# APPENDIX G

ENVIRONMENTAL NOISE ANALYSIS

Environmental Noise Analysis

# Eliot Quarry SMP-23 Reclamation Plan Amendment Project

Alameda County, California

BAC Job # 2017-049

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# Introduction

CEMEX Construction Materials Pacific, LLC. ("CEMEX") owns and operates the Eliot Quarry, a ±920-acre sand and gravel mining facility, located between the cities of Livermore and Pleasanton, at 1544 Stanley Boulevard in unincorporated Alameda County. CEMEX and its predecessors-in-interest have been continuously mining for sand and gravel at the Eliot Quarry since at least 1906. In addition to mining and reclamation, existing permitted and accessory uses at the Eliot Quarry include aggregate, asphalt and ready-mix concrete processing, as well as ancillary uses such as aggregate stockpiling, load-out, sales, construction materials recycling, and equipment storage and maintenance. CEMEX's mining operations at the site are vested per pre-1957 mining activities and Alameda County Quarry Permits Q-1 (1957), Q-4 (1957), and Q-76 (1969). Surface mining reclamation activities at the site are currently conducted pursuant to Surface Mining Permit and Reclamation Plan No. SMP-23 ("SMP-23"), approved in 1987.

Under the Eliot Quarry SMP-23 Reclamation Plan Amendment Project ("Project"), CEMEX proposes a revised Reclamation Plan that serves to adjust reclamation boundaries and contours, enhance drainage and water conveyance facilities, incorporate a pedestrian and bike trail, and achieve current surface mining reclamation standards. The planned post-mining end uses are water management, open space, and agriculture (non-prime).

Consistent with prior approvals, the Project will develop Lake A and Lake B, which are the first two lakes in the Chain of Lakes pursuant to the *Alameda County Specific Plan for Livermore-Amador Valley Quarry Area Reclamation* adopted in 1981 ("Specific Plan"). Upon reclamation, Lake A and Lake B, along with their appurtenant water conveyance facilities, will be dedicated to the Zone 7 Water Agency ("Zone 7") for purposes of water storage, conveyance and recharge management.

Lake A reclamation will include installation of a surface water diversion from the Arroyo del Valle ("ADV") to Lake A; conversion of a berm that crosses the west side of the lake to a small island to allow water to flow across the lake; installation of a water conveyance pipeline from Lake A to future Lake C (located off-site to the northwest); and an overflow outlet to allow water to flow back into ADV when Lake A water levels are high to prevent flooding in the localized area. The final surface area of Lake A will be 81 acres as compared to 208 acres in SMP-23.

No further mining will occur in Lake A. In addition, each of the proposed Lake A components of the project would be short-term in nature and related to construction of water flow/conveyance improvements. As a result, the Lake A improvements are considered to fall under the category of Construction activities for purposes of this evaluation.

Lake B reclamation will include installation of a pipeline turn-out from Lake A, a water pipeline conduit to future Lake C, and an overflow outlet to allow water to flow back into ADV when Lake B water levels are high. The final bottom elevation of Lake B is proposed at 150 feet above mean sea level ("msl"), in order to maximize the available aggregate resource. The final surface area of Lake B will be 208 acres as compared to 243 acres in SMP-23.

To facilitate the southerly progression of Lake B, the Project includes realignment and restoration of a ±5,800 linear foot reach of the ADV. The proposed ADV realignment will result in an enhanced riparian corridor that flows around, rather than through (as currently anticipated in SMP-23), Lake B. The ADV realignment was contemplated in the Specific Plan and subject to environmental review in 1981.

With the exception of the southerly progression of mining activities in Lake B (following realignment of the ADV), all Lake B project activities are also considered to be construction related. Because the southerly progression of mining activities in Lake B are currently vested per pre-1957 mining activities and Alameda County Quarry Permits Q-1 (1957), Q-4 (1957), and Q-76 (1969), analysis of those ongoing mining activities which are not related to this reclamation plan amendment is not required. As a result, this analysis focuses on the activities related to the reclamation plan amendment.

Outside of Lake A and Lake B, reclamation treatment for other disturbed areas, including the Lake J excavation (not part of the Chain of Lakes), processing plant sites, and process water ponds will involve backfills and/or grading for a return to open space and/or agriculture.

The Project is a modification of an approved project. Except as outlined above, CEMEX proposes no change to any fundamental element of the existing operation (e.g., mining methods, processing operations, production levels, truck traffic, or hours of operation). As a result, this analysis focuses on the change in noise and vibration environments which would result from the Reclamation Plan Amendments, not the existing operations which will remain the same. A more complete description of the proposed Project is contained in CEMEX's Project Description, Revised Reclamation Plan, and other application materials provided to the County.

## Objectives of This Analysis

The objectives of this analysis are as follows:

- To provide background information pertaining to the effects of noise & vibration.
- To identify existing sensitive land uses in the immediate project vicinity.
- To quantify existing ambient noise levels and identify ambient sources of vibration at those nearest noise-sensitive land uses.
- To identify the Alameda County, City of Pleasanton, and City of Livermore noise & vibration standards which would be most applicable to this project.
- To predict project-related noise & vibration levels at the nearest sensitive areas, and to compare those levels against the applicable noise & vibration standards.
- To recommend mitigation, as necessary, to ensure compliance with the applicable project noise & vibration standards.
- To summarize the results of this analysis into a report for eventual use in the development of the project environmental documents.

# Noise Fundamentals and Terminology

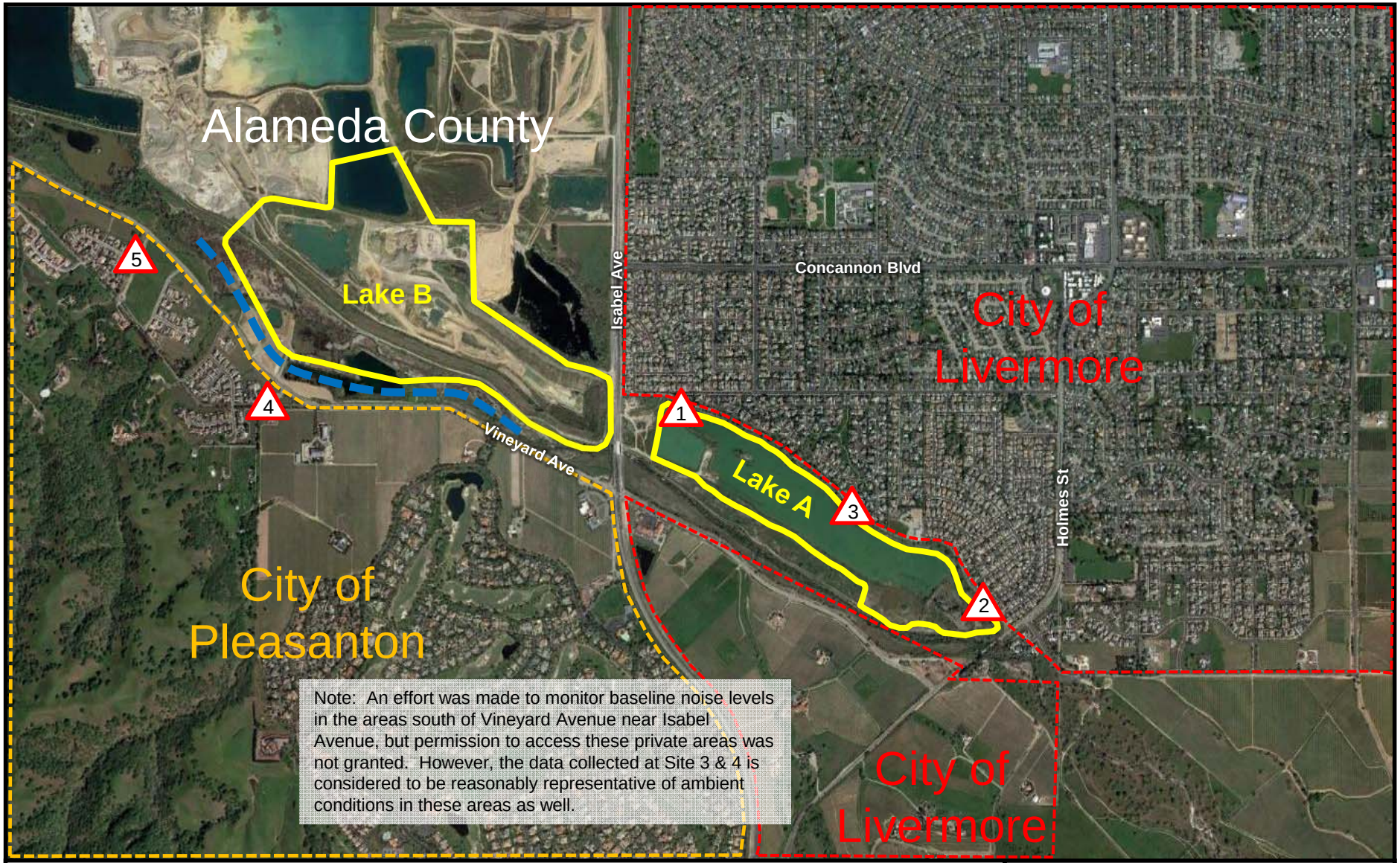
Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is 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. Figure 2 illustrates common noise sources associated with a range of decibel levels.

