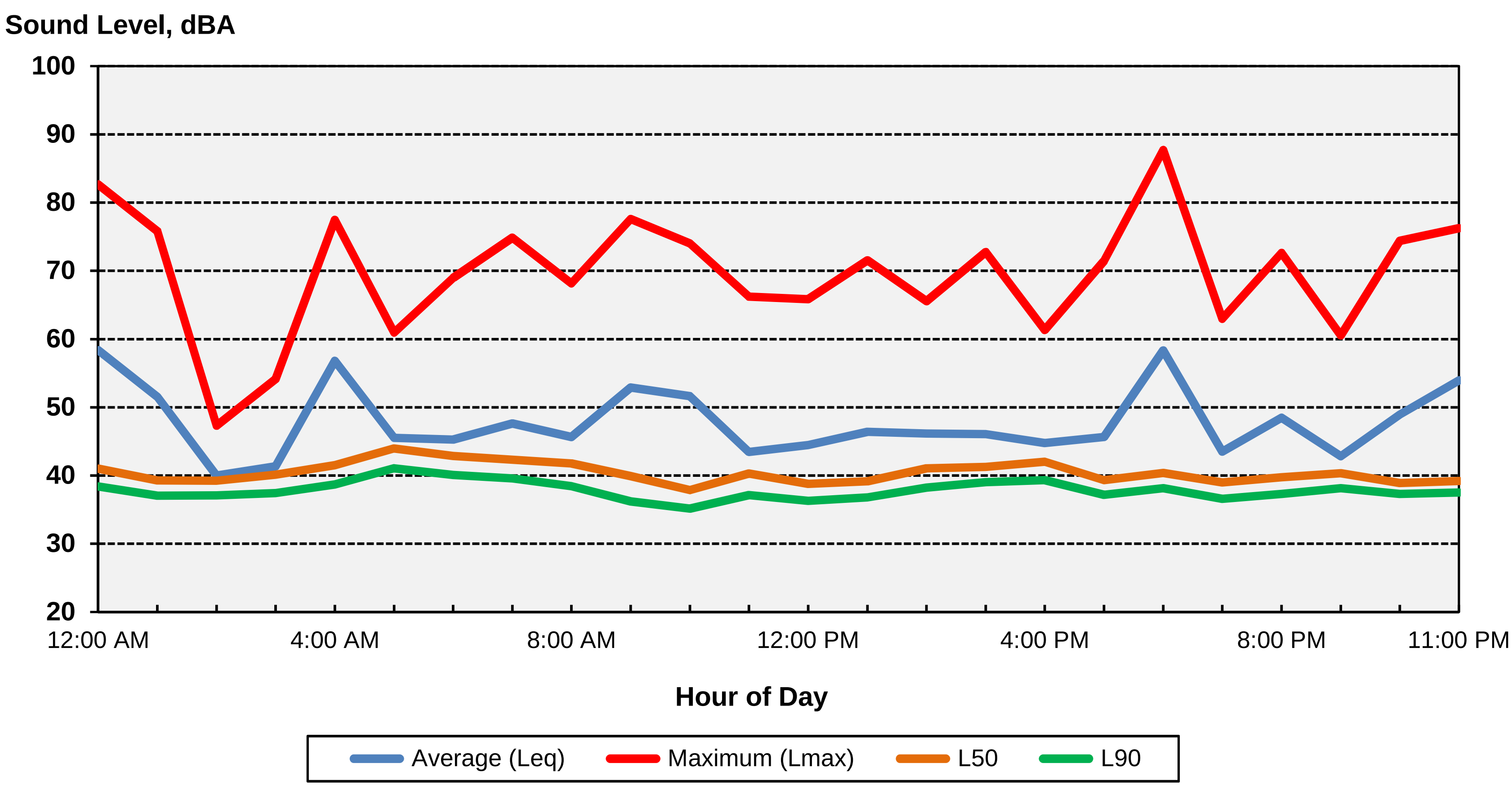
Appendix C-12
Site F - Continuous Noise Measurement Results
Boca Quarry Project - Nevada County, CA
Wednesday, May 15, 2013



CNEL: 59 dB

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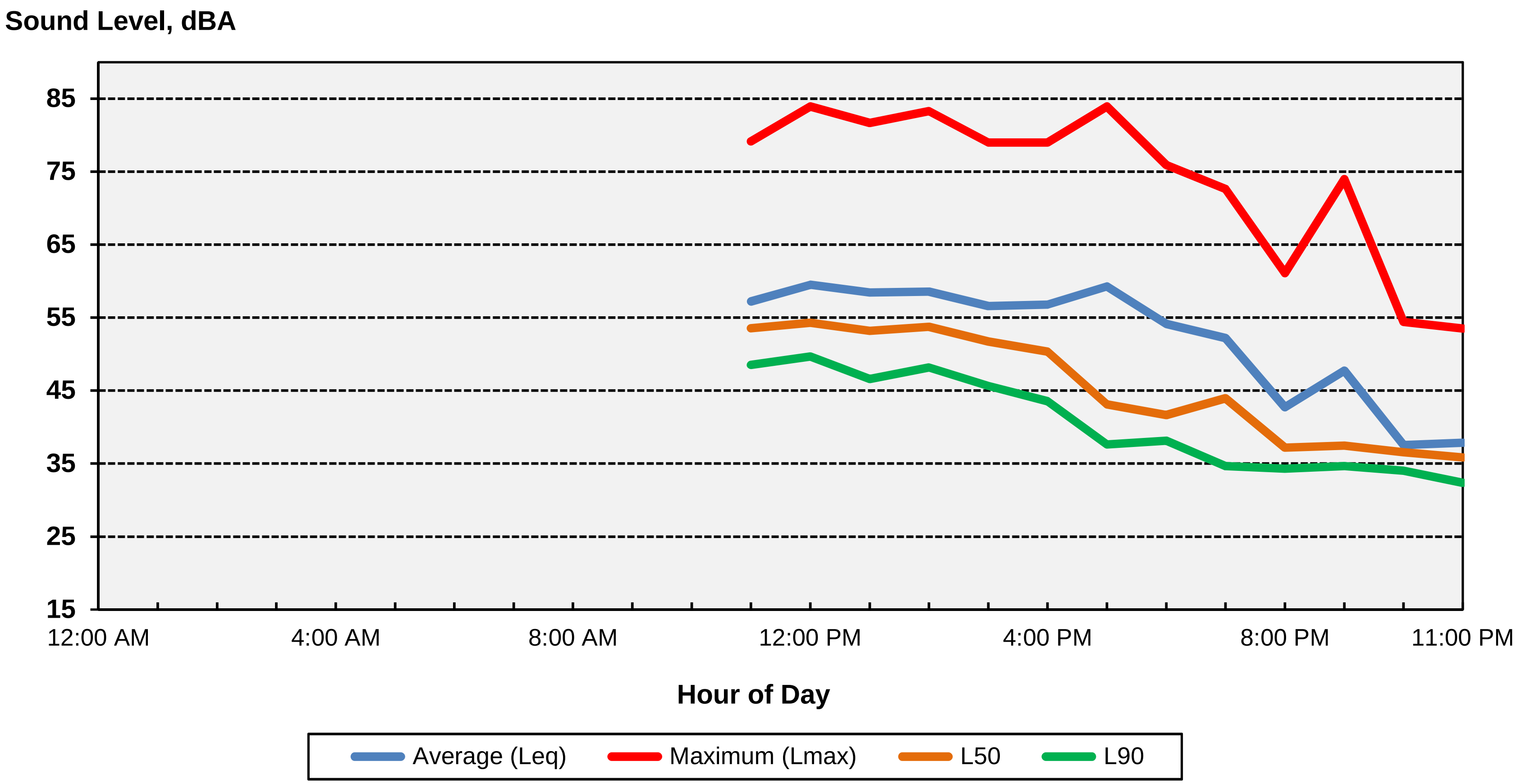
Appendix C-13
Site A - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Wednesday, September 20, 2017



