Environmental Noise Assessment

La Barr Meadows Green Waste Management Facility

Grass Valley, California

BAC Job # 2024-091

Prepared For:

SCO Planning, Engineering & Surveying

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Introduction

The La Barr Meadows Green Waste Management Facility (project) is located at 12270 La Barr Meadows Road in Grass Valley, California. The project consists of the development and operation of a green waste management facility and the Senior Firewood Program on the approximately 21-acre lot. The project site is bordered by Highway 49 to the west, Larr Barr Meadow Road to the east, the Nevada County corporation yard to the south, and residences to the south and west. Figure 1 shows the project location and nearest noise-sensitive receptors (residences). Figure 2 shows the project site plan.

Due to the proximity of the project site to existing residences, Bollard Acoustical Consultants, Inc. (BAC) was retained by the SCO Planning & Engineering to prepare this noise assessment. Specifically, the purposes of this assessment are to quantify noise generation of the proposed project operations at the nearest residences, to compare those levels against the applicable standards for acceptable noise exposure, and to recommend noise mitigation measures where needed to achieve satisfaction with those standards. This report contains BAC's evaluation.

Project Description

Tree logs and wood debris will be delivered on site through the Nevada County Corporation Yard access road from La Barr Meadows Road to the southern property line of the site. Trucks will be unloaded in the raw wood debris storage area and exit through the same access road as shown in Figure 2.

A skid steer, forklift, and excavator will manage the wood. Selected logs will be transported via hauling trucks, and the rest chipped and/or processed by a carbonizer.

The project proposes two operational periods: *Peak Operation* from April to October and *Winter Operation* from November to March. During *Peak Operation*, the facility will operate from 7:00 AM to 3:30 PM, Monday through Thursday, and 7:00 Am to 12:00 PM on Friday. A daily maximum of 24 truckloads, or 48 truck trips. During *Winter Operation*, at most two carbonizers may operate continuously.

Additionally, this project proposes to accommodate the Senior Firewood Program managed by Gold Country Senior Services. This portion of the yard would operate from 8:00 AM to 12:00 PM Monday through Wednesday, and occasionally up to 3:30 PM. Up to five splitter machines and four chainsaws will be used in this yard.

Legend

- Project Boundary (Approximate)
- Long-Term Noise Measurement Locations
- Representative Residences

N

Scale (Feet)

0 250 500

Project Area

La Barr Meadows Green Waste Management Facility
Grass Valley, California

Figure 1

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Legend

- Project Boundary (Approximate)
- Haul Truck Route
- Carbonizer
- Tree Chipper
- Wood Storage Area

N

Scale (Feet)

0 100 200

Site Plan

La Barr Meadows Green Waste Management Facility
Grass Valley, California

Figure 2

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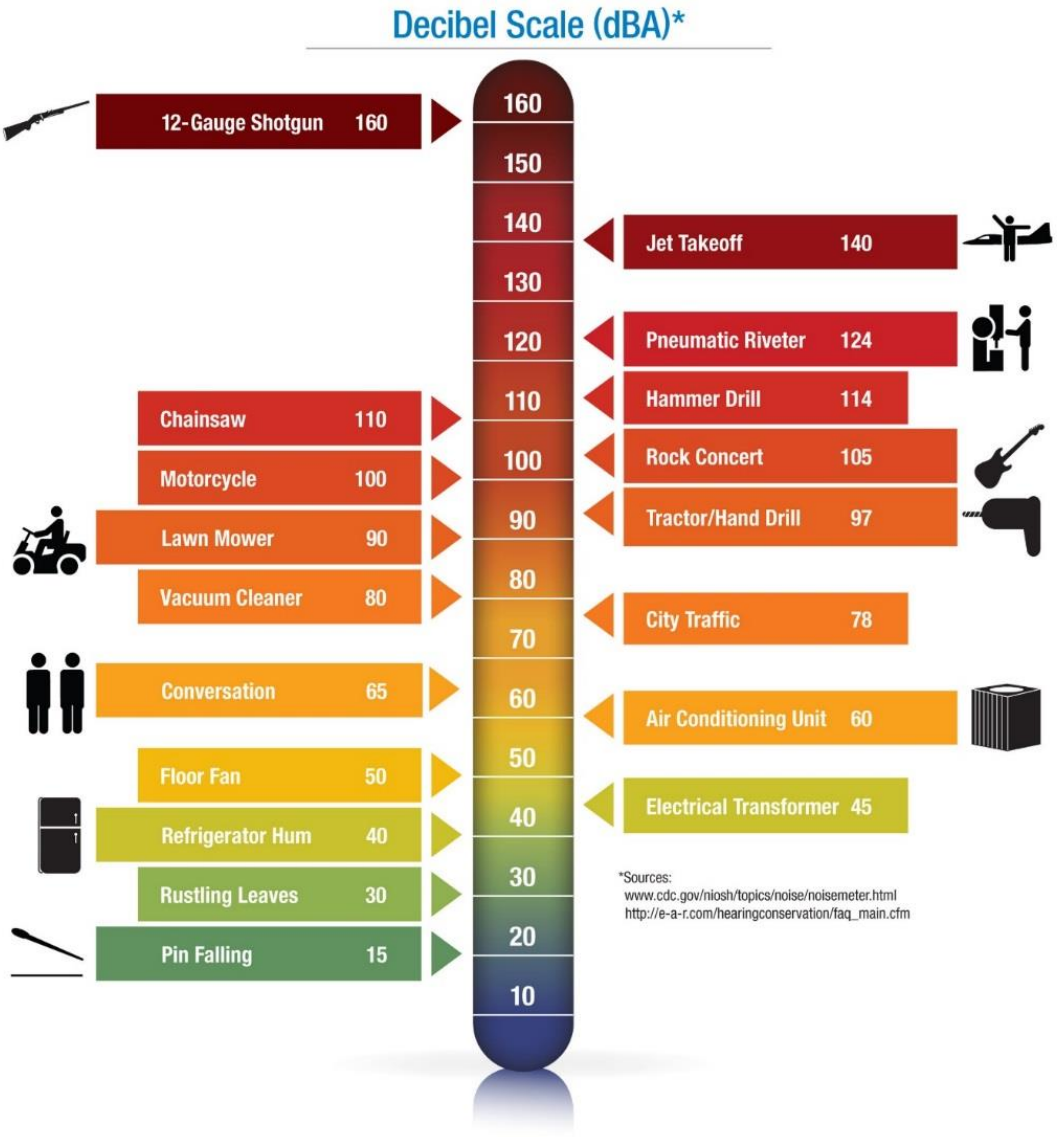
Noise Fundamentals and Terminology

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

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



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

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

The Day-Night Average Level (DNL) is based upon the average noise level over a 24-hour day, with a +10-decibel weighting 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 DNL represents a 24-hour average, it tends to disguise short-term variations in the noise environment. DNL-based noise standards are commonly used to assess noise impacts associated with traffic, railroad, and aircraft noise sources.

Environmental Setting

Identification of Existing Noise-Sensitive Receivers (Residences)

BAC utilized aerial imagery and site inspections to identify the locations of the nearest representative potentially affected sensitive receivers to the project area. It is important to note that it is not necessary to evaluate impacts at every residence or sensitive receiver in the project vicinity. Rather, sensitive receivers with similar noise exposure are typically grouped, with one or more representative receiver(s) selected to be applicable to the larger group. This approach was applied to this analysis.

Since sound decreases with distance, it is also normally unnecessary to model receivers at considerable distances from the project area, particularly if there are closer receivers in the same general direction which are to be analyzed. If no noise impacts are identified at closer receivers, it can normally be concluded that a similar finding would occur at the more distant receivers. Conversely, if impacts are identified at closer receivers, often mitigation implemented for those closer receivers would benefit the more distant receivers as well, depending on the type of mitigation.