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 (Leq) over a given time period (usually one hour). The Leq is the foundation of the Day-Night Average Level noise descriptor, Ldn, and shows very good correlation with community response to noise.

The Day-night Average Level (Ldn) 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 Ldn represents a 24-hour average, it tends to disguise short-term variations in the noise environment. Ldn-based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.




***Legend***

- # Ambient Noise Measurement Sites
- Approximate Lake A & B Reclamation Areas
- Arroyo Del Valle Realignment Area

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**Cemex Eliot Mine, Lake A & B Reclamation Areas**
Livermore, California

Figure 1

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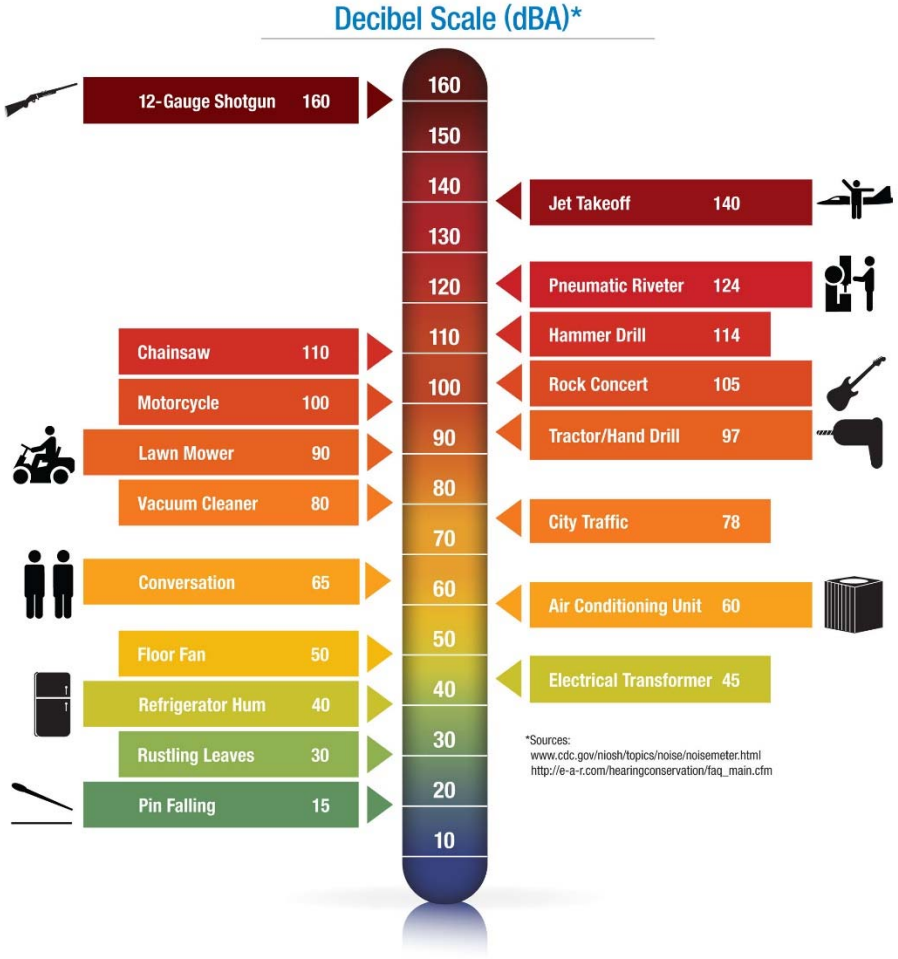
**Figure 2**
**Noise Levels Associated with Common Noise Sources**




The Alameda County and City of Livermore noise standards, which would be most applicable to this project and which are discussed in detail later in this section, are expressed in terms of hourly statistical descriptors ($L_n$) for both daytime and nighttime periods. The City of Pleasanton noise standards, which are also discussed later in this section, utilize maximum ($L_{max}$) noise level limits.

In addition to applying the applicable City and County 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 Alameda County, City of Livermore and City of Pleasanton noise standards). Specifically, single-event maximum ($L_{max}$) noise levels and hourly median ($L_{50}$) noise levels, both with and without the project, were compared so that the assessment of noise impacts was based on an assessment of project-generated noise in short-term fluctuations in the ambient noise environment.

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, whether by the addition of a single vehicle on a roadway, or by 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. 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.

## Vibration Fundamentals and Terminology

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 in terms of velocity in inches per second peak particle velocity (IPS, PPV) or root-mean-square (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 RMS velocities.

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.

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. Ground vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities. However, traffic rarely generates vibration amplitudes high enough to cause structural or cosmetic damage.

## Sensitive Receptors in Project Vicinity

There are two distinct areas where the majority of project reclamation activities will occur; Lake A and Lake B. For the Lake A work, which is east of Highway 84 (Isabel Avenue), noise-sensitive receptors consist of single-family residential uses along the entire northern boundary of Lake A. The residences are located along Alden Lane, Old Oak Road, Lakeside Circle, and Siena Road. On the south side of Vallecitos Road there is a cluster of residences on Tolentino Court. Finally, there are a few large-lot residential uses on the south side of East Vineyard Avenue. These residences are setback approximately 300 to 500 feet from East Vineyard Avenue.

For the Lake B component of the project, the nearest noise-sensitive receptors are primarily residences located on the south side of Vineyard Avenue. An exception is a small cluster of residences located on Yolanda Court. The residences on the South side of Vineyard are generally dispersed along on Ruby Hill Drive, Old Vineyard Avenue, Mingoia Street, Safreno Way, Manor Lane, Vineyard Heights Lane, and Vineyard Terrace.

## Ambient Noise Environment at Nearest Sensitive Receptors

The existing ambient noise environment in the immediate project vicinity is defined primarily by local and distant traffic. Existing operations at the CEMEX facility also periodically contribute to the noise environment at the nearest sensitive receptors, but at lower levels than existing traffic noise. It should be noted that there is very little CEMEX activity currently occurring in the Lake A area, as excavation operations are currently occurring within the Lakes B and J areas.

To quantify the existing ambient noise environment in the immediate project vicinity, continuous noise level measurements were conducted at the five (5) locations identified on Figure 1 during the period of September 27 to October 8, 2018. The monitoring survey sites were intended to represent the ambient noise environment at the nearest residences to the proposed project operations. CEMEX mining and processing activities were active at the Eliot facility during the noise monitoring periods.

In addition to the five (5) noise monitoring sites indicated on Figure 1, BAC attempted to conduct monitoring within the private Ruby Hill neighborhood but was not granted access. Because traffic on Vineyard Avenue is the dominant noise source at the residences on the south side of that roadway, the data collected at Site 4 was able to be used to project ambient noise conditions at the nearest residences within the Ruby Hill community.

Weather conditions present during the ambient noise monitoring program were typical for the season, with no anomalous conditions present which would adversely affect the validity of the survey results in describing typical ambient conditions.

Larson Davis Laboratories (LDL) Model 820, LxT and 831 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 1. The graphical results of the noise monitoring program are provided in Appendix B.