CNEL: 54 dB

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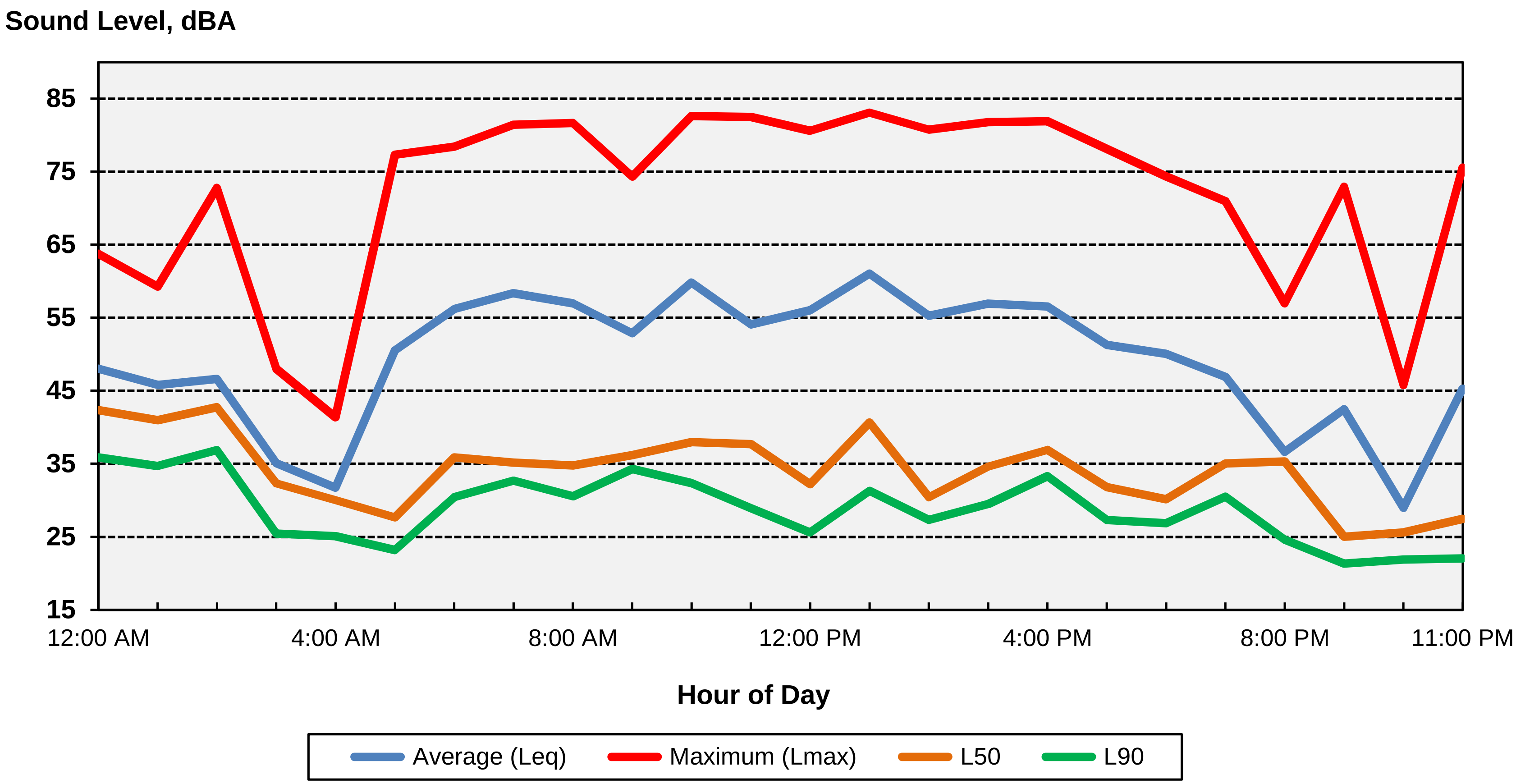
Appendix C-14
Site A - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Thursday, September 21, 2017



CNEL: 57 dB

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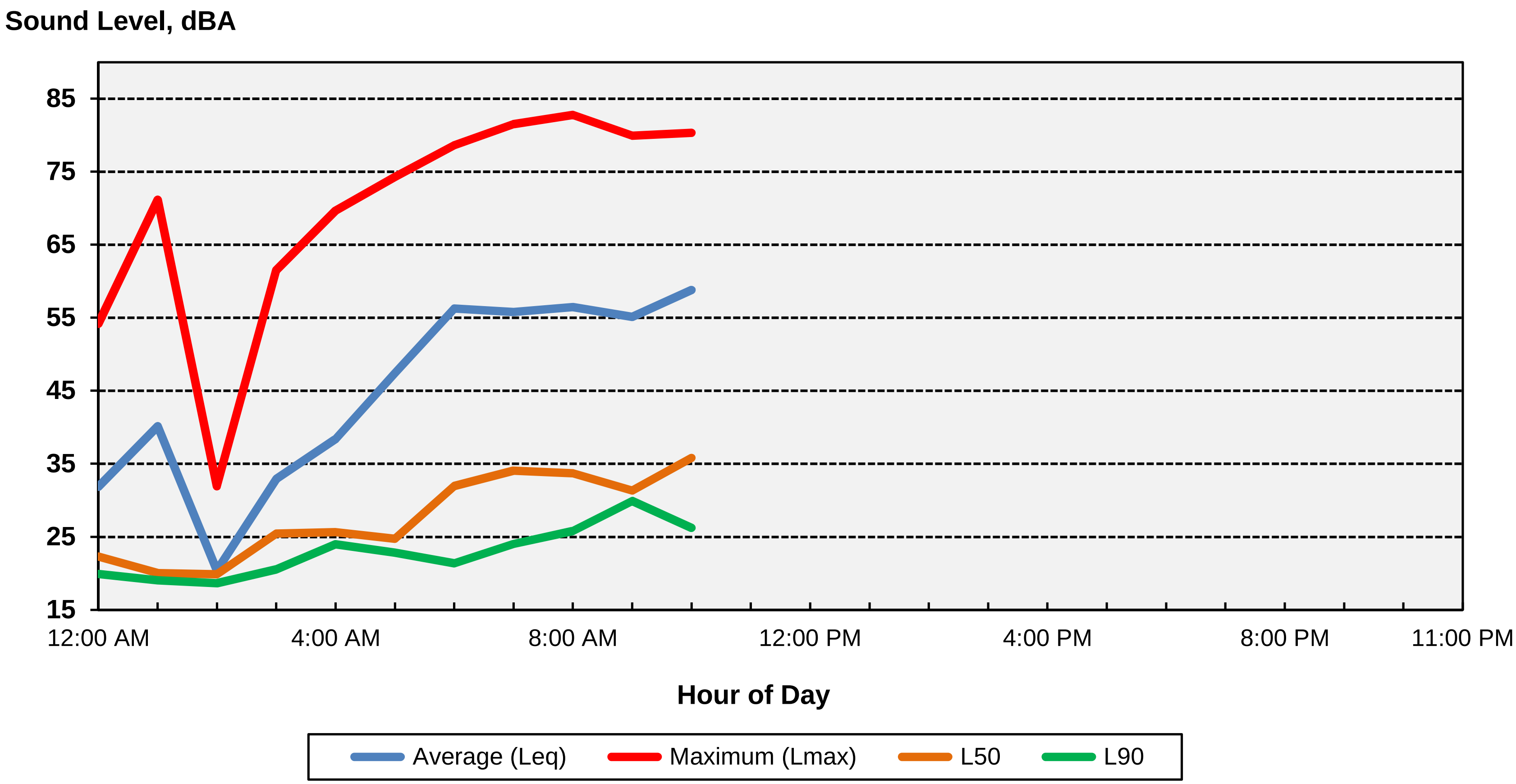
Appendix C-15
Site A - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 55 dB

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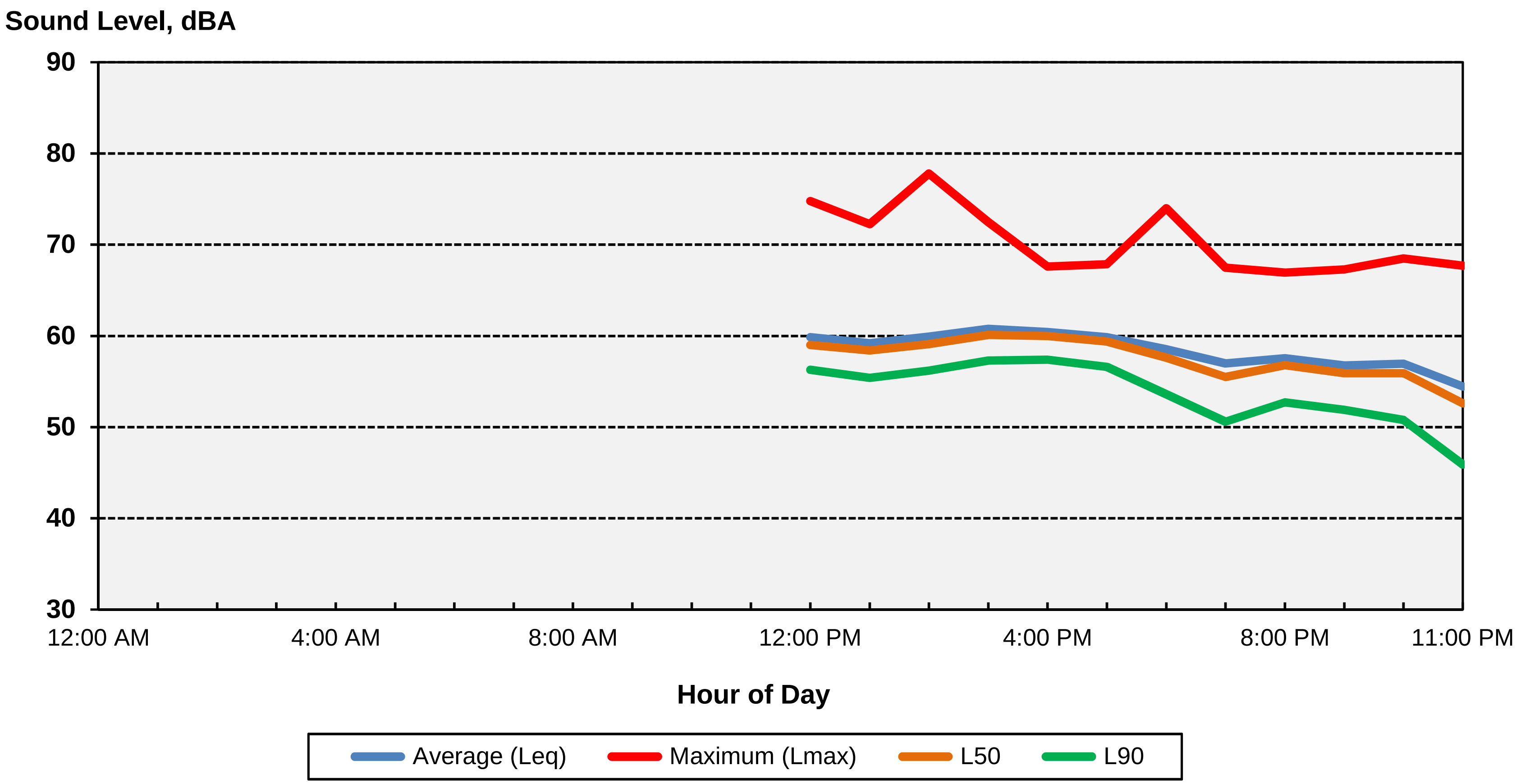
Appendix C-16
Site B - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Wednesday, September 20, 2017