Exceptions to this general rule occur when there are considerable differences in topographic screening between the closer and more distant receivers. In such cases, a closer receiver which is topographically shielded could have a lower project noise exposure than a more distant unshielded receiver. Another exception would occur if the mitigation was receiver specific, rather than project specific.

For this project, a total of six receiver locations were selected to represent noise-sensitive residences in the immediate and general project vicinity. According to the Nevada County Zoning District Map, receivers R1 – R5 are zoned Residential Agricultural (RA) and receiver R6 is zoned Public-Site Performance Combining District (P-SP). The receivers analyzed in this study are depicted graphically in Figure 1.

Existing Ambient Noise Environment within the Project Vicinity

The existing ambient noise environment at the project site is defined primarily by traffic on Highway 49 and La Barr Meadows Road. To quantify the existing ambient noise level environment at the project site, BAC conducted a long-term (72-hour) noise level survey from June 14 to June 16, 2024, at the two locations shown in Figure 1. Long-term noise measurement site LT-1 was selected to quantify noise generated by Highway 49. LT-2 was selected to quantify noise generated by La Barr Meadows Road. Photographs of the noise survey locations are provided in Appendix B.

Larson-Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used to complete the ambient noise level survey. The meters were calibrated immediately 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 long-term ambient noise level survey results are summarized in Table 1. The detailed results of the ambient noise survey are contained in Appendix C in tabular format and graphically in Appendix D.

Table 1
Summary of Long-Term Noise Survey Measurement Results[1]

Date	DNL [dBA]	Average Hourly Noise Levels [dBA]					
		Daytime[3]		Evening[4]		Nighttime[5]	
		Leq	Lmax	Leq	Lmax	Leq	Lmax
Site LT-1, 55' to Hwy-49 C/L at Smith Rd							
6/14/2024	74	72	89	70	88	64	85
6/15/2024	73	71	89	70	89	63	83
6/16/2024	72	71	88	69	91	62	84
Average	**73**	**72**	**89**	**70**	**89**	**63**	**84**
Site LT-2, 80' to La Barr Meadows Rd at Nevada Co. Corporation Yard Entrance							
6/14/2024	62	61	76	58	77	51	70
6/15/2024	61	59	75	58	72	52	72
6/16/2024	59	58	75	57	72	50	68
Average	**61**	**59**	**76**	**58**	**73**	**51**	**70**

Notes
1. Detailed summaries of the noise monitoring results are provided in Appendices C and D.
2. Long-term noise survey locations are identified in Figure 1.
3. Daytime hours: 7:00 a.m. to 7:00 p.m.
4. Evening hours: 7:00 p.m. to 10:00 p.m.
5. Nighttime hours: 10:00 p.m. to 7:00 a.m.

Source: Bollard Acoustical Consultants, Inc.

Table 1 indicates that the measured day-night average noise levels (DNL) at LT-1 averaged 73 dB. The measured DNL at LT-2 averaged 61 dB—which is below the County's 60 dB DNL exterior noise level standard. Average daytime maximum noise levels during the same period were measured to be 89 dB and 76 dB Lmax at site LT-1 and LT-2, respectively.

Criteria for Acceptable Noise Exposure

The project site is located within the City of Grass Valley whereas the nearest noise-sensitive receptors (residences) to the project site are located outside of the Grass Valley City limits within unincorporated Nevade County. So while the noise generation of the project would occur within the City of Grass Valley, it would potentially impact residences within Nevada County. Because the Nevada County and City of Grass Valley noise standards applicable to the project are essentially similar, an assessment of impacts relative to Nevada County noise standards would ensure impacts relative to City of Grass Valley noise standards are adequately evaluated as well.

City of Grass Valley General Plan Noise Element

The Noise Element of the City of Grass Valley General Plan contains policies to ensure that City residents are not subjected to noise beyond acceptable levels. The specific noise implementation actions, which are generally applicable to this project, are reproduced below.

2-NI Require that noise created by new development of fixed noise sources be mitigated so as not to exceed the noise level standards of Table 6-5 [Table 2 in this report] as measured immediately within the property line of lands designated for noise-sensitive land uses.

4-NI Require that an acoustical analysis be performed where new development of fixed noise sources, or modification of existing fixed noise sources, is likely to produce noise levels exceeding the performance standards of Table 6-5 [Table 1 in this report], and that noise mitigation be included in the project design.

Table 2
Noise Level Performance Standards
For Residential Areas Affected by Non-Transportation Noise Sources

Noise Level Descriptor	Daytime (7 a.m. - 10 p.m.)	Nighttime (10 p.m. - 7 a.m.)
Hourly L_{eq}, dB	55	50
Maximum, L_{max}	75	65

Source: Table 6-5, City of Grass Valley 2020 General Plan

6-NI Require mitigation of noise created by new transportation noise sources so as not to exceed the levels specified in Table 6-6 [Table 3 in this report] at designated outdoor activity areas and interior spaces of existing noise-sensitive land uses.

8-NI Require an acoustical analysis and appropriate mitigation measures where new transportation noise sources are likely to produce noise levels exceeding the standards of Table 6-6 [Table 3 in this report] at existing or planned noise-sensitive uses.

Table 3
Maximum Allowable Noise Exposure – Transportation Noise Sources
City of Grass Valley General Plan Noise Element

Land Use	Outdoor Activity Areas Ldn/CNEL [dB]	Interior Spaces Ldn/CNEL [dB]	Interior Spaces Leq[1] [dB]
Residential	60[2]	45	--
Transient Lodging	60[3]	45	--
Hospitals, Nursing Homes	60[2]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls	60[2]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

Notes:

1. As determined for a typical worst-case hour during periods of use.
2. Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.
3. In the case of hotel/motel facilities or other transient lodging, there may be no designated outdoor activity areas (e.g., pool areas). In such cases, only the interior noise level criterion will apply.

Source: City of Grass Valley General Plan Noise Element, Table 6-6

10-NI Apply the following standards and practices to acoustical analyses:

Where the locations of outdoor activity areas are not known or designated, the exterior noise level standards shall be applied immediately inside the property line of the receiving land use.

In rural areas with large residential lots, the exterior noise level standard shall be applied at a point 100 feet from the residence.

Where it is not practical to mitigate exterior noise levels at patios or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

Where noise mitigation measures are required to achieve the standards of Table 6-5 [Table 2] and 6-6 [Table 3], the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

When determining the effectiveness of noise mitigation measures, the noise standards shall be applied on the receptor side of noise barriers or other property line noise mitigation measures.

Nevada County General Plan Noise Element

The Nevada County General Plan Noise Element contains the following policies which would be applicable to this project.

9.1.2 The following noise standards (Table 4), 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 4
Noise Exposure Limits
Nevada County Noise Element of the General Plan

Land Use Category	Zoning Districts	Time Period	L_{eq}, dB	L_{max}, dB
Rural	A1, TPZ, AE,	7 a.m. - 7 p.m.	55	75
	OS, FR, IDR	7 p.m. - 10 p.m.	50	65
		10 p.m. - 7 a.m.	40	55
Residential & Public	RA, R1, R2, R3,	7 a.m. - 7 p.m.	55	75
	P	7 p.m. - 10 p.m.	50	65
		10 p.m. - 7 a.m.	45	60
Commercial &	C1, C2, C3, CH,	7 a.m. - 7 p.m.	70	90
Recreation	CS, OP, REC	7 p.m. - 7 a.m.	65	75
Business Park	BP	7 a.m. - 7 p.m.	65	85
		7 p.m. - 7 a.m.	60	70
Industrial	M1, M2	any time	80	80

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 9.1.2b. 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 9.1.13 and the Nevada County Noise Element Manual.

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

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.