**Table 1**
**Statistical Summary of Ambient Noise Measurement Results**
**CEMEX Eliot Mine Site Vicinity**

| | | Daytime (7 a.m. - 10 p.m.) | | Nighttime (10 p.m. to 7 a.m.) | | |
|---|---|---|---|---|---|---|
| **Site** | **Date** | **Median ($L_{50}$)** | **Maximum ($L_{max}$)** | **Median ($L_{50}$)** | **Maximum ($L_{max}$)** | **$L_{dn}$** |
| 1 | Oct 4 | 46 | 64 | 43 | 65 | 47 |
| | Oct 5 | 45 | 67 | 44 | 62 | 55 |
| | Oct 6 | 44 | 68 | 44 | 61 | 53 |
| | Oct 7 | 41 | 66 | 40 | 59 | 52 |
| | Oct 8 | 43 | 65 | 42 | 63 | 51 |
| | **Averages** | **44** | **66** | **43** | **62** | **52** |
| 2 | Oct 4 | 47 | 61 | 45 | 64 | 48 |
| | Oct 5 | 41 | 51 | 43 | 57 | 52 |
| | Oct 6 | 44 | 63 | 41 | 57 | 50 |
| | Oct 7 | 44 | 62 | 39 | 56 | 50 |
| | Oct 8 | 44 | 61 | 41 | 57 | 48 |
| | **Averages** | **44** | **60** | **42** | **58** | **50** |
| 3 | Sept 27 | 46 | 68 | 41 | 61 | 54 |
| | Sept 28 | 45 | 61 | 40 | 54 | 49 |
| | Sept 29 | 44 | 59 | 41 | 56 | 50 |
| | Sept 30 | 41 | 61 | 37 | 55 | 48 |
| | Oct 1 | 40 | 60 | 40 | 55 | 49 |
| | **Averages** | **43** | **62** | **40** | **56** | **50** |
| 4 | Sept 27 | 56 | 77 | 43 | 71 | 62 |
| | Sept 28 | 47 | 75 | 39 | 70 | 61 |
| | Sept 29 | 54 | 75 | 36 | 70 | 61 |
| | Sept 30 | 51 | 77 | 34 | 69 | 62 |
| | Oct 1 | 56 | 76 | 42 | 73 | 67 |
| | **Averages** | **53** | **76** | **42** | **73** | **67** |
| 5 | Sept 27 | 46 | 68 | 41 | 61 | 54 |
| | Sept 28 | 41 | 59 | 35 | 56 | 50 |
| | Sept 29 | 44 | 68 | 30 | 58 | 50 |
| | Sept 30 | 43 | 64 | 28 | 56 | 48 |
| | Oct 1 | 46 | 65 | 35 | 60 | 52 |
| | **Averages** | **44** | **65** | **34** | **58** | **51** |

Source: Bollard Acoustical Consultants, Inc.
The noise measurement locations are identified on Figure 1.
Noise level data shown in this table represent averages for the periods. For a complete depiction of hourly measurement results, please refer to Appendix B.

The Table 1 data indicate that measured ambient noise levels were fairly consistent at the Sites 1-3, located along the northern side of Lake A. Site 4 was located 75 feet from the centerline of Vineyard Avenue whereas Site 5 was 300 feet from the centerline of that roadway. This explains why the data collected at Site 4 was considerably higher than at Site 5. When the distance between the microphone and centerline of Vineyard Road is normalized, the data collected at Sites 4 and 5 were found to be comparable.

# Ambient Vibration Environment at Nearest Sensitive Receptors

Existing sources of ambient vibration in the immediate project vicinity consist of traffic on the local roadway network, aggregate processing operations at the Eliot Facility, and existing excavation activities in the Lake B and Lake J areas. However, BAC staff observed no discernible traffic or excavation-related vibration at any of the nearest residential areas to the project site. As a result, existing ambient vibration levels in the project vicinity are considered to be negligible.

# Criteria for Acceptable Noise & Vibration Exposure

## State of California Criteria

### California Environmental Quality Act (CEQA):

The State of California has established regulatory criteria that are applicable to this assessment. Specifically, Appendix G of the State of California Environmental Quality Act (CEQA) Guidelines are used to assess the potential significance of noise and vibration impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. According to Appendix G of the CEQA guidelines, the project would result in a significant noise impact if the project were to results in exposure of persons to noise levels in excess of the applicable local standards or if the project would result in a substantial temporary or permanent increase in ambient noise levels in the project vicinity. The project would result in a significant vibration impact if it would expose persons to excessive groundborne vibration.

### California Department of Transportation (Caltrans)

The California Department of Transportation (Caltrans) criteria applicable to damage and annoyance potential from transient and continuous vibration that is usually associated with construction activity are presented in Tables 2 and 3. Equipment or activities typical of continuous vibration include: excavation equipment, static compaction equipment, tracked vehicles, traffic on a highway, vibratory pile drivers, pile-extraction equipment, and vibratory compaction equipment. Equipment or activities typical of single-impact (transient) or low-rate repeated impact vibration include: impact pile drivers, blasting, drop balls, “pogo stick” compactors, and crack-and-seat equipment (California Department of Transportation 2013).

**Table 2**
**Guideline Vibration Damage Potential Threshold Criteria**

| Structure and Condition | Maximum PPV (inches/second) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Intermittent Sources |
| Extremely fragile historic buildings, ruins, ancient monuments | 0.12 | 0.08 |
| Fragile buildings | 0.2 | 0.1 |
| Historic and some old buildings | 0.5 | 0.25 |
| Older residential structures | 0.5 | 0.3 |
| New residential structures | 1.0 | 0.5 |
| Modern industrial/commercial buildings | 2.0 | 0.5 |

Source: California Department of Transportation, Transportation and Construction Vibration Guidance Manual (2013)

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

PPV = peak particle velocity.

**Table 3**
**Guideline Vibration Annoyance Potential Criteria**

| Human Response | Maximum PPV (inches/second) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Intermittent Sources |
| Barely perceptible | 0.04 | 0.01 |
| Distinctly perceptible | 0.25 | 0.04 |
| Strongly perceptible | 0.9 | 0.10 |
| Severe | 2.0 | 0.4 |

Source: California Department of Transportation, Transportation and Construction Vibration Guidance Manual (2013)

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

PPV = peak particle velocity.

Given the relatively short-term nature of this project, and to be consistent with CEQA policy for noise, project generated vibration levels should be strongly perceptible prior to the finding that a significant vibration impact will occur, not just perceptible or distinctly perceptible. Therefore, vibration thresholds of 0.9 and 0.1 inches/second are applied for transient and continuous vibration sources, respectively.

## Local Criteria

The CEMEX project site is located within Alameda County, but the surrounding residential land uses are located within the Cities of Pleasanton to the southwest and Livermore to the northeast.

As a result, the noise standards of all three jurisdictions which would be most applicable to this assessment are discussed below.

## Alameda County Noise Standards:

The Alameda County noise standards are contained in the County's Noise Ordinance (County Code Section 6.60 – Noise). The provisions of the County's Noise Ordinance which are germane to this evaluation are provided below:

### 6.60.020 - Definitions.

"**Construction**" means construction, erection, enlargements, alteration, conversion or movement of any building, structures or land together with any scientific surveys associated therewith.

### 6.60.030 - Noise measurement criteria.

A. Any noise measurement made pursuant to the provisions of this chapter shall be made with a sound level meter using the 'A' weighted network (scale) at slow meter response. Fast meter response shall be used for an impulsive noise. Calibration of the measurement equipment, utilizing an acoustic calibrator, shall be performed immediately prior to recording any noise date.

B. The exterior noise levels shall be measured at any point on the affected residential property, school, hospital, church, public library or commercial property. Where practical, the microphone shall be positioned three to five feet above the ground and away from reflective surfaces.

### 6.60.040 - Exterior noise level standards.

A. It is unlawful for any person at any location within the unincorporated area of the county to create any noise or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any single- or multiple-family residential, school, hospital, church, public library or commercial properties situated in either the incorporated or unincorporated area to exceed the noise level standards as set forth in Table 6.60.040A or Table 6.60.040B:

(Alameda County Code Tables 6.60.040A and B are reproduced in this report as Tables 4 & 5.)