CNEL: 59 dB

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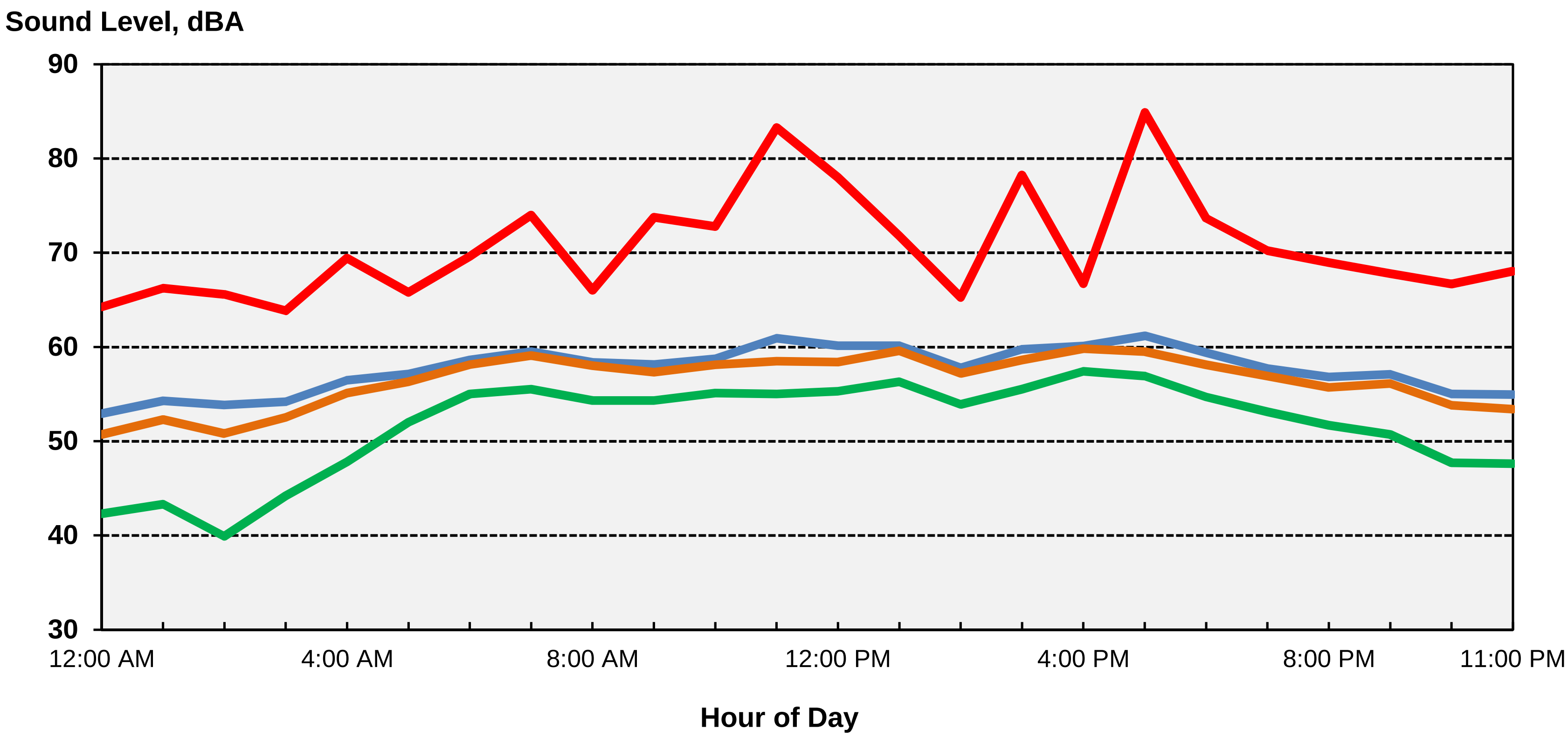
Appendix C-17
Site B - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Thursday, September 21, 2017



CNEL: 63 dB

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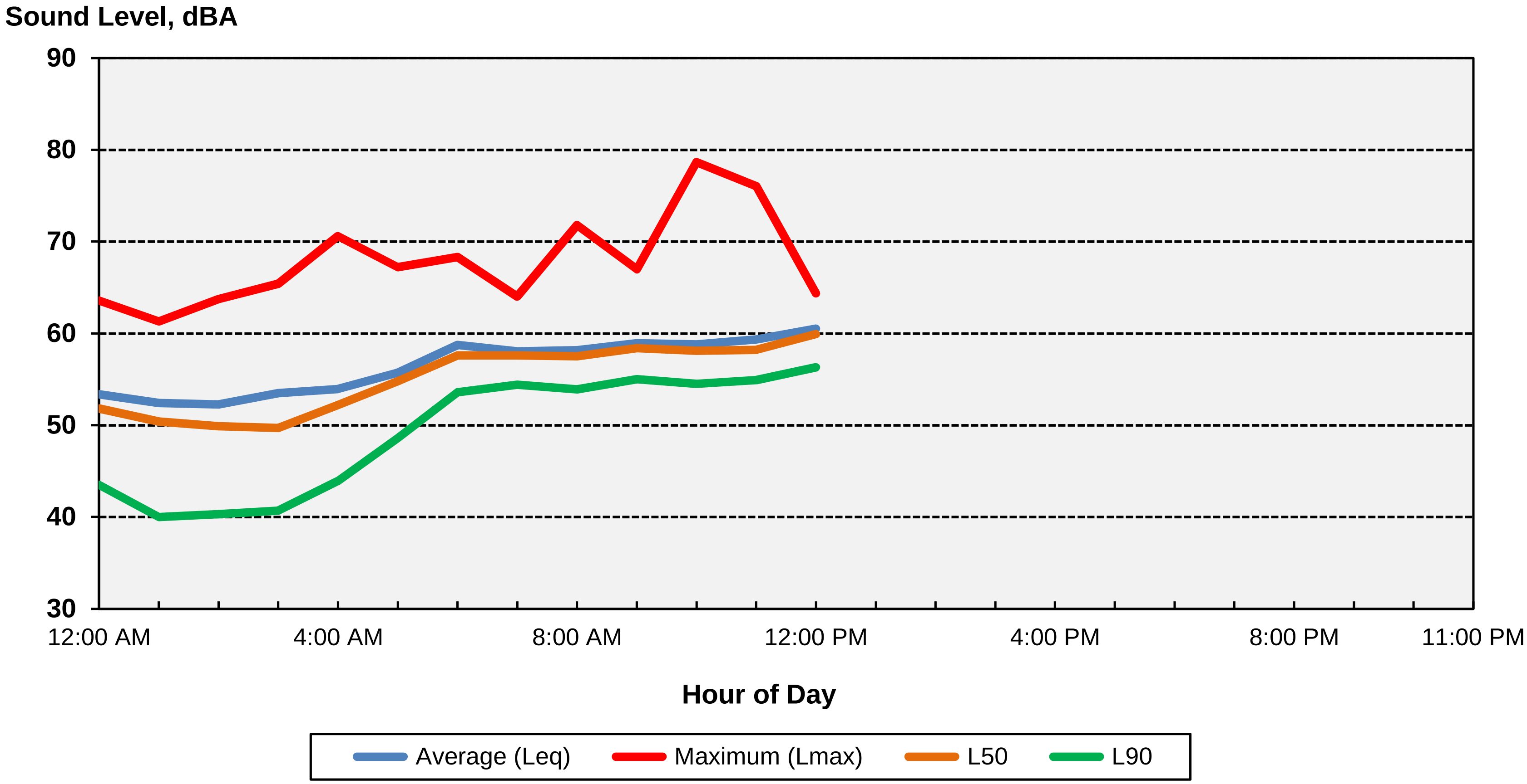
Appendix C-18
Site B - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 60 dB