Nevada County Code

Title 3, Chapter II, Article 4, Division 4.1.7 of the Nevada County Code regulates noise. The following specific provisions of the County Noise Code would be applicable to this project.

D. **Noise Standards.** All land use projects requiring a Development Permit or a Use Permit shall comply with the noise standards provided herein. Permitted residential land uses, including parcel and tentative maps, are not subject to the standards contained in Table L-II 4.1.7 [Table 4 above] of the County Code.

Because County Code Table L-II 4.1.7 is identical to the County General Plan Noise Element standards shown in Table 4 above, it is not reproduced here.

Adjustments to Nevada County Noise Standards

As noted above in the footnotes to Table 4, there are various adjustments to the County's noise limits which are to be applied if certain conditions are satisfied.

Footnote D of Table 4 states that if the measured ambient level exceeds that permitted in Table 4, 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.*
    - Except for warning devices on mobile equipment (back-up beepers), the project does not propose any sources of noise which contain pure tones. 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.*
    - 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.
- *The noise source is of a long duration.*
    - On days when tree chipping and carbonizing takes place, the noise generation of the project could be constant. As a result, these constant 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.*
    - In no case were measured ambient noise levels more than 10 dB below the Table 4 noise standards. As a result, no *downward* offset to the Table 4 standards was warranted based on measured ambient conditions.

As noted previously; to define ambient conditions for this study, continuous noise monitoring was performed for 72-hour periods at two locations with the results presented in Table 1. The duration of the noise monitoring program considerably exceeds the requirement of Footnote A (minimum of three 20-minute samples). Table 1 data indicates that existing ambient noise levels exceeded the Table 4 noise standards in most categories at most locations. Pursuant to Footnote D of Table 4, 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.

Some of the noise sources associated with the project would be subject to more restrictive noise standards due to the sources being tonal (back-up beepers) or of long duration (tree chipping and carbonizing operations). Conversely, the measured ambient noise conditions exceeded the applicable noise standards at monitoring sites representing the six sensitive receptors evaluated in this study. To reconcile these adjustments at all receptors, this assessment of project noise impacts conservatively establishes the measured ambient noise environment as the project threshold of significance for long-duration operations. For the heavy truck traffic and the Senior Firewood Program chainsaw 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.

Because project operations would be limited to daytime hours, Table 5 summarizes the adjusted daytime standards only.

Table 5
Nevada County Exterior Daytime Noise Limits Adjusted to Ambient Conditions[4]

Noise Source Type	Receiver[1]	Monitoring Site[2]	Zoning[3]	Adjusted Leq [dBA]	Adjusted Lmax [dBA]
Long-Duration[4]	R1 - R5	LT-1	RA	72	89
	R6	LT-2	P-SP	59	76
Haul Trucks &	R1 - R5	LT-1	RA	77	94
Chainsaws[5]	R6	LT-2	P-SP	64	81

Notes:
1. Receiver locations are shown in Figure 1.
2. This column indicates the noise monitoring site which is most representative of ambient conditions at the receiver location.
3. Land use designations were obtained from Nevada County Zoning Maps.
4. These standards are applicable to all long-duration project noise sources (tree chipper, carbonizer).
5. Pursuant to Footnote D of Table 4, these standards are applicable to heavy truck traffic and Senior Firewood Program chainsaws and wood splitter machines.

Off-Site Project Noise Generation

Project Truck Traffic Noise Analysis

As noted in the project description, the project would generate a maximum of 50 total daily haul truck trips per day. The incoming truck route will be from Highway 49 to McKnight Way to La Barr Meadows Road. Chip and log trucks will use the same route to haul sorted logs or processed chips from the site to final disposition. Therefore, the estimated increase in commercial vehicle traffic will be 50 truck trips per day.

To compute hourly noise levels associated with project heavy truck passbys, the following formula is used:

$$\text{Hourly Leq} = \text{SEL} + 10 * \log (N) - 35.6$$

Where SEL is the sound exposure level of a heavy semi-trailer truck operation, N is the number of operations during the hour, and 35.6 is 10 times the logarithm of the number of seconds in an hour.

From BAC noise level data collected for previous trucking facility noise studies, it was determined that the SEL of a single heavy semi-trailer truck operation (including arriving, backup beepers, etc.) is approximately 83 dB at 50 feet. The maximum noise level for the same truck passage is 75 dB Lmax. It should be noted that Lmax values for truck passbys will always be lower than SEL values because the SEL value is computed as the entire sound energy of the pass by event compressed into a one-second duration (to allow normalization of the duration of the pass by event), whereas the maximum value (Lmax) is the highest noise level at a discrete point in time.

Given the formula and noise level data, the predicted heavy truck noise exposure at the nearest residences was computed assuming a sound level decay rate of 4.5 dB per doubling of distance (commensurate with a moving point source), and standard values for atmospheric absorption of sound in air. It was conservatively assumed that busy operations could consist of up to 15 trucks in an hour. The results of that analysis are summarized in Table 6.

Table 6
Summary of Off-Site Heavy Truck Noise Levels at Nearest Residences

Receiver[1]	Distance[2] [feet]	Predicted Off-Site Heavy Truck Noise Levels[3,4] [dB]		Adjusted Standards [dB]		Impact?
		Leq	Lmax	Leq	Lmax	
R1	170	51	64	77	94	No
R2	140	52	66	77	94	No
R3	130	53	67	77	94	No
R4	120	53	67	77	94	No
R5	260	48	60	77	94	No
R6	170	51	64	64	81	No

Notes:
1. Receiver locations identified on Figure 1.
2. Distances were scaled from the centerline of Highway 49 (receivers 1-5) or La Barr Meadows Road (receiver 6) to the nearest residences.
3. Analysis based on SEL of 83 dB at 50 feet and maximum noise level of 75 dB at 50 feet.
4. Assumes decay rate of -4.5 dB per doubling of distance and -1.5 dB per 1,000 feet due to atmospheric absorption.

Source: Bollard Acoustical Consultants.

Table 6 indicates that predicted off-site heavy truck noise levels range from 48 – 53 dBA Leq and 60 – 67 dB Lmax at the nearest noise-sensitive receivers. These noise levels would be in compliance with the County's adjusted noise standards. As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

On-Site Project Noise Generation

As noted in the project description, the primary noise-generating components of the primary project will consist of a tree chipper, two carbonizers, a skid steer, an excavator, and haul trucks. The haul trucks will have an internal access road as shown in Figure 2. The skid steer and excavator will transport wood and charcoal between storage piles, equipment, and haul trucks.

Because of the different noise standards applied to long-duration noise sources and haul trucks (see Table 5), the potential impacts of these on-site noise sources are evaluated in two separate sections. The third section evaluates the cumulative noise impacts to the strictest noise standards. The noise generation related to the Senior Firewood Program is evaluated in the fourth section.

On-Site Haul Trucks Noise Analysis

The methodology described previously for off-site heavy truck movements was also utilized for on-site movements. Rather than scaling from the centerline of the project roadways (Highway 49 and La Barr Meadows Road), distances were scaled from the nearest edge of the proposed haul truck route shown in Figure 2. The results of that analysis are summarized in Table 7.

Table 7
Summary of On-Site Haul Truck Noise Levels at Nearest Residences

Receiver[1]	Distance[2] [feet]	Predicted Off-Site Heavy Truck Noise Levels[3,4] [dB]		Adjusted Standards [dB]		Impact?
		Leq	Lmax	Leq	Lmax	
R1	570	42	53	77	94	No
R2	410	45	56	77	94	No
R3	350	46	58	77	94	No
R4	320	47	58	77	94	No
R5	580	37	48	77	94	No
R6	750	40	50	64	81	No

Notes:

5. Receiver locations identified on Figure 1.
6. Distances were scaled from the centerline of Highway 49 (receivers 1-5) or La Barr Meadows Road (receiver 6) to the nearest residences.
7. Analysis based on SEL of 83 dB at 50 feet and maximum noise level of 75 dB at 50 feet.
8. Assumes decay rate of -4.5 dB per doubling of distance and -1.5 dB per 1,000 feet due to atmospheric absorption.