**Table 4**
**Noise Level Standards Applicable to Residential and Other Noise Sensitive Land Uses**
**(Alameda County Code Table 6.60.040A)**

| Category | Cumulative Number of Minutes in any one hour time period | Daytime 7 a.m. to 10 p.m. | Nighttime 10 p.m. to 7 a.m. |
|---|---|---|---|
| 1 | 30 | 50 | 45 |
| 2 | 15 | 55 | 50 |
| 3 | 5 | 60 | 55 |
| 4 | 1 | 65 | 60 |
| 5 | 0 | 70 | 65 |

**Table 5**
**Noise Level Standards Applicable to Commercial Properties**
**(Alameda County Code Table 6.60.040B)**

| Category | Cumulative Number of Minutes in any one hour time period | Daytime 7 a.m. to 10 p.m. | Nighttime 10 p.m. to 7 a.m. |
|---|---|---|---|
| 1 | 30 | 65 | 60 |
| 2 | 15 | 70 | 65 |
| 3 | 5 | 75 | 70 |
| 4 | 1 | 80 | 75 |
| 5 | 0 | 85 | 80 |

B. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal said ambient noise level.

C. Each of the noise level standards specified in Tables 6.60.040A and B shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music or for recurring impulsive noises.

D. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the applicable noise level standards in Table 6.60.040A and Table 6.60.040B.

E. Notwithstanding the noise level standards set forth in this section, the noise level standard applicable to the emission of sound from transformers, regulators, or associated equipment in electrical substations shall be 60 dB(A).

### 6.60.070 - Special provisions or exceptions.

E. Construction. The provisions of this chapter shall not apply to noise sources associated with construction, provided said activities do not take place before seven a.m. or after seven p.m. on any day except Saturday or Sunday, or before eight a.m. or after five p.m. on Saturday or Sunday.

## City of Livermore Noise Standards

The City of Livermore noise standards which would be most applicable to this project are contained in the City's General Plan Noise Element. The City's Land Use Compatibility Guidelines for Exterior Noise are contained in Table 9-7 of the City's Noise Element. That table establishes an exterior noise environment of 60 dB $L_{dn}$ as being normally acceptable for single-family residential uses.

In addition to the City's $L_{dn}$-based standards, Policy P1 under objective N-1.5 establishes the following noise levels for exterior environments applicable to industrial and commercial uses affecting sensitive land uses:

(a) 55 dBA $L_{50}$ (7am – 10 pm)

(b) 45 dBA $L_{50}$ (10 pm to 7 am).

Policy P4 under Noise Element Objective N-1.5 states that temporary construction activities shall be exempt from the standards of Policy P1 (shown above) between the hours of 7 am and 8 pm. However, during the hours of 8 pm to 10 pm the City's 55 dBA $L_{50}$ standard would continue to apply and all temporary construction activities occurring between 10 pm – 7 am would be subject to the City's 45 dBA $L_{50}$ standard.

**City of Pleasanton Noise Standards**

The City of Pleasanton General Plan Noise Element establishes a noise level standard of 60 dB $L_{dn}$ as being normally acceptable for exterior spaces of residential land uses. The City of Pleasanton noise standards which would be most applicable to this project are contained in the City's Municipal Code (Section 9.04 Noise Regulations). Those standards are provided below:

**9.04.035 Noise Limits – Commercial or industrial use adjacent to residential zone.**

Any commercial or industrial use, not including a special downtown accessory entertainment use in the downtown hospitality transition area, which is located within 300 feet from any residential zone and which remains open for business at any time between the hours of 10 pm and 6 am shall adhere to the following standards of performance:

A. The noise level produced on the business premises between the hours of 10 pm and 6 am shall not exceed the residential noise standard at the property plane between the residential zoning district and the commercial zoning district.

**9.04.050 Noise Limits – Industrial property.**

No person shall produce or allow to be produced by any machine, animal, device or any combination of the same on commercial property, a noise level in excess of 75 dBA at any point outside the property plane unless otherwise provided in this chapter.

**9.04-070 Daytime Exceptions**

Any noise which does not produce a noise level exceeding 70 dBA at a distance of 25 feet under its most noisy condition of use shall be exempt from the provisions of sections 9.04.030, 9.04.040, and 9.04.060(A) of this Chapter between the hours of 8 am and 8 pm daily, except Sundays and holidays, when the exemption herein shall apply between 10 am and 6 pm.

**9.04.100 Construction**

Notwithstanding any other provision of this chapter, between the hours of 8 am and 8 pm daily, except Sunday and holidays, when the exemption shall apply between 10 am and 6 pm, construction, alteration or repair activities which are authorized by a valid city permit shall be allowed if they meet at least one of the following noise limitations:

A. No individual piece of equipment shall produce a noise level exceeding 83 dBA at a distance of 25 feet. If the device is housed within a structure on the property, the measurements shall be made outside the structure at a distance as close to 25 feet from the equipment as possible; or

B. The noise level at any point outside of the property plane of the project shall not exceed 86 dBA.

## Criteria for Determination of a Significant Noise Increase

As noted previously, the CEQA guidelines state that a project would result in a significant noise impact if the project would result in a substantial increase in ambient noise levels at a sensitive

receptor location. However, CEQA does not define what constitutes a "substantial" increase in noise levels.

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. A 10 dB increase in noise levels is considered to be the level at which a doubling of loudness is perceived (Egan, Architectural Acoustics, page 21, 1988, McGraw Hill).

The California Department of Transportation (Caltrans) requires a project-related traffic noise level increase of 12 dB for a finding of significance. The California Energy Commission (CEC) considers project-related noise level increases between 5-10 dB significant, depending on local factors.

To assess the significance of changes in 24-hour aircraft noise exposure, the Federal Interagency Commission on Noise (FICON) has developed the graduated scale ranging from 1.5 to 5 dB shown in Table 6. The rationale for the graduated scale used in the FICON standards is that test subject's 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 FICON standards have been used extensively in recent years by the authors of this report in the preparation of the noise sections of Environmental Impact Reports that have been certified in many California cities and counties. However, because the FICON standards were developed to evaluate permanent changes in 24-hour noise exposure related to aircraft noise, their use as criteria for assessing temporary impacts related to construction activities is considered overly conservative. A more appropriate threshold for assessing the significance of changes in short-term noise exposure would be temporary doubling of loudness, or 10 dB, which is more consistent with Caltrans and CEC criteria.

**Table 6**
**Criteria for Determining Significance of Permanent[1] Changes in Noise Exposure**

| Ambient Noise Level Without Project, $L_{dn}$ | Increase Required for Significant Impact |
|---|---|
| Less than 60 dB | +5.0 dB or more |
| 60 to 65 dB | +3.0 dB or more |
| Greater than 65 dB | +1.5 dB or more |

1. For temporary changes in noise exposure, such as those resulting from construction-related activities unrelated to ongoing operations, a 10 dB increase is considered the threshold of significance.
2. Source: Federal Interagency Committee on Noise (FICON)

## Noise Standards Applied to this Project

As noted in the Introduction section of this report, the proposed reclamation activities related to water diversion and conveyance improvements in Lake A, and the realignment of the ADV, are considered to be construction-related activities as they are not related to the long-term excavation or processing operations at the CEMEX Eliot Facility (mining and processing activities are vested rights at this facility). As noted above, construction-related activities are exempt from the local noise standards in the City of Livermore and Alameda County provided the construction activities occur during certain hours and days of the week which are considered to be less noise-sensitive. For sensitive receptors located in the City of Pleasanton, construction noise levels at any point outside of the property plane shall not exceed 86 dBA.

For the assessment of noise impacts relative to CEQA significance criteria for temporary construction activities, a 10 dB increase over baseline ambient conditions is considered significant.

Because the project site is located within unincorporated Alameda County whereas the surrounding residential uses are located within the Cities of Livermore and Pleasanton, it is unclear which noise standards would be applicable to the assessment of potential noise impacts for this project should the reclamation activities occur outside of the hours during which they are exempt. As a result, the approach to impact assessment for this project is to apply the City of Livermore's noise standards at noise-sensitive receptors located within the City of Livermore, and to apply the City of Pleasanton's noise standards at noise-sensitive receptors located within the City of Pleasanton.