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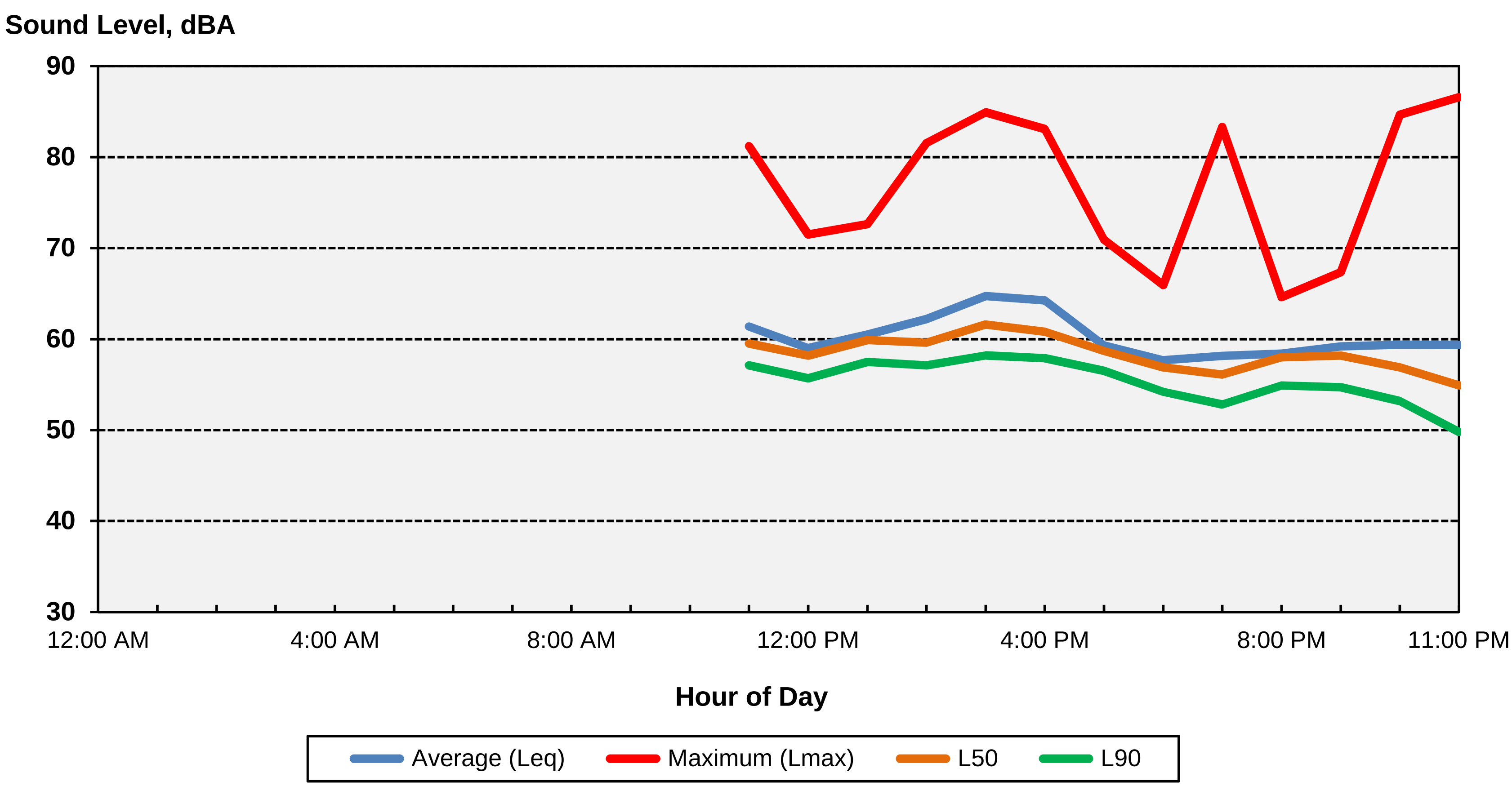
Appendix C-19
Site C - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Wednesday, September 20, 2017



CNEL: 62 dB

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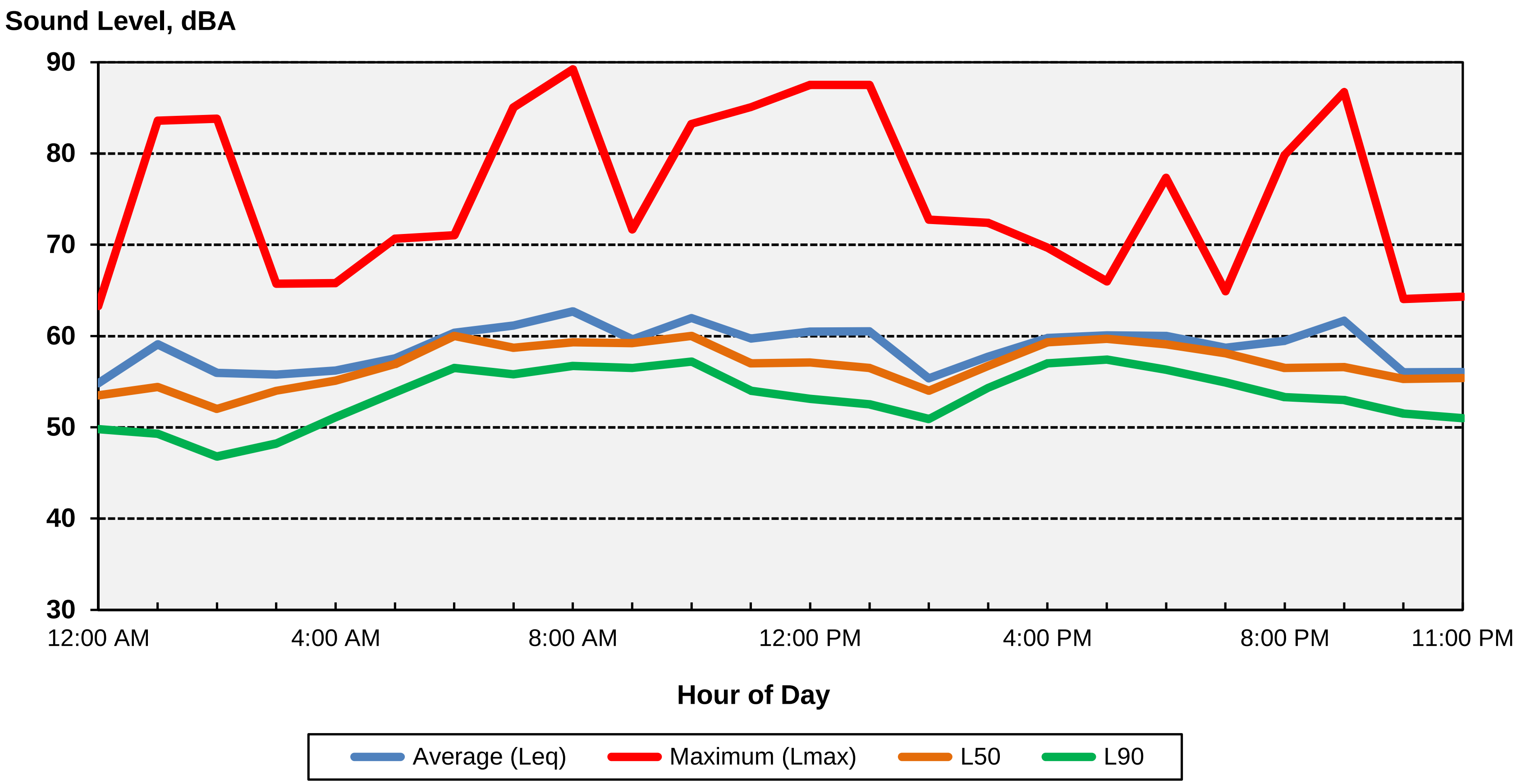
Appendix C-20
Site C - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Thursday, September 21, 2017



CNEL: 65 dB

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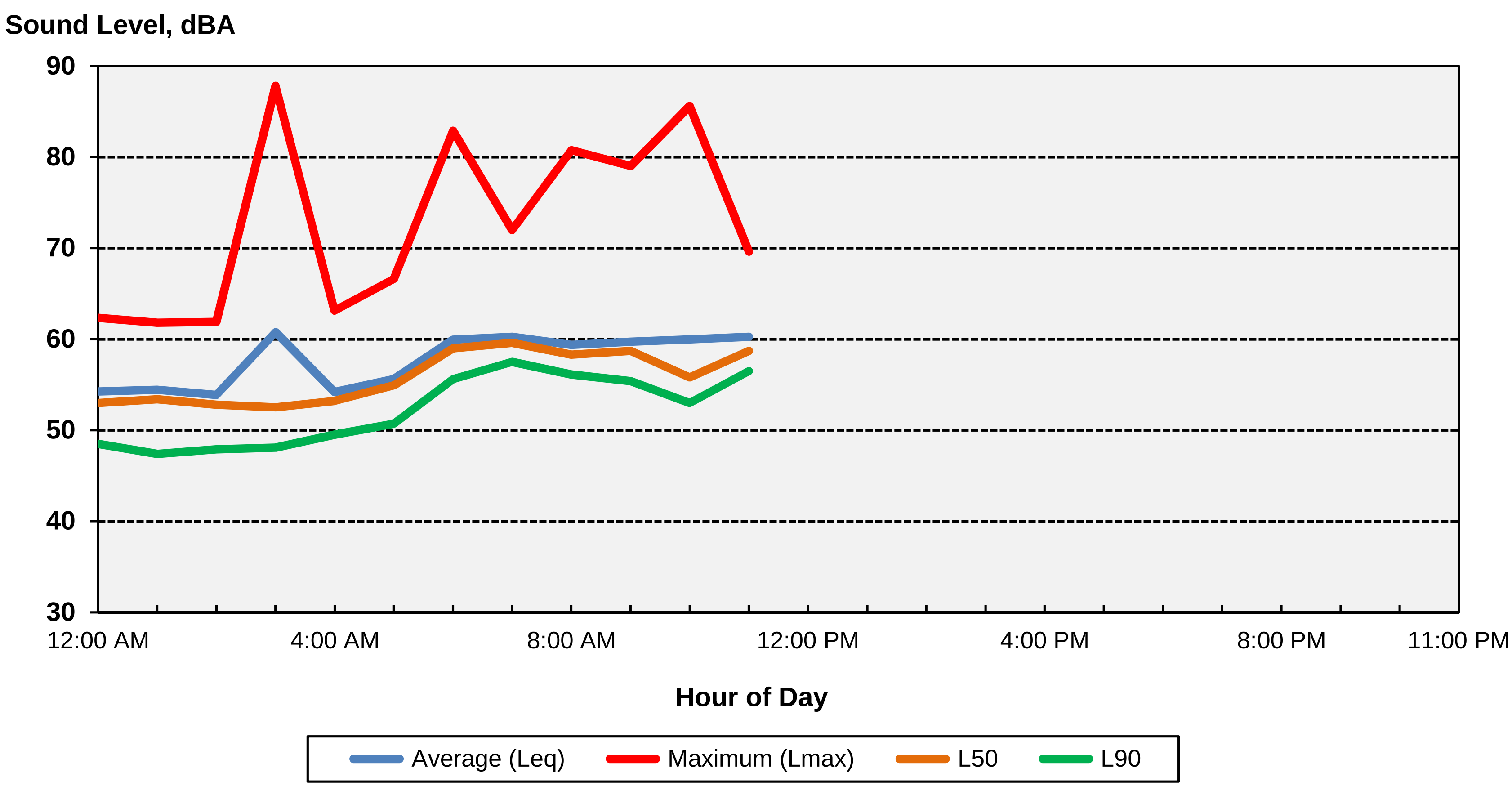
Appendix C-21
Site C - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 62 dB