Source: Bollard Acoustical Consultants.

Table 7 indicates that predicted off-site heavy truck noise levels range from 37-46 dBA Leq and 48-58 dB Lmax at the nearest noise-sensitive receivers. These noise levels would be in compliance with the County's adjusted noise standards (also shown in Table 5). As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

On-Site Long-Duration Operations Noise Analysis

Reference Noise Levels for Project Noise Sources

The proposed skid steer and excavator were modeled by two loaders from the FHWA Construction Noise Handbook, Table 9.1. Based on that source, the sound power level (PWL) for the wheel loaders is 112 dB. The noise level at a reference distance of 100 feet from the chipper was calculated to be 74 dB.

The proposed carbonizer is a Tigercat 6040. According to data provided by the manufacturer, the noise level of the carbonizer is 65 dB at 100 feet.

The proposed tree chipper is Vermeer 2300XL. The manufacturer's noise specifications indicate a sound power level of 119 dB. The noise level at a reference distance of 100 feet from the chipper was calculated to be 78 dB.

Prediction of On-Site Long-Duration Noise Levels

To predict project-generated noise levels at the nearest residences, the noise prediction model utilized the reference noise levels provided in the previous section, the locations of the equipment as shown in Figure 2, and any topographical shielding.

For a conservative approach to the assessment of potential project noise impacts, the carbonizer, tree chipper, and excavator noise levels were modeled as continuous, simultaneous, and for the duration of a full hour. Therefore, the most applicable noise metric would be the Hourly Average, Leq.

Assuming standard spherical spreading loss (-6 dB per doubling of distance), and an atmospheric absorption rate of 1.5 dB per thousand feet, project-equipment noise exposure at the nearest residences was calculated and the results of those calculations are presented in Table 8.

Table 8
Predicted Long-Duration Daytime Noise Levels, Hourly Average

	Noise Source[2], Leq[3] [dBA]					Adjusted Standard, Leq [dBA]
Receiver[1]	2x Carbonizers	Tree Chipper	Excavator 1	Excavator 2	Total	
R1	50	63	50	50	**63**	72
R2	52	64	52	52	**65**	72
R3	54	65	53	53	**66**	72
R4	54	65	54	55	**66**	72
R5	45	56	45	47	**58**	72
R6	42	52	42	42	**53**	59

Notes
1. Receiver locations are shown in Figure 1.
2. Noise source locations are identified in Figure 2.

Source: Bollard Acoustical Consultants.

Table 8 indicates that the total noise exposure from long-duration noise sources is 53 – 66 dB Leq. This is mainly attributed to the tree chipper operations. These noise levels are predicted to comply with the adjusted Nevada County noise standards (also shown in Table 5). As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

Cumulative On-Site Project Noise Analysis

The combined noise exposure due to the proposed on-site operations was calculated and summarized in Table 9.

Table 9
Cumulative On-Site Project Operation Noise Levels at Nearest Residences

	Predicted On-Site Project Noise Levels, Leq [dB]				
Receiver[1]	Long-Duration Operations	Haul Trucks	Cumulative	Adjusted Standards, Leq [dB]	Impact?
R1	63	42	63	72	No
R2	65	45	65	72	No
R3	66	46	66	72	No
R4	66	47	66	72	No
R5	58	37	58	72	No
R6	53	40	53	59	No

Notes:
1. Receiver locations identified in Figure 1.

Source: Bollard Acoustical Consultants.

Table 9 indicates that long-duration operations would be the major contributing noise source. Predicted cumulative project noise exposure levels at all receivers are predicted to satisfy the adjusted Nevada County noise level standards. As a result, no further noise mitigation measures would be required for the project.

On-Site Senior Firewood Program Noise Analysis

As noted in the project description, the processing yard for the Senior Firewood Program will operate three days a week from about 8:00 AM to 12:00 PM. Up to five splitter machines and four chainsaws will be used. Because the equipment will not be used continuously, it is subject to the adjusted maximum (Lmax) noise level standards presented in Table 5.

To predict project-generated noise levels at the nearest residences, the noise prediction model utilized reference noise levels for chainsaws and wood splitter machines. A total of four chainsaws and four splitter machines were modeled to operate simultaneously, with two on the west and east boundary of the firewood yard. The location of the equipment is shown in Figure 2.

Assuming standard spherical spreading loss (-6 dB per doubling of distance), and an atmospheric absorption rate of 1.5 dB per thousand feet, project-equipment noise exposure at the nearest residences was calculated and the results of those calculations are presented in Table 10.

Table 10
Predicted Senior Firewood Program Hourly Maximum Noise Levels

Receiver[1]	Noise Source[2], Lmax[3] [dBA]					Adjusted Standard, Lmax [dBA]
	2x Chainsaw West	2x Chainsaw East	2x Splitter Machine West	2x Splitter Machine East	Total	
R1	56	57	50	51	61	94
R2	57	58	51	52	61	94
R3	57	58	51	52	62	94
R4	57	58	51	52	62	94
R5	50	51	44	45	54	94
R6	62	62	56	56	66	81

Notes
2. Receiver locations are shown in Figure 1.
3. Noise source locations are identified in Figure 2.

Source: Bollard Acoustical Consultants.

Table 10 indicates that the total noise exposure from the Senior Firewood Program noise sources is 54 – 66 dB Lmax. This is mainly attributed to the chainsaws. These noise levels are predicted to comply with the adjusted Nevada County noise standards (also shown in Table 5). As a result, no further consideration of noise mitigation measures would be warranted for this aspect of the project.

Conclusions

Based on the equipment noise level data in the analyses presented above, noise generation due to operations at the proposed project is expected to satisfy the Nevada County noise exposure limits at the nearest residences.

This concludes BAC's environmental noise assessment of the La Barr Meadows Green Waste Management Facility project in Grass Valley, California. Please contact BAC at (530) 537-2328 or paulb@bacnoise.com any comments or questions regarding this report.

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.

IIC Impact Insulation Class (IIC): A single-number representation of a floor/ceiling partition's impact generated noise insulation performance. The field-measured version of this number is the FIIC.

L_{dn} Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

L_{eq} Equivalent or energy-averaged sound level.

L_{max} 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.

STC Sound Transmission Class (STC): A single-number representation of a partition's noise insulation performance. This number is based on laboratory-measured, 16-band (1/3-octave) transmission loss (TL) data of the subject partition. The field-measured version of this number is the FSTC.