For the assessment of noise impacts related to CEQA criteria, 10 dB is added to the ambient noise measurement results shown in Table 1. The Table 1 data indicate that existing median daytime ambient noise levels at the nearest residences to the north of the project area, within the City of Livermore, were generally in the mid 40 dB $L_{50}$ range (44 dB $L_{50}$ on average). As a result, this analysis applies a noise criteria of 54 dB $L_{50}$ at those residences between the hours of 7 am and 10 pm. During the hours of 10 pm to 7 am, measured median ambient noise levels at the Livermore residences on the north side of Lake A averaged 42 dBA $L_{50}$. As a result, this analysis applies a noise criteria of 52 dB $L_{50}$ at those residences between the hours of 10 pm and 7 am.

The residences located in closer proximity to Vineyard Avenue experience higher noise levels of approximately 53 dB $L_{50}$ during the daytime hours of 7 am – 10 pm (Site 4 of Table 1). As a result, this analysis applies a noise criteria of 63 dB $L_{50}$ at those residences between the hours of 7 am and 10 pm. During the hours of 10 pm to 7 am, measured median ambient noise levels at Site 4 averaged 42 dB $L_{50}$. As a result, this analysis applies a noise criteria of 52 dB $L_{50}$ at the residences on the south side of Vineyard Road (both City of Pleasanton and Livermore), between the hours of 10 pm and 7 am.

# Noise Generation of the Project

As noted in the Introduction section of this report, different activities are proposed within the Lake A and Lake B reclamation areas as follows:

**Lake A Area:** Lake A reclamation will include installation of a surface water diversion from the Arroyo del Valle ("ADV") to Lake A, conversion of a berm that is currently located in Lake A to a small island to allow water to flow across the lake, installation of a water conveyance pipeline from Lake A to future Lake C (located northwest), and an overflow outlet to allow water to flow back into ADV when Lake A water levels are high to prevent flooding in the localized area. These components are considered to be short-term construction activities rather than long-term operational activities.

**Lake B Area:** Lake B reclamation will include installation of a pipeline turn-out from Lake A, a water pipeline conduit to future Lake C, and an overflow outlet to allow water to flow back into ADV when Lake B water levels are high. The final bottom elevation of Lake B is proposed at 150 feet above mean sea level ("msl"), in order to maximize the available aggregate resource. The Project includes realignment and restoration of a ±5,800 linear foot reach of the ADV. The proposed ADV realignment will result in an enhanced riparian corridor that flows around, rather than through (as currently anticipated in SMP-23), Lake B. These components are considered to be short-term construction activities rather than long-term operational activities.

The proposed reclamation operations would involve relatively minor earthmoving and construction activities in Lake A, with more intensive earthmoving to occur in the Lake B area as part of the ADV realignment. The proposed earthmoving operations and installation of pipelines would not result in any fundamental changes to existing operations (e.g., mining methods, processing operations, production levels, truck traffic, or hours of operation).

According to information provided by the project applicant, the most significant noise generating equipment to be utilized for the proposed project would consist of the following:

- Caterpillar Model 330 and 349 Excavators
- Caterpillar Model 966 Front Loaders
- Caterpillar Model 623 Scraper
- Caterpillar Model 14H Motor Grader
- Caterpillar Model 815 & 825 Compactors
- Caterpillar D10 Dozer

To quantify the noise generation of equipment identified above, reference data contained within the Federal Highway Administration Roadway Construction Noise Model (RCNM) was utilized. The equipment was assigned to the approximate closest point of proximity to existing residences where it will be in operation during the various phases of the project, and estimated offsets were applied to account for shielding by intervening topography and differences between median ($L_{50}$) values and maximum ($L_{max}$) values.

Specifically, median (L50) levels were assumed to be 10 dB below maximum noise levels reported in the RCNM. This assumption is based on the fact that the mobile equipment will vary in terms of both distance from the locations where the noise standards are applicable and in terms of percentage of the hour during which the equipment will operate at the highest sound output.

In addition, shielding by intervening topography was estimated to be between 5 and 10 dB depending on the extent by which intervening topography is expected to intercept line of sight between the project noise sources and nearby sensitive receptors. These shielding offsets are based on the fact that the majority of the proposed reclamation operations would occur below grade at positions which would not be visible from the nearest sensitive receptors, particularly sensitive receptors to the south of Vineyard Avenue.

The noise levels were then projected to the locations of the nearest residences. Table 7 presents the maximum noise levels generated by the various types of project-related earth-moving equipment to be used during the project. Table 8 shows the predicted noise levels at the nearest potentially-affected residences for the various aspects of the project.

**Table 7**
**Maximum Noise Generation of Construction Equipment**

| Equipment Type | Maximum Noise Level ($L_{max}$) at 50 feet, dBA |
|---|---|
| Compactor | 83 |
| Dozer | 82 |
| Excavator | 81 |
| Loader | 79 |
| Motor Grader | 83 |
| Pad Drum Roller | 80 |
| Scraper | 84 |

Source: FHWA Roadway Construction Noise Model

**Table 8**
**Predicted Noise Levels for Various Project-Related Components at Nearest Residences**
**Eliot Quarry SMP-23 Reclamation Plan Amendment Project**

| Operation | Receiver Location | Approximate Distance to Nearest Receiver, feet | Predicted Maximum Noise Level at Receiver $L_{max}$ dBA | Predicted Median Noise Level at Receiver $L_{50}$ dBA |
|---|---|---|---|---|
| Realign Arroyo del Valle | CEMEX Southern Property Plane | 100 | 68 | 64 |
| | Pleasanton Residences South of Vineyard Avenue | 250 | 60 | 56 |
| | Livermore Residences South of Vineyard Avenue | 1,400 | 45 | 41 |
| | Livermore Residences North of Lake A | 2000 | 42 | 38 |
| Arroyo del Valle to Lake A Diversion | CEMEX Southern Property Plane | 300 | 60 | 54 |
| | Pleasanton Residences South of Vineyard Avenue | 3,500 | 39 | 33 |
| | Livermore Residences South of Vineyard Avenue | 400 | 58 | 52 |
| | Livermore Residences North of Lake A | 1,000 | 50 | 44 |
| Install Conduits and Pipelines | CEMEX Southern Property Plane | 1,000 | 53 | 49 |
| | Pleasanton Residences South of Vineyard Avenue | 2,000 | 47 | 43 |
| | Livermore Residences South of Vineyard Avenue | 3,500 | 42 | 38 |
| | Livermore Residences North of Lake A | 250 | 65 | 61 |

Source: FHWA Roadway Construction Noise Model with inputs from BAC and distance scaling from aerial imagery.

## Vibration Generation of the Project

The typical vibration levels generated by construction equipment to be used in the proposed reclamation activities is presented in Table 9 (Federal Transit Administration 2018) at various distances.

**Table 9**
**Vibration Source Levels for Construction Equipment**

| Equipment | Maximum PPV (inches/second) | | | | |
|---|---|---|---|---|---|
| | PPV at 25 feet | PPV at 50 feet | PPV at 75 feet | PPV at 100 feet | PPV at 175 feet |
| Vibratory roller | 0.210 | 0.074 | 0.040 | 0.026 | 0.011 |
| Large bulldozer | 0.089 | 0.032 | 0.017 | 0.011 | 0.005 |
| Loaded trucks | 0.076 | 0.027 | 0.015 | 0.010 | 0.004 |
| Small bulldozer | 0.003 | 0.001 | 0.001 | 0.000 | 0.000 |

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual (2018)
PPV = peak particle velocity.

The vibration data shown in Table 9 indicate that heavy equipment vibration levels dissipate rapidly with distance.

## Noise & Vibration Impacts & Mitigation Measures

**Impact 1: Construction noise impacts relative to locally adopted noise standards**

As noted previously, the realignment of the Arroyo Del Valle, the Arroyo Del Valle to Lake A Diversion, and the installation of conduits and pipelines fall under the category of temporary construction components of the overall project as they are not associated with long-term, ongoing operation of the CEMEX facility. Both Alameda County and the City of Livermore exempt construction activities from the provisions of their local noise standards provided those activities occur during the hours of 7 am and 8 pm (Livermore) and 8 am – 8 pm (Pleasanton). The City of Pleasanton applies a construction noise standard of 86 dBA at any point outside of the property plane.