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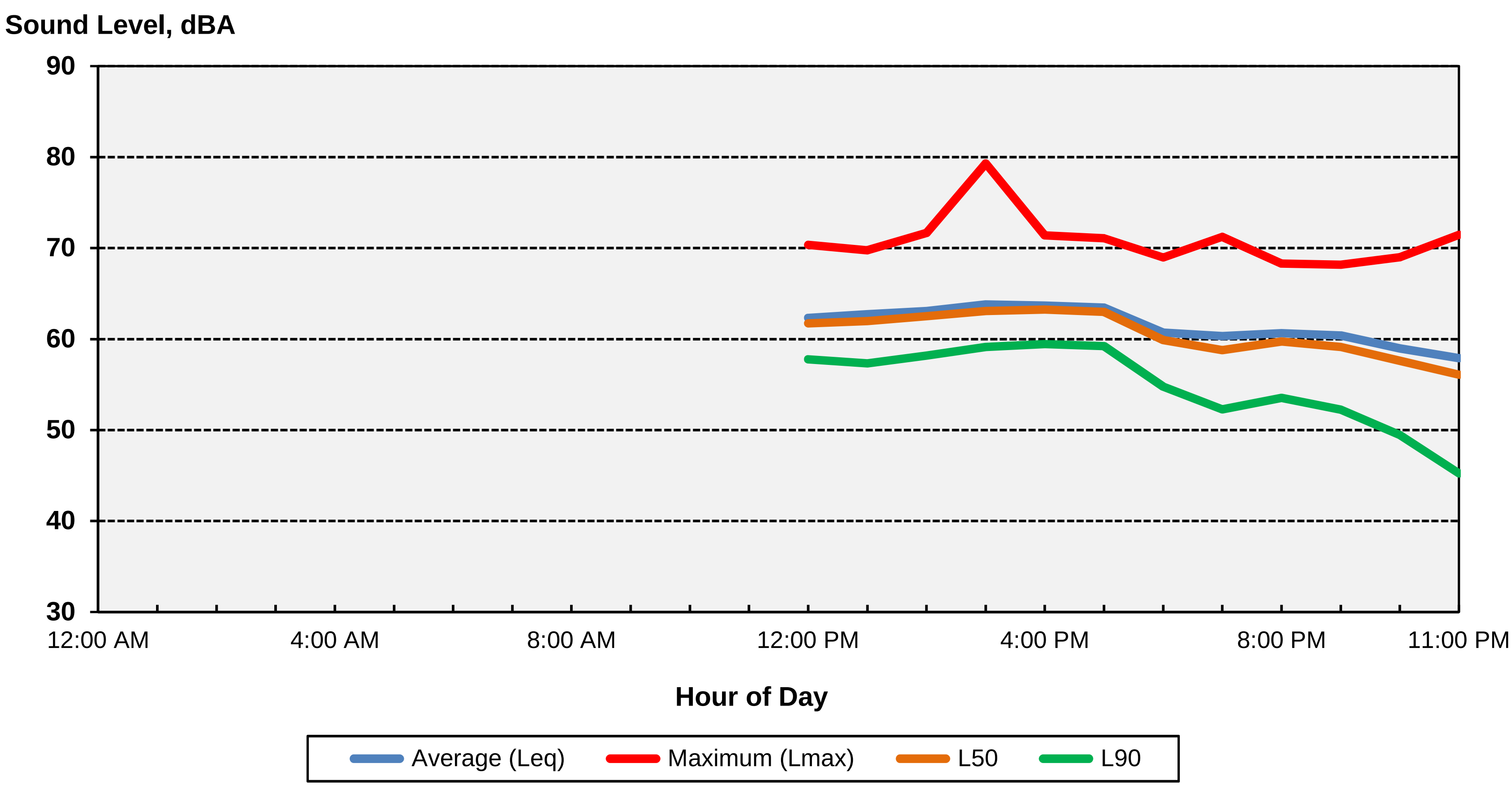
Appendix C-22
Site D - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 20, 2017



CNEL: 62 dB

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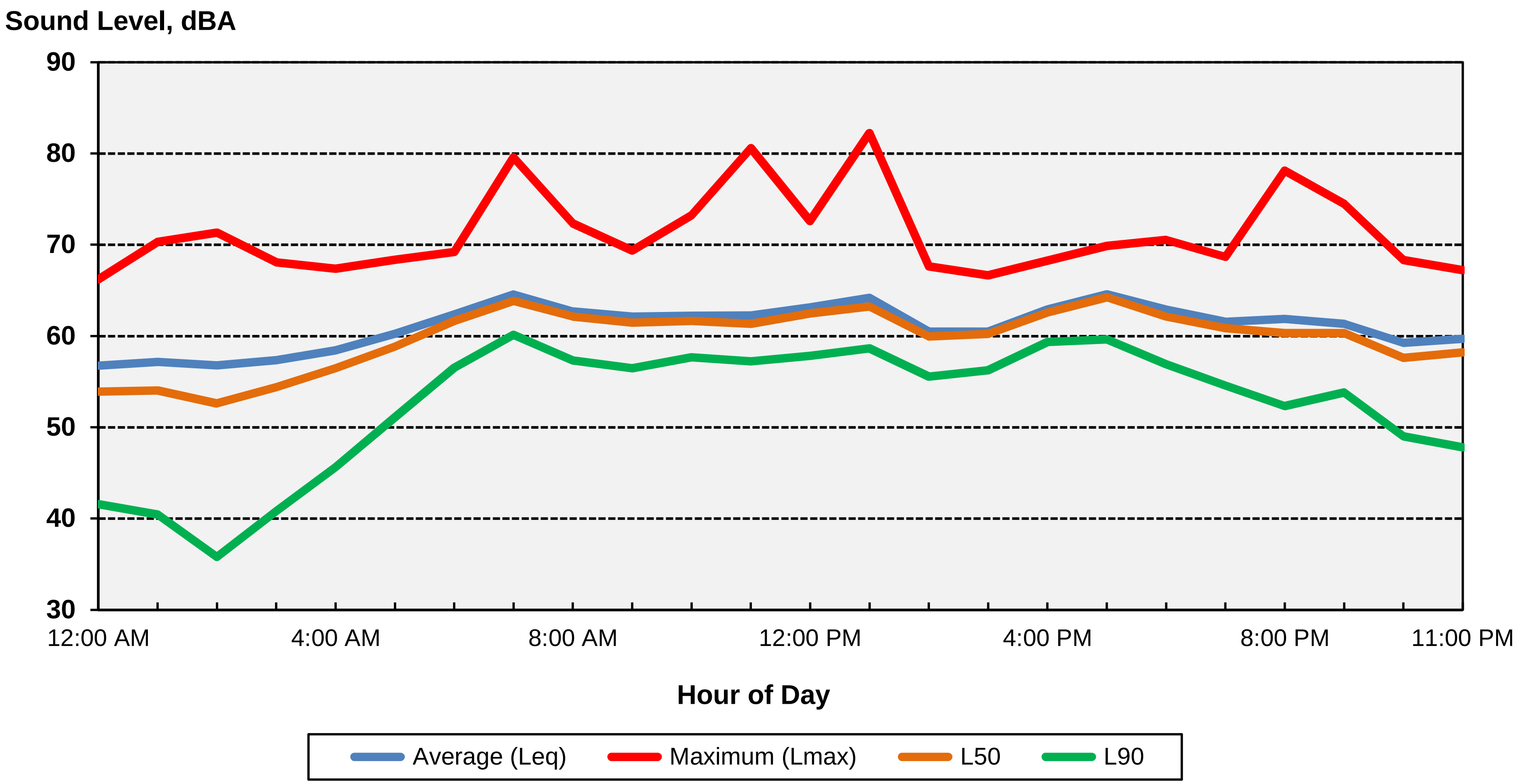
Appendix C-23
Site D - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 21, 2017