Legend

A Site LT-1 Facing North

B Smith Road Facing East Towards Site Highway 49 & Site LT-1

C Site LT-2 Facing North

D Site LT-2 Facing South

Microphone Location

Noise Survey Photographs

La Barr Meadows Green Waste Management Facility
Grass Valley, California

Appendix B

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Appendix C-1
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Friday, June 14, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	60	81	41	36
1:00 AM	60	82	40	37
2:00 AM	60	78	42	39
3:00 AM	61	86	41	38
4:00 AM	65	87	47	41
5:00 AM	69	90	61	45
6:00 AM	71	86	68	53
7:00 AM	72	92	70	59
8:00 AM	72	86	71	62
9:00 AM	72	87	71	62
10:00 AM	72	83	71	63
11:00 AM	72	84	71	64
12:00 PM	72	85	71	64
1:00 PM	72	91	71	64
2:00 PM	72	86	71	64
3:00 PM	73	89	72	66
4:00 PM	72	86	72	66
5:00 PM	73	98	72	65
6:00 PM	72	99	70	58
7:00 PM	70	83	69	54
8:00 PM	70	95	67	49
9:00 PM	69	87	65	47
10:00 PM	67	83	61	42
11:00 PM	65	92	51	38

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	73	69	72	71	60	66
Lmax (Maximum)	99	83	89	92	78	85
L50 (Median)	72	65	70	68	40	50
L90 (Background)	66	47	60	53	36	41

Computed DNL, dB	74
% Daytime Energy	87%
% Nighttime Energy	13%

GPS Coordinates
39°11'11.21"N
121° 3'8.10"W

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Appendix C-2
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Saturday, June 15, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	62	82	43	36
1:00 AM	59	77	39	35
2:00 AM	59	80	38	29
3:00 AM	61	83	40	29
4:00 AM	63	88	41	29
5:00 AM	64	82	47	40
6:00 AM	67	89	60	44
7:00 AM	70	85	67	49
8:00 AM	71	93	69	54
9:00 AM	72	94	70	60
10:00 AM	72	86	71	62
11:00 AM	72	88	71	64
12:00 PM	72	93	71	64
1:00 PM	72	92	71	62
2:00 PM	72	91	71	62
3:00 PM	71	88	70	61
4:00 PM	72	86	71	62
5:00 PM	71	85	71	61
6:00 PM	71	86	70	56
7:00 PM	71	90	69	54
8:00 PM	70	94	67	51
9:00 PM	69	83	66	48
10:00 PM	68	84	64	46
11:00 PM	66	83	55	40

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	72	69	71	68	59	64
Lmax (Maximum)	94	83	89	89	77	83
L50 (Median)	71	66	70	64	38	47
L90 (Background)	64	48	58	46	29	37

Computed DNL, dB	73
% Daytime Energy	89%
% Nighttime Energy	11%

GPS Coordinates
39°11'11.21"N
121° 3'8.10"W

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Appendix C-3
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Sunday, June 16, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	63	83	44	35
1:00 AM	63	91	39	31
2:00 AM	59	78	35	27
3:00 AM	58	79	35	27
4:00 AM	60	80	37	28
5:00 AM	62	83	42	35
6:00 AM	65	88	52	38
7:00 AM	67	81	62	43
8:00 AM	70	82	68	52
9:00 AM	71	91	70	57
10:00 AM	71	87	71	61
11:00 AM	72	92	72	64
12:00 PM	72	88	71	64
1:00 PM	72	87	71	64
2:00 PM	72	91	71	61
3:00 PM	72	90	71	60
4:00 PM	71	87	70	60
5:00 PM	72	94	70	60
6:00 PM	71	89	69	56
7:00 PM	70	88	69	53
8:00 PM	70	93	67	51
9:00 PM	68	91	62	43
10:00 PM	65	86	54	39
11:00 PM	65	88	47	35

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	72	67	71	65	58	63
Lmax (Maximum)	94	81	89	91	78	84
L50 (Median)	72	62	69	54	35	43
L90 (Background)	64	43	57	39	27	33

Computed DNL, dB	72
% Daytime Energy	91%
% Nighttime Energy	9%

GPS Coordinates
39°11'11.21"N
121° 3'8.10"W

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Appendix C-4
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Friday, June 14, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	51	70	37	33
1:00 AM	47	66	35	33
2:00 AM	43	65	34	32
3:00 AM	48	69	38	34
4:00 AM	50	70	39	34
5:00 AM	57	75	49	44
6:00 AM	59	76	54	46
7:00 AM	62	81	59	50
8:00 AM	61	80	59	50
9:00 AM	61	71	59	48
10:00 AM	60	73	58	47
11:00 AM	61	74	59	49
12:00 PM	60	77	59	48
1:00 PM	61	74	59	48
2:00 PM	61	82	58	48
3:00 PM	61	73	59	48
4:00 PM	61	74	60	49
5:00 PM	61	76	59	48
6:00 PM	60	76	58	48
7:00 PM	60	76	56	44
8:00 PM	58	74	53	42
9:00 PM	57	81	51	41
10:00 PM	55	73	46	36
11:00 PM	53	71	42	35

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	62	57	60	59	43	54
Lmax (Maximum)	82	71	76	76	65	70
L50 (Median)	60	51	58	54	34	42
L90 (Background)	50	41	47	46	32	36

Computed DNL, dB	62
% Daytime Energy	88%
% Nighttime Energy	12%

GPS Coordinates
39°10'59.66"N
121° 2'52.44"W

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Appendix C-5
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Saturday, June 15, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	51	72	37	33
1:00 AM	50	73	36	32
2:00 AM	47	66	34	29
3:00 AM	46	69	34	29
4:00 AM	47	71	36	30
5:00 AM	54	74	43	39
6:00 AM	57	72	48	42
7:00 AM	59	75	54	46
8:00 AM	60	76	57	47
9:00 AM	59	72	56	46
10:00 AM	59	72	57	45
11:00 AM	59	73	57	45
12:00 PM	61	83	56	44
1:00 PM	59	84	56	44
2:00 PM	58	73	54	45
3:00 PM	58	74	54	44
4:00 PM	58	75	55	46
5:00 PM	59	79	54	46
6:00 PM	58	71	54	45
7:00 PM	58	76	53	44
8:00 PM	58	69	54	47
9:00 PM	57	71	51	45
10:00 PM	58	81	51	44
11:00 PM	55	72	45	39

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	61	57	59	58	46	53
Lmax (Maximum)	84	69	75	81	66	72
L50 (Median)	57	51	55	51	34	40
L90 (Background)	47	44	45	44	29	35

Computed DNL, dB	61
% Daytime Energy	84%
% Nighttime Energy	16%

GPS Coordinates
39°10'59.66"N
121° 2'52.44"W

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Appendix C-6
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Sunday, June 16, 2024

Hour	Leq	Lmax	L50	L90
12:00 AM	51	68	41	35
1:00 AM	49	65	37	30
2:00 AM	45	65	32	28
3:00 AM	46	66	33	28
4:00 AM	45	65	33	28
5:00 AM	49	65	39	33
6:00 AM	54	70	43	37
7:00 AM	60	87	51	44
8:00 AM	59	76	56	44
9:00 AM	59	75	56	43
10:00 AM	59	73	56	42
11:00 AM	59	78	56	43
12:00 PM	59	72	56	45
1:00 PM	58	71	54	42
2:00 PM	58	79	55	43
3:00 PM	57	74	53	43
4:00 PM	57	70	53	44
5:00 PM	58	76	53	44
6:00 PM	58	75	54	43
7:00 PM	58	74	53	43
8:00 PM	58	72	53	44
9:00 PM	56	70	48	42
10:00 PM	53	72	43	39
11:00 PM	50	68	42	36

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	60	56	58	54	45	50
Lmax (Maximum)	87	70	75	72	65	67
L50 (Median)	56	48	54	43	32	38
L90 (Background)	45	42	43	39	28	33