As indicated in Table 8, noise generated by construction activities would be a maximum of 68 dB, thus satisfactory relative to the City of Pleasanton 86 dBA standard applicable at the property plane of the project during daytime hours. In addition, construction noise is exempt from the requirements of the Alameda County and City of Livermore noise standards provided construction activities are limited to the hours of 7 am – 7 pm, Monday through Friday, and 8 am – pm on

Saturday or Sunday. However, if construction activities were to occur during nighttime hours after 7 pm, such activities would not be exempt from the local noise standards and the applicable nighttime noise level standards would be exceeded at the residences to the south of Vineyard Avenue. As a result, **this nighttime noise impact is considered *potentially significant*.**

**Mitigation for Impact 1:**

**MM 1A:** All construction activities shall be limited to the hours of 7 am – 7 pm Monday through Friday, and 8 am – 5 pm on Saturday and Sunday.

**Significance of Impact 1 after mitigation: *Less than significant*.**

**Impact 2: Construction noise impacts relative to existing ambient conditions**

Despite the finding in Impact 1 that construction noise impacts relative to locally adopted noise standards would be less than significant after implementation of mitigation measure MM 1A, construction noise impacts are also evaluated relative to changes in ambient conditions. The threshold for a finding of a significant temporary noise impact relative to construction activities is 10 dB above ambient conditions.

As indicated in Table 1, ambient noise levels at the nearest residences to the north of Lake A in the City of Livermore are approximately 44 dBA $L_{50}$ and 63 dB $L_{max}$ during daytime hours. As a result, the threshold of significance for those residences for short-term construction noise would be 54 dB $L_{50}$ and 73 dB $L_{max}$.

According to Table 8, predicted construction noise levels at the residences on the north side of Lake A would range from 42 to 65 dB $L_{max}$ and 38 to 61 dB $L_{50}$. The predicted noise levels would satisfy the maximum ($L_{max}$) noise level criteria for all aspects of the project construction. In addition, predicted median ($L_{50}$) noise levels would be satisfactory at the northern residences during the construction activities related to the realignment of the Arroyo Del Valle and Arroyo Del Valle to Lake A diversion. **These impacts are considered *less-than-significant*** relative to baseline ambient conditions at the residences on the north side of Lake A.

However, the predicted median noise level of 61 dB $L_{50}$ at the northern residences during the conduit and pipeline installation would exceed the 54 dB $L_{50}$ project standard of significance by 7 dB. As a result, **this impact is considered *significant*** relative to baseline ambient conditions at the residences on the north side of Lake A.

At the nearest residences located on the south side of Vineyard Avenue, Table 1 Indicates that the ambient noise levels are approximately 53 dBA $L_{50}$ and 76 dB $L_{max}$ during daytime hours. As a result, the threshold of significance for those residences for short-term construction noise would be 63 dB $L_{50}$ and 86 dB $L_{max}$.

According to Table 8, predicted construction noise levels at the residences on the south side of Vineyard Avenue would range from 39 to 60 dB $L_{max}$ and 33 to 56 dB $L_{50}$. The predicted noise levels are well below the maximum ($L_{max}$) and median ($L_{50}$) noise level criteria for all aspects of the project construction. As a result, construction noise impacts at the residences located south of Vineyard Avenue are predicted to be ***less-than-significant*** relative to ambient conditions.

**Mitigation for Impact 2:**

**MM 2A** Implement MM 1A which limits construction activities to the hours of 7 am – 7 pm Monday through Friday, and 8 am – 5 pm on Saturday and Sunday hours.

**AND**

**MM 2B** All residences within 500 feet of the conduit and pipeline installation components of the project should be provided notice of the pipeline installation schedule and informed that short-term periods of elevated daytime ambient noise levels could occur during that period.

**AND**

**MM 2C** All mobile equipment shall be fitted with mufflers consistent with manufacturers recommendations & shall be well maintained.

**Significance of Impact 2 after mitigation: *Less than significant*.**

**Impact 3: Construction vibration impacts relative to existing ambient conditions**

The nearest residences to the proposed reclamation areas would be 150 feet or more from the earthmoving equipment. As indicated in Table 9, at distances of 100 feet or more vibration levels are expected to be below 0.03 inches/second. As noted in the criteria section, the threshold for annoyance resulting from project construction is 0.1 inches/second and the threshold for damage to structures is 0.3 inches/second (for older residences). The predicted vibration levels of 0.03 inches/second at the nearest residence is below these thresholds for annoyance and damage to structures. As a result, ***this impact is considered less than significant.***

## Summary of Noise Levels, Impacts and Mitigation Measures

Table 10 provides a summary of predicted noise levels for the various aspects of the project, the noise standard applicable to the sensitive receptors affected by the noise levels, a determination as to whether the proposed activities would result in a significant noise impact, and the required mitigation measures where applicable.

**Table 10**
**Summary of Predicted Noise Levels, Applicable Noise Standards, Impacts and Mitigation Measures**
**Eliot Quarry SMP-23 Reclamation Plan Amendment Project**

| Operation | Receiver Location | Applicable Daytime[1] Noise Standard | Predicted Noise Level (Lmax/ L50) | Noise Impact? | Mitigation Measures | Significance after Mitigation |
|---|---|---|---|---|---|---|
| Realign Arroyo del Valle | Southern Property Plane | Alameda Co: Exempt<br>Pleasanton: 86 dB Lmax<br>CEQA: N/A – no receptors | 68 / 64 | Less-than-significant if construction limited to daytime hours. Significant for nighttime construction. | **MM 1A:** Limit construction to daytime hours | Less Than Significant |
| | Pleasanton Residences South of Vineyard Ave. | Pleasanton: 86 dB Lmax<br>CEQA: 86 Lmax / 63 $L_{50}$ | 60 / 56 | | | |
| | Livermore Residences South of Vineyard Ave. | Livermore: Exempt<br>CEQA: 75 Lmax / 54 $L_{50}$ | 45 / 41 | | | |
| | Livermore Residences North of Lake A | Livermore: Exempt<br>CEQA: 63 Lmax / 54 $L_{50}$ | 42 / 38 | | | |
| Arroyo del Valle to Lake A Diversion | Southern Property Plane | Alameda Co: Exempt<br>Pleasanton: 86 dB Lmax<br>CEQA: 86 Lmax / 63 $L_{50}$ | 60 / 54 | Less-than-significant if construction limited to daytime hours. Significant for nighttime construction. | **MM 1A:** Limit construction to daytime hours | Less Than Significant |
| | Livermore Residences South of Vineyard Ave. | Livermore: Exempt<br>CEQA: 75 Lmax / 54 $L_{50}$ | 58 / 52 | | | |
| | Pleasanton Residences South of Vineyard Ave. | Pleasanton: 86 dB Lmax<br>CEQA: 86 Lmax / 63 $L_{50}$ | 39 / 33 | | | |
| | Livermore Residences North of Lake A | Livermore: Exempt<br>CEQA: 63 Lmax / 54 $L_{50}$ | 50 / 44 | | | |
| Install Conduits and Pipelines | Southern Property Plane | Alameda Co: Exempt<br>Pleasanton: 86 dB Lmax<br>Livermore: Exempt<br>CEQA: 75 Lmax / 54 $L_{50}$ | 53 / 49 | Less-than-significant if construction limited to daytime hours. Significant for nighttime construction. | **MM 2A:** Limit construction to daytime hours | Less Than Significant<br>Less Than Significant |
| | Pleasanton Residences South of Vineyard Ave. | Pleasanton: 86 dB Lmax<br>Livermore: Exempt | 47 / 43 | | | |
| | Livermore Residences South of Vineyard Ave. | Livermore: Exempt<br>CEQA: 75 Lmax / 54 $L_{50}$ | 42 / 38 | | | |
| | Livermore Residences North of Lake A | Livermore: Exempt<br>CEQA: 63 Lmax / 54 $L_{50}$ | 65 / 61 | Short-term increases in ambient noise levels could result in significant impact | **MM 2A:** Limit hours.<br>**MM 2B:** Advanced notification for residences within 500 feet.<br>**MM 2C:** Mufflers | Less Than Significant |

1. "Daytime" term used generically in this study as hours of construction noise exemption vary subtly between the Cities of Livermore and Pleasanton.
2. Source: Bollard Acoustical Consultants, Inc. (BAC), City of Livermore, City of Pleasanton, and Alameda County noise standards, CEQA guidelines.