CNEL: 67 dB

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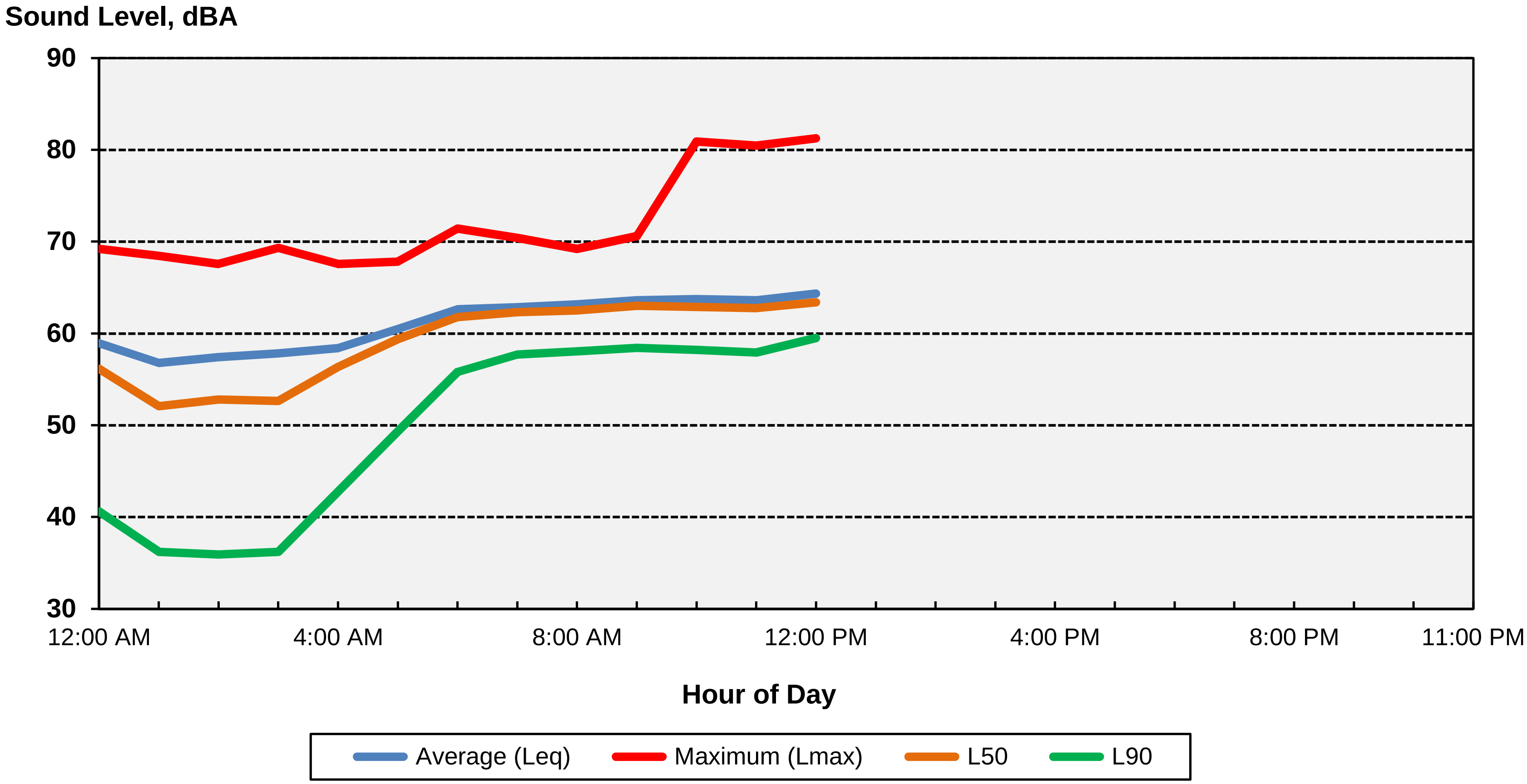
Appendix C-24
Site D - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 65 dB

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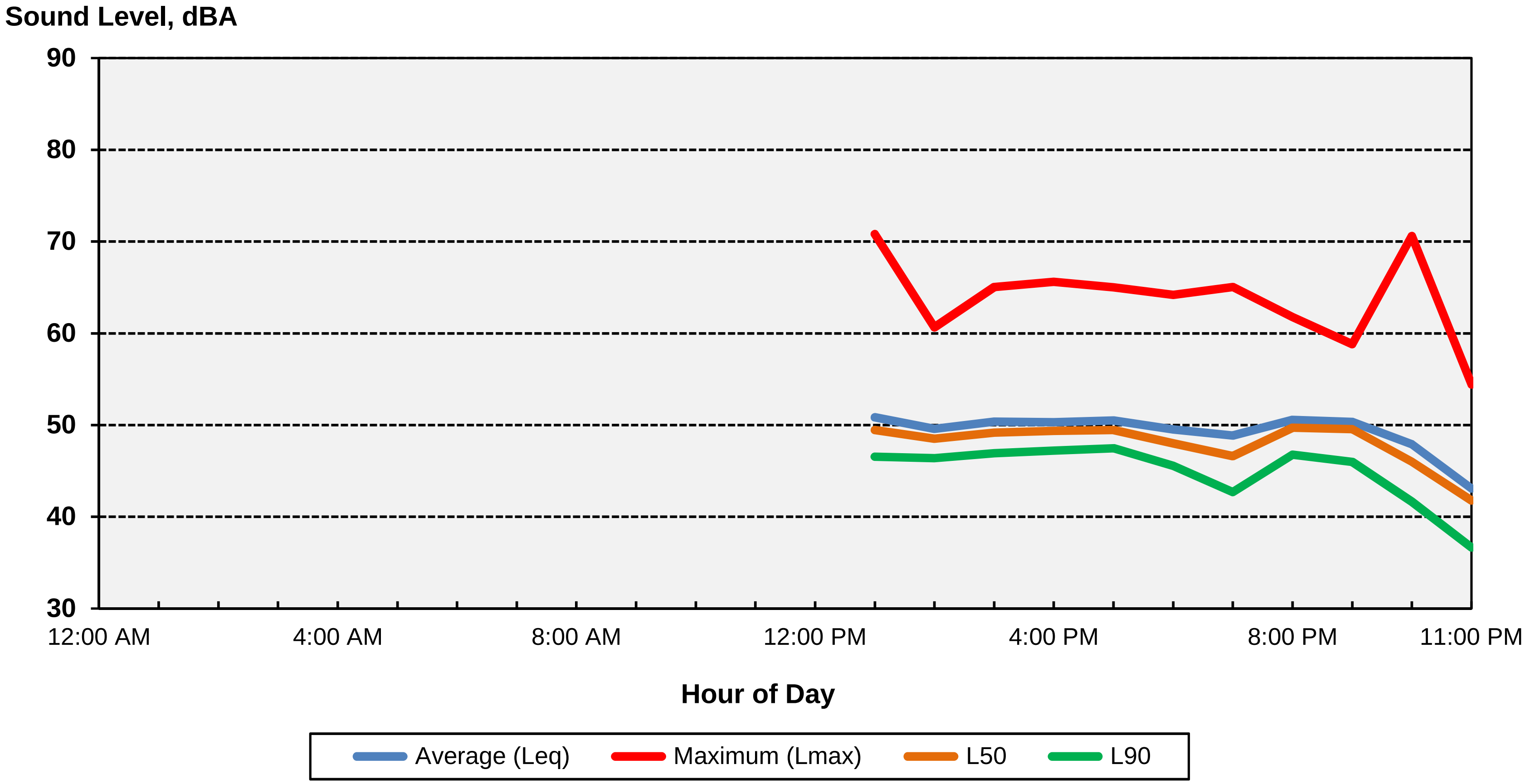
Appendix C-25
Site E - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 20, 2017



CNEL: 50 dB

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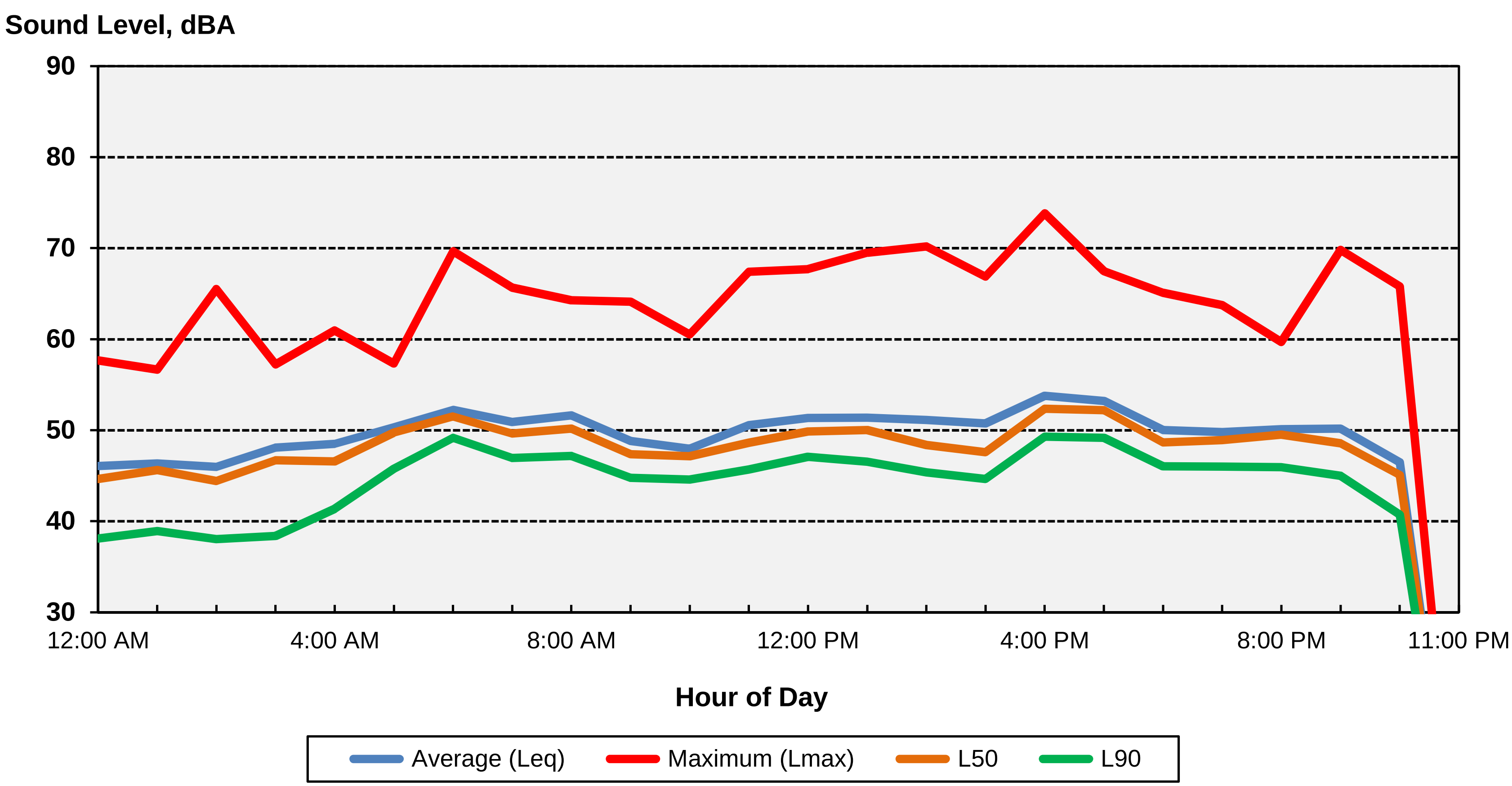
Appendix C-26
Site E - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 21, 2017