Computed DNL, dB	59
% Daytime Energy	92%
% Nighttime Energy	8%

GPS Coordinates
39°10'59.66"N
121° 2'52.44"W

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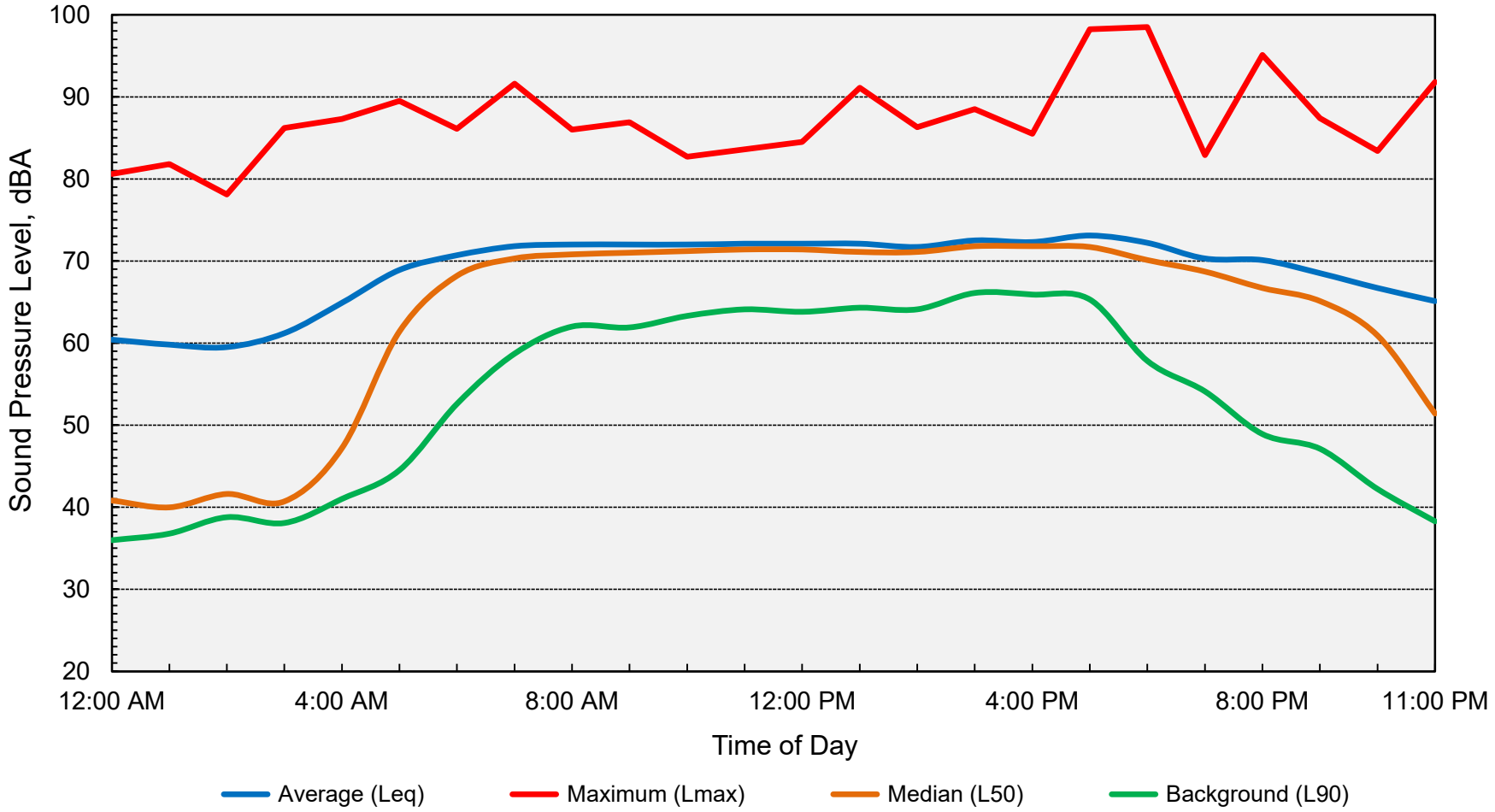
Appendix D-1
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Friday, June 14, 2024



Computed DNL = 74 dB

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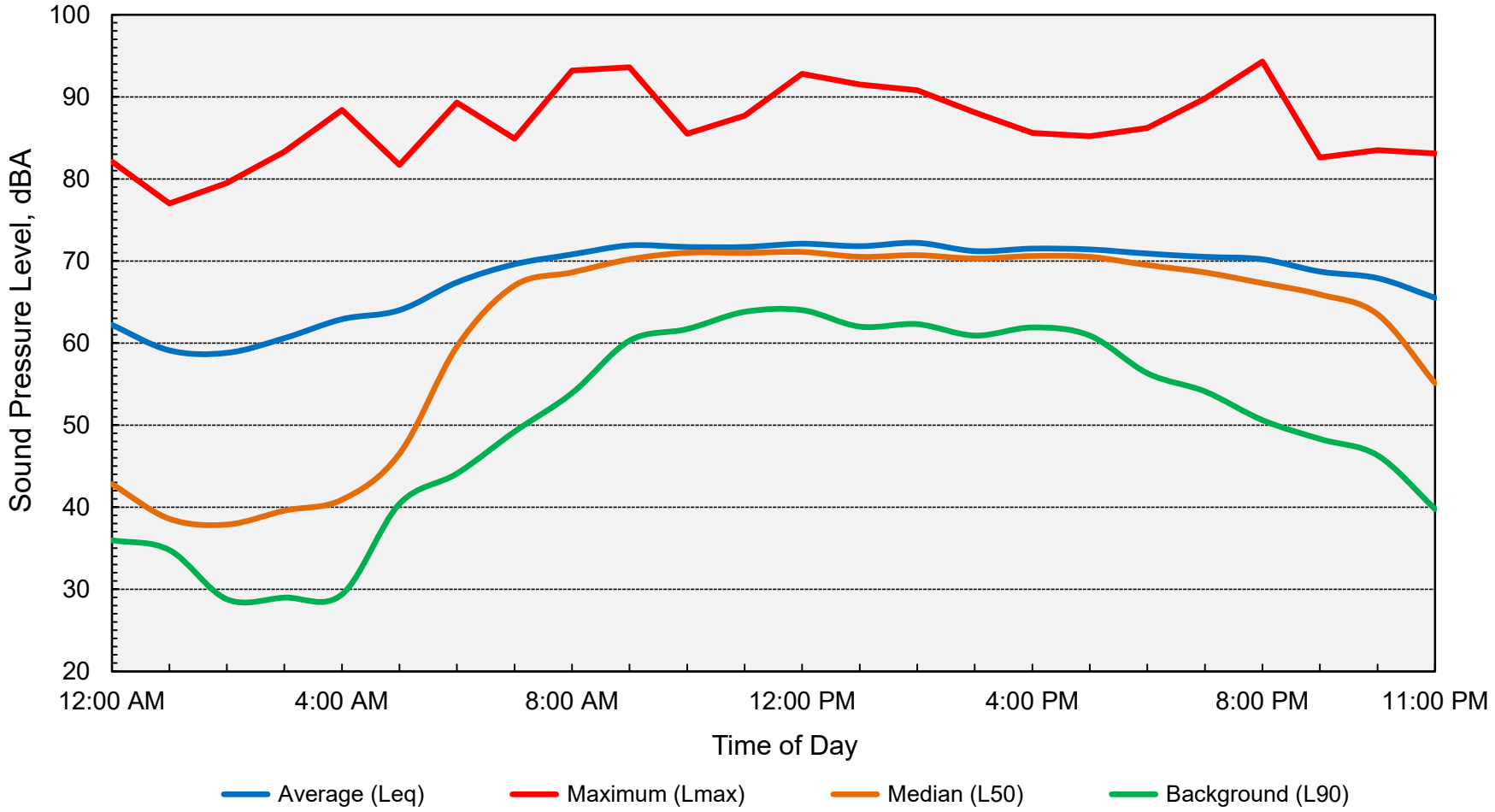
Appendix D-2
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Saturday, June 15, 2024