# Conclusions

This analysis concludes that, following implementation of the identified noise mitigation measures, the proposed reclamation activities would not result in adverse noise impacts at nearby residences relative to Alameda County, City of Pleasanton, and City of Livermore noise standards, as well as relative to measured existing ambient conditions.

This concludes BAC's analysis of the CEMEX Eliot Mine Lake A and B reclamation project. Please contact BAC at (916) 663-0500 or Info@bacnoise.com with any questions or comments on this analysis.

**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.

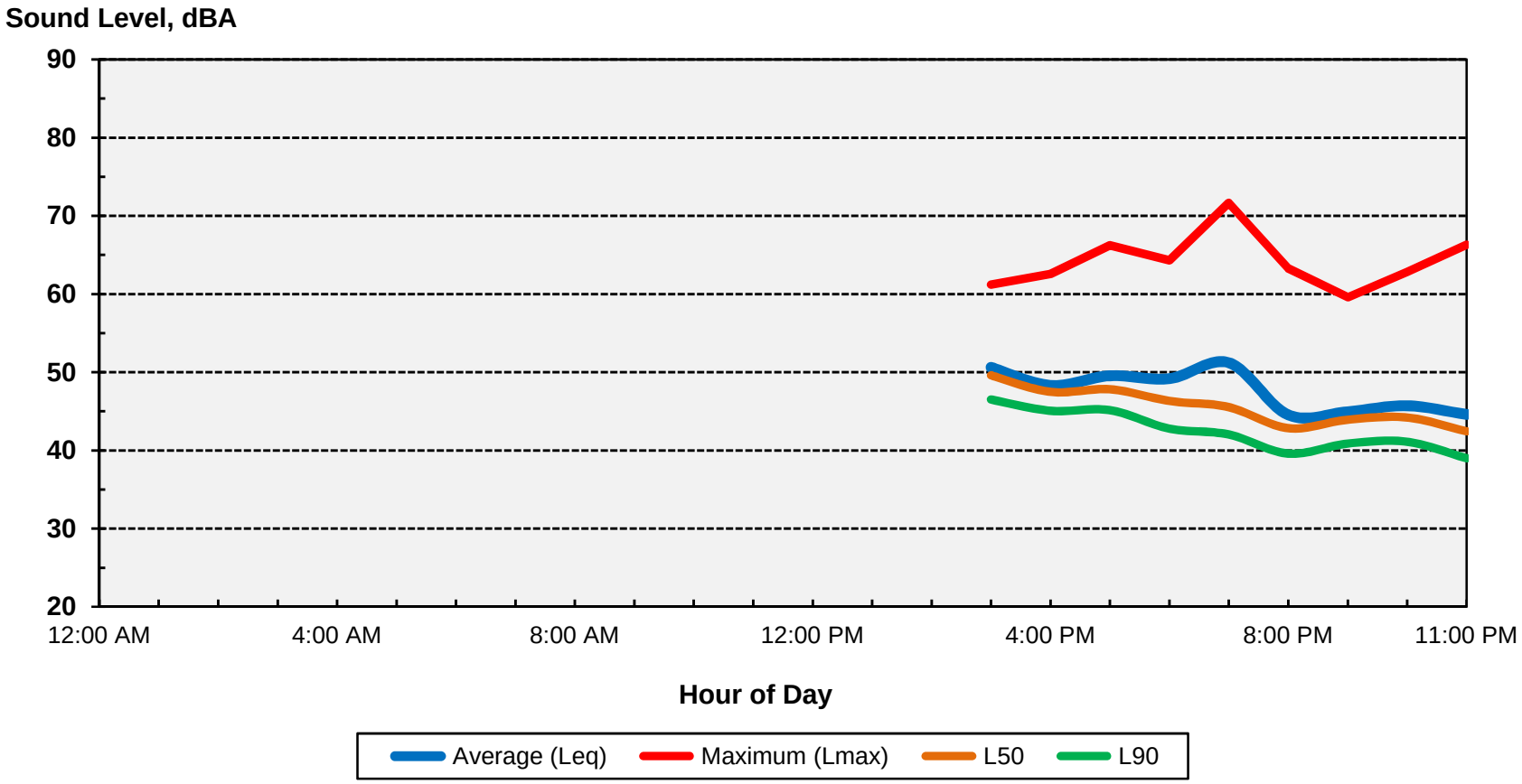
**Sabin** The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.

**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**
**Ambient Noise Monitoring Results - Site 1**
**Eliot Quarry Reclamation Plan Amendment Project**
**Thursday, October 04, 2018**




**Ldn: 47 dB**

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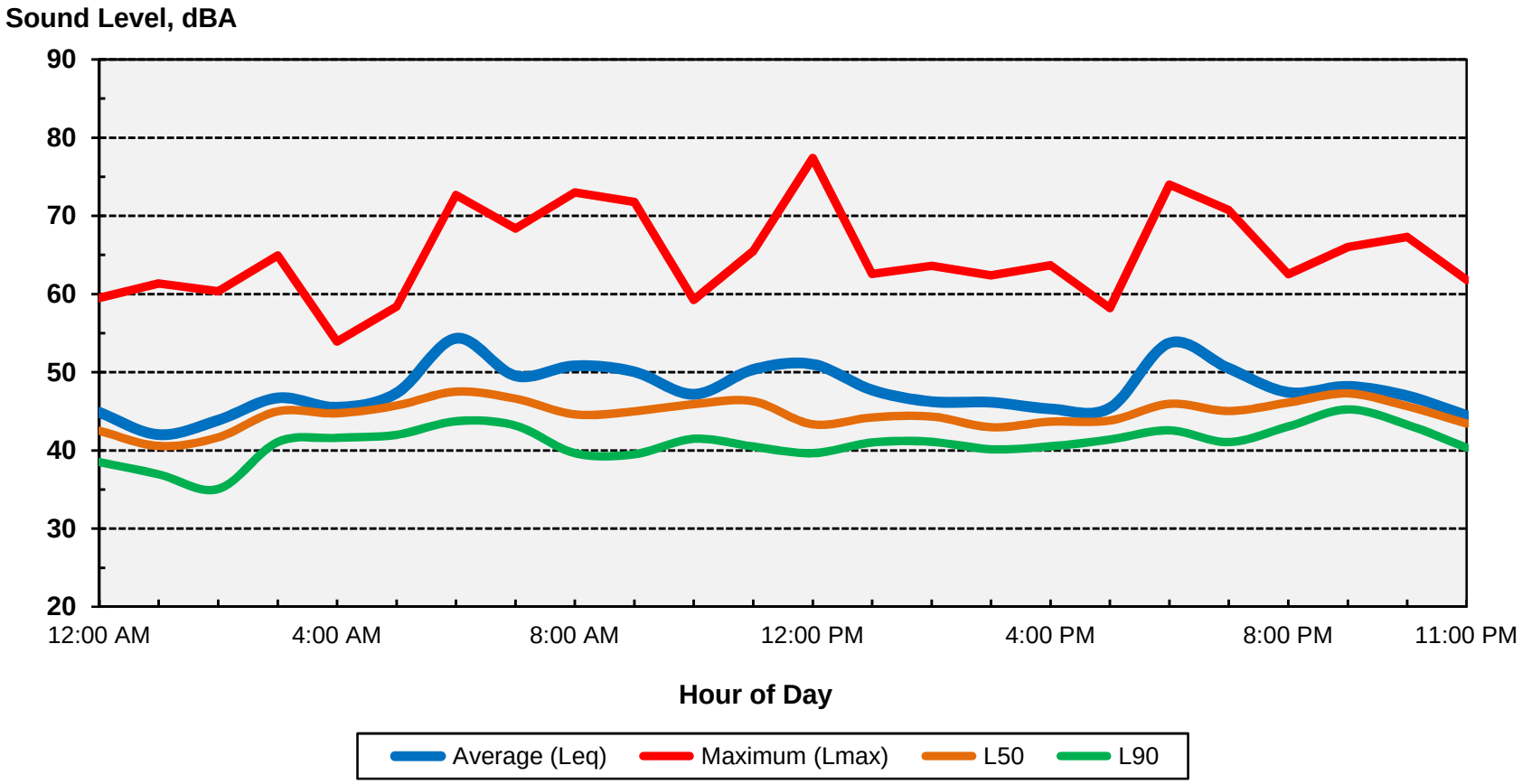
**Appendix B-2**
**Ambient Noise Monitoring Results - Site 1**
**Eliot Quarry Reclamation Plan Amendment Project**
**Friday, October 05, 2018**