CNEL: 55 dB

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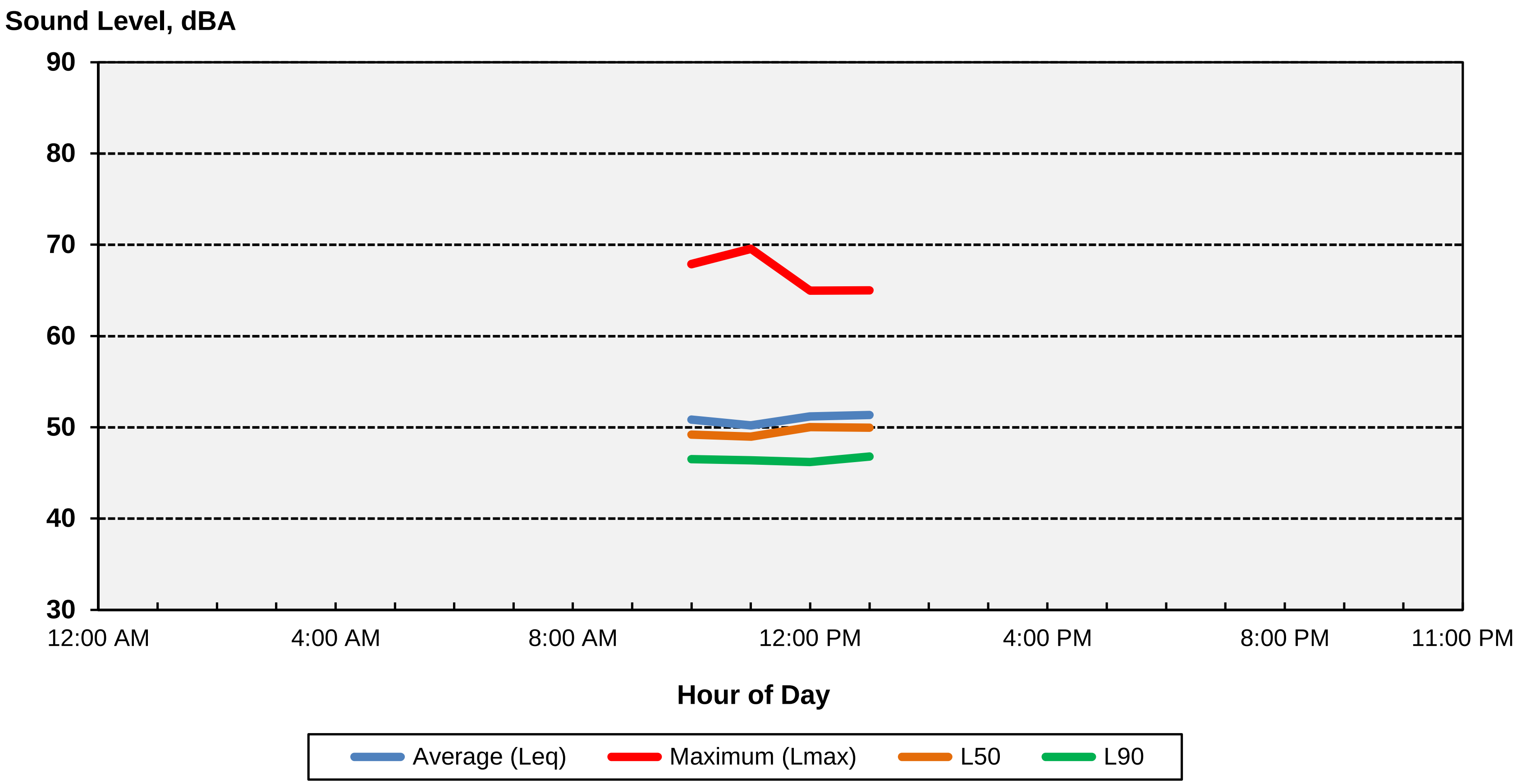
Appendix C-27
Site E - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 43 dB

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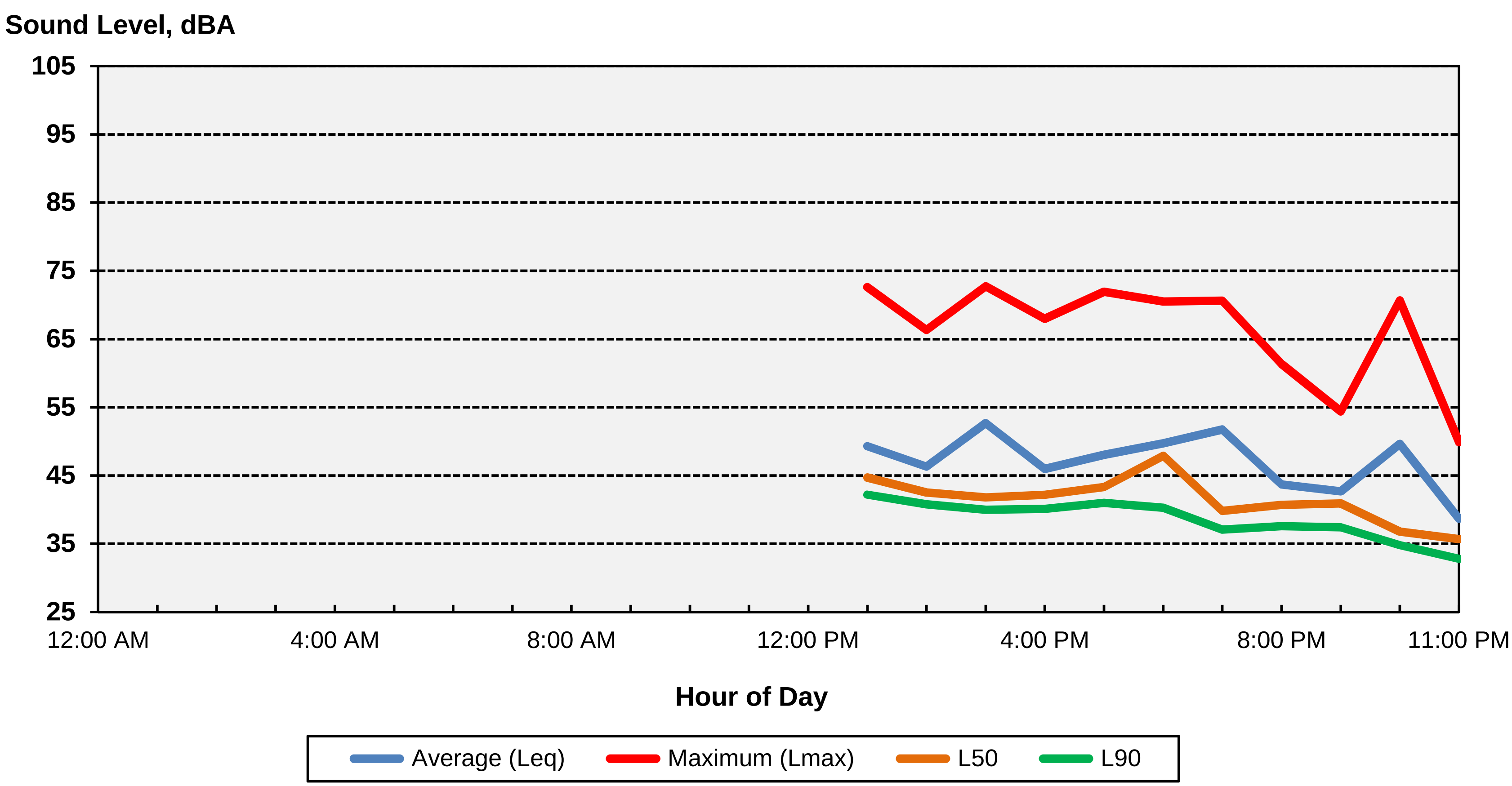
Appendix C-28
Site F - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 20, 2017