Computed DNL = 73 dB

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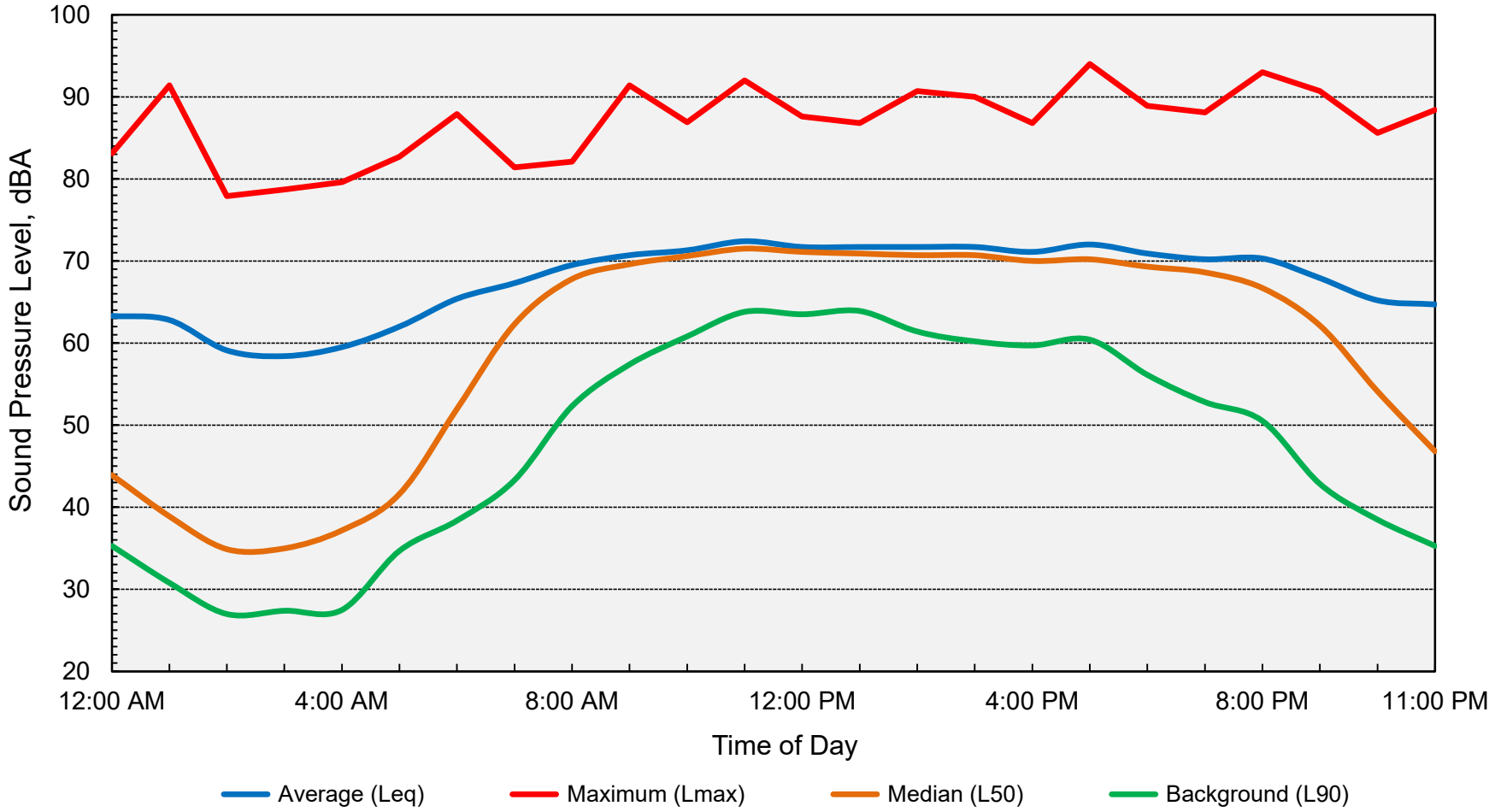
Appendix D-3
Long-Term Ambient Noise Monitoring Results, LT-1
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Sunday, June 16, 2024



Computed DNL = 72 dB

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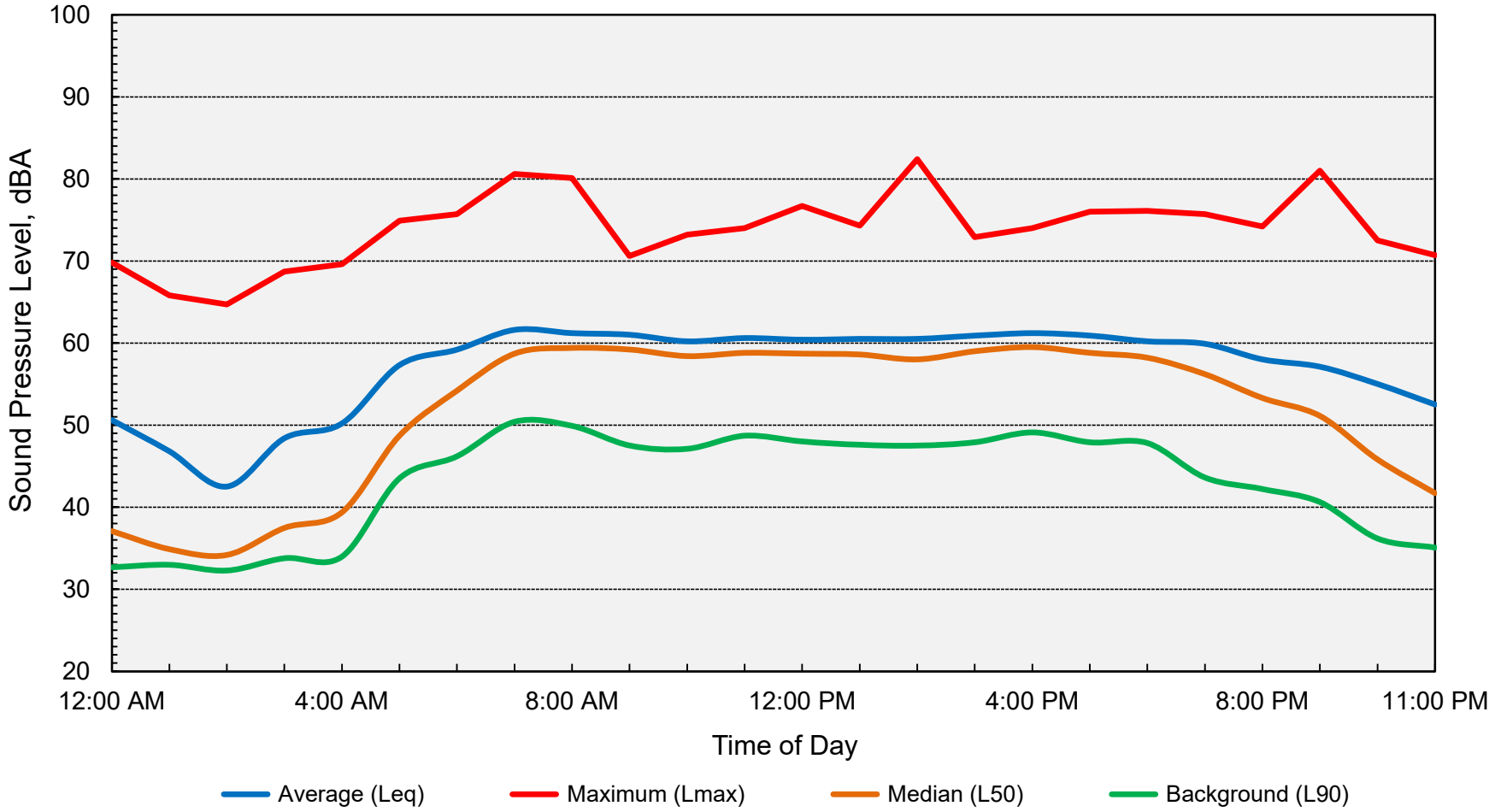
Appendix D-4
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Friday, June 14, 2024