CNEL: 49 dB

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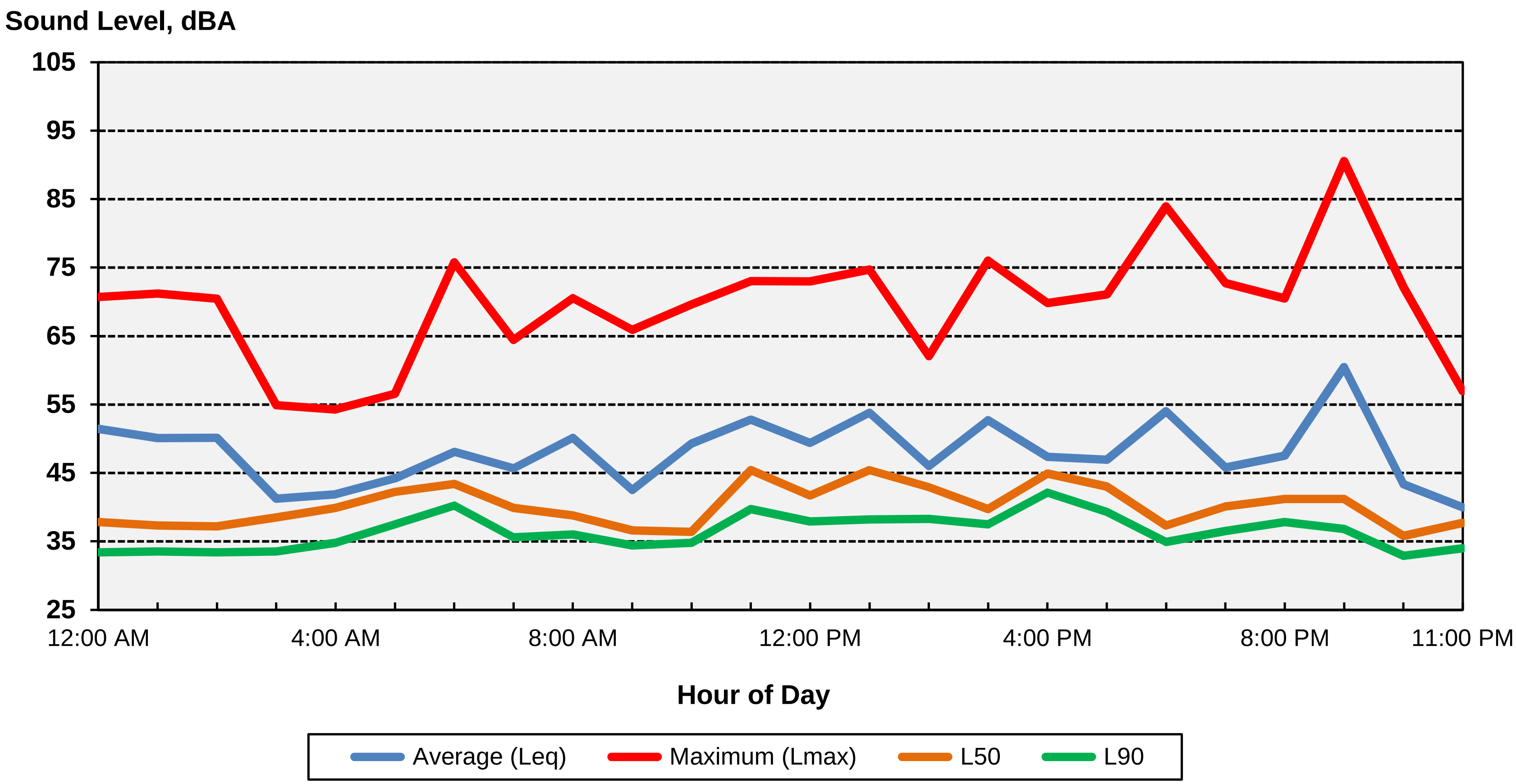
Appendix C-29
Site F - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 21, 2017



CNEL: 56 dB

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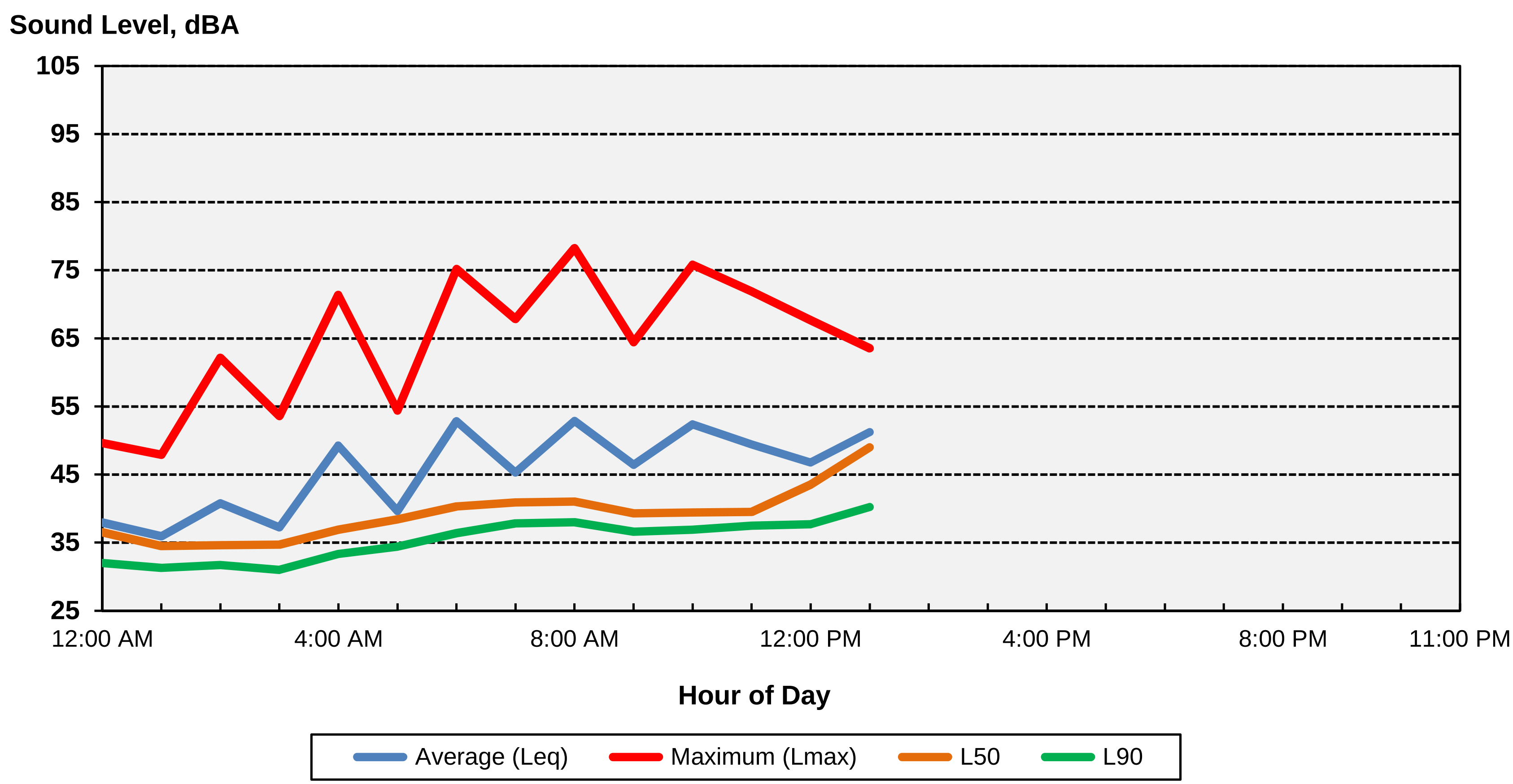
Appendix C-30
Site F - Ambient Noise Monitoring Results
Boca Quarry Project - Nevada County, CA
Friday, September 22, 2017



CNEL: 52 dB

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Appendix D-1
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**A**
Description	**Boca Reservoir Campgrounds**
Latitude	**39° 25.249'N**
Longitude	**120° 5.161'W**
Elevation	**5625 feet**

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Appendix D-2
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**B**
Description	**Reservoir Caretaker Residence – Stampede Meadows Road**
Latitude	**39° 22.951'N**
Longitude	**120° 4.984'W**
Elevation	**5558 feet**

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Appendix D-3
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**C**
Description	**RV Park**
Latitude	**39° 25.249'N**
Longitude	**120° 5.161'W**
Elevation	**5625 feet**

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Appendix D-4
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**D**
Description	**Buckhorn Ridge Residential Area**
Latitude	**39° 22.810'N**
Longitude	**120° 5.148'W**
Elevation	**5780 feet**

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Appendix D-5
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**E**
Description	**Nearest Hirschdale Residences**
Latitude	**39° 22.559'N**
Longitude	**120° 4.690'W**
Elevation	**5600 feet**

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Appendix D-6
Ambient Noise and Vibration Monitoring Site Information
Teichert Boca Quarry Project

Site	**F**
Description	**Central Hirschdale Residence**
Latitude	**39° 22.139'N**
Longitude	**120° 4.604'W**
Elevation	**5495 feet**