Computed DNL = 62 dB

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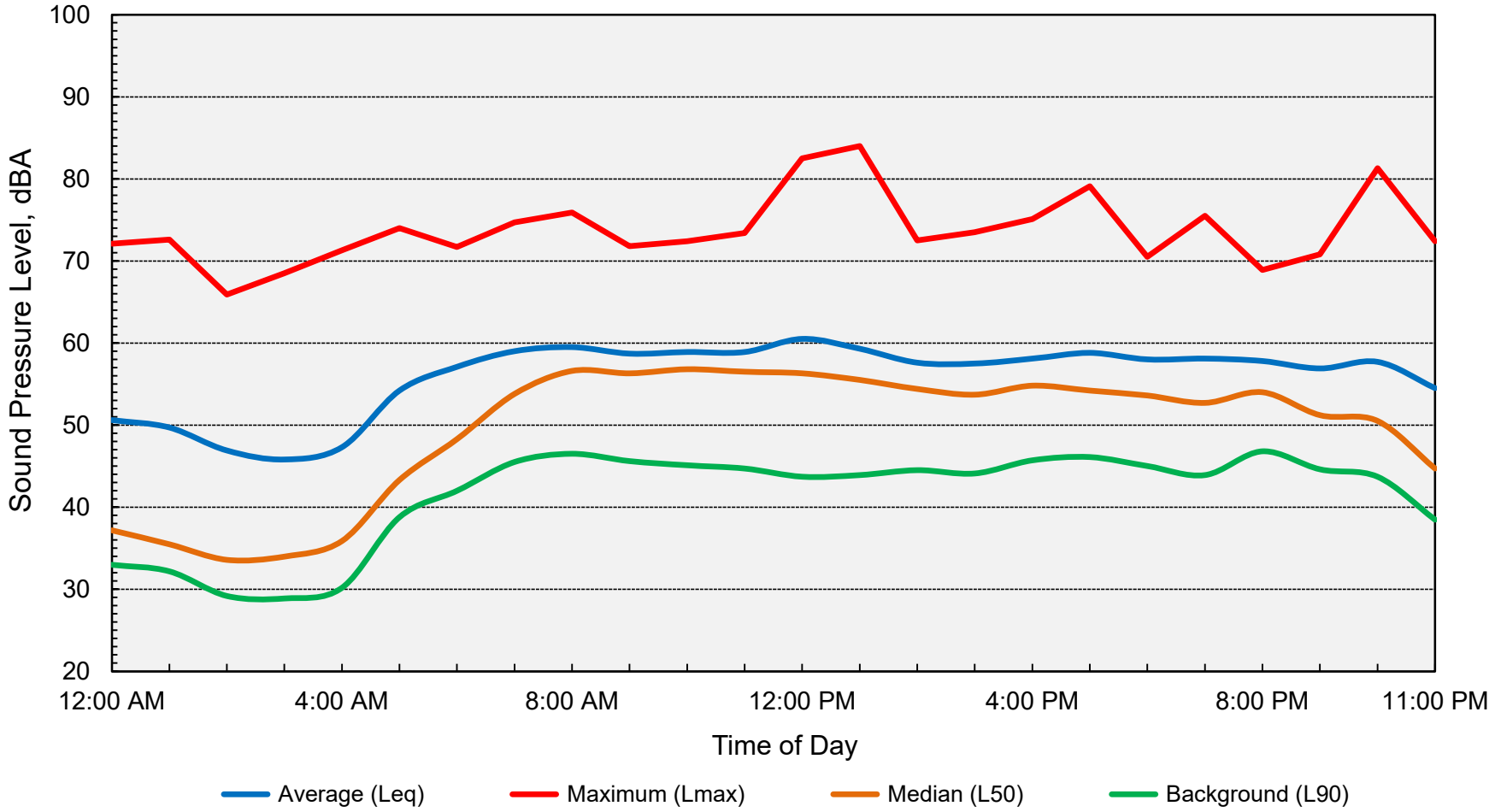
Appendix D-5
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Saturday, June 15, 2024



Computed DNL = 61 dB

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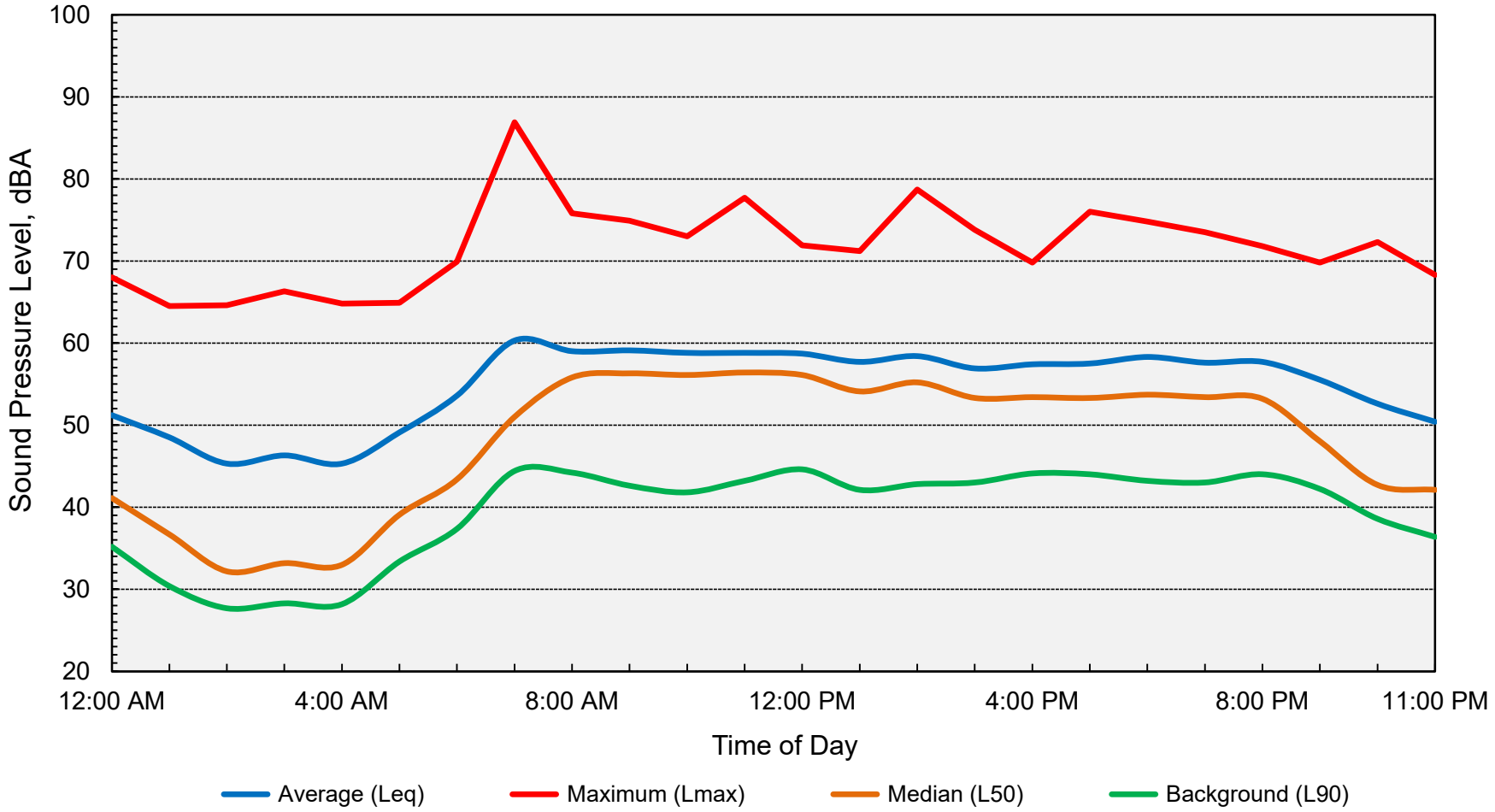
Appendix D-6
Long-Term Ambient Noise Monitoring Results, LT-2
La Barr Meadows Green Waste Management Facility - Grass Valley, California
Sunday, June 16, 2024



Computed DNL = 59 dB

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