**Ldn: 55 dB**

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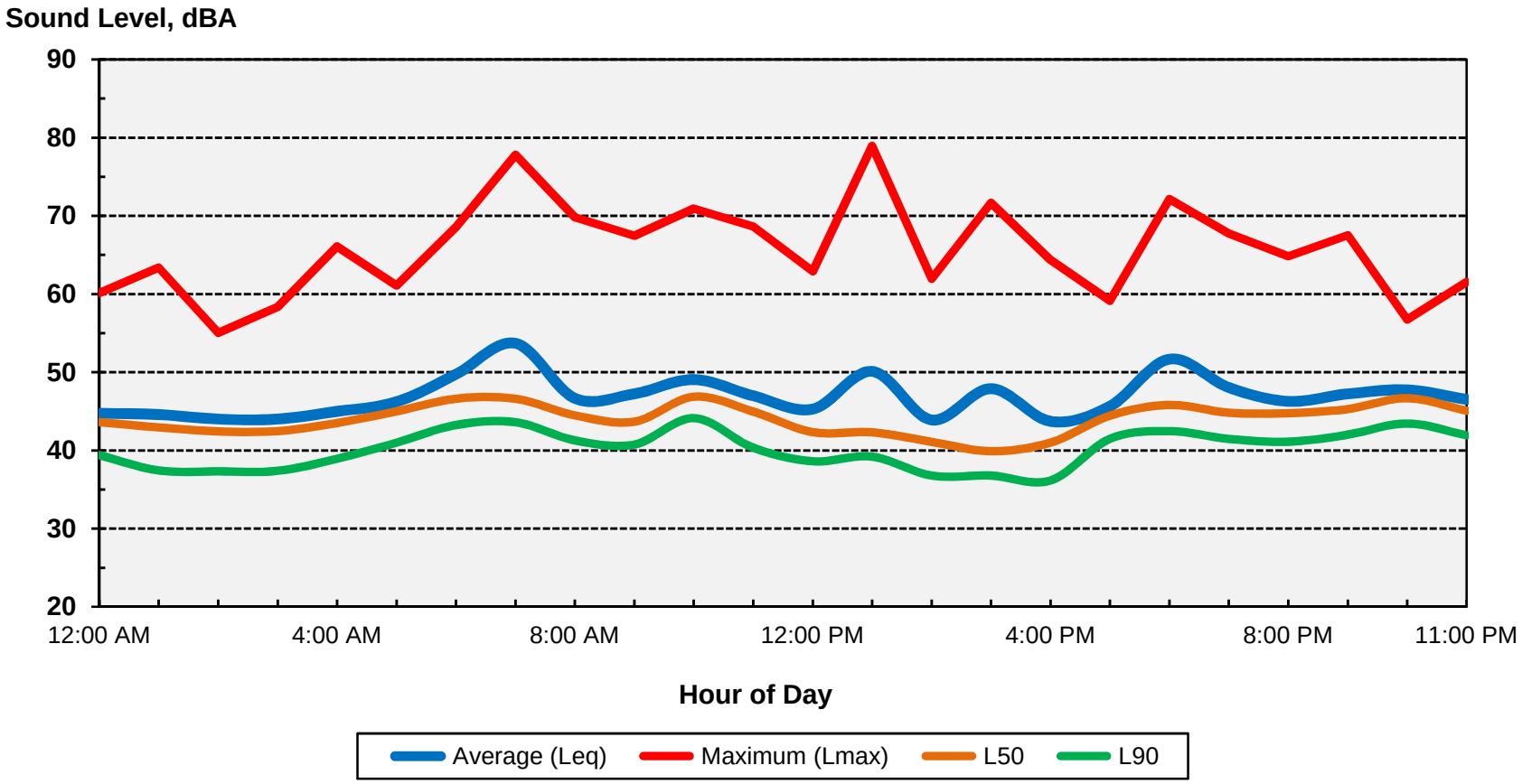
**Appendix B-3**
**Ambient Noise Monitoring Results - Site 1**
**Eliot Quarry Reclamation Plan Amendment Project**
**Saturday, October 06, 2018**




**Ldn: 53 dB**

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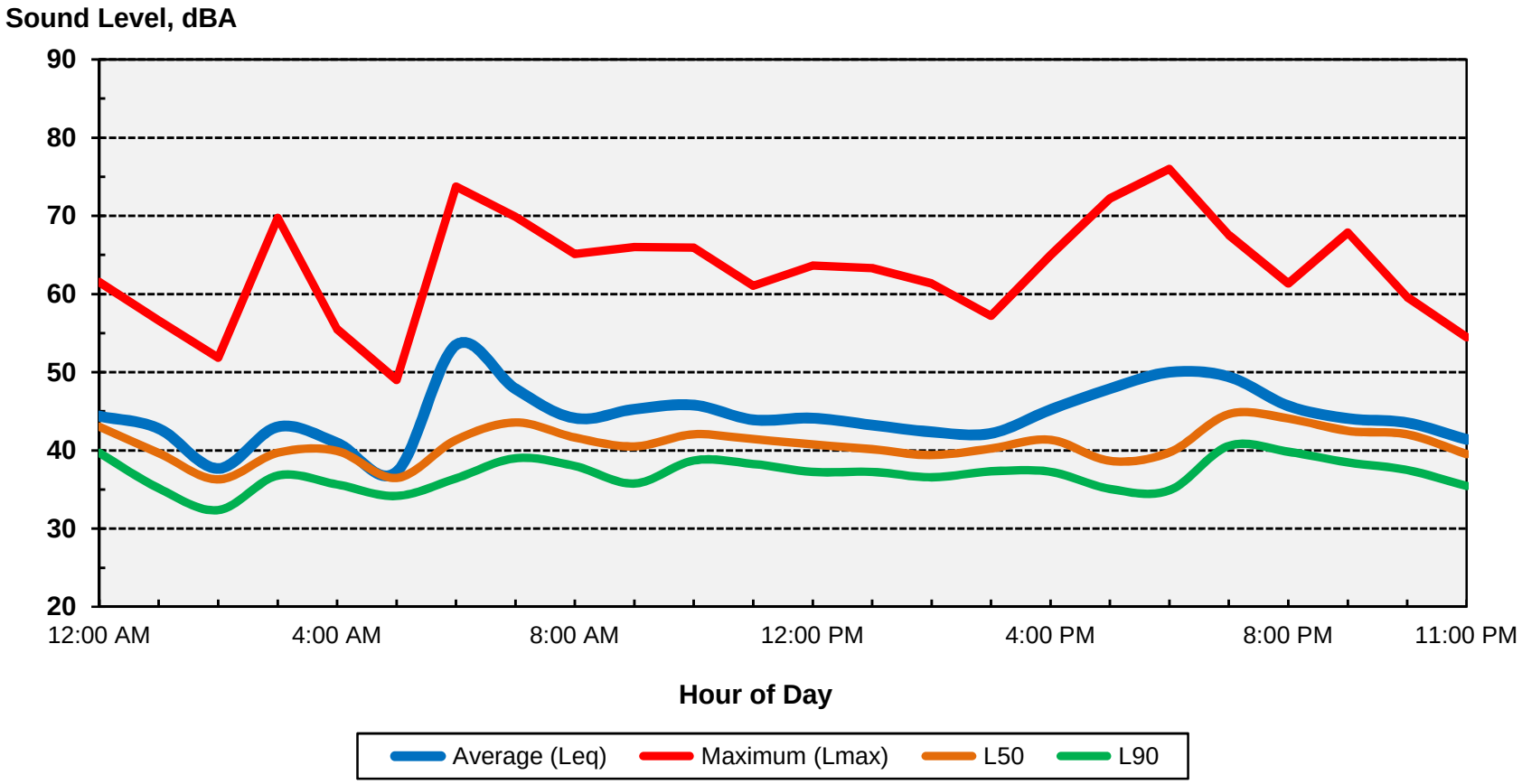
**Appendix B-4**
**Ambient Noise Monitoring Results - Site 1**
**Eliot Quarry Reclamation Plan Amendment Project**
**Sunday, October 07, 2018**




**Ldn: 52 dB**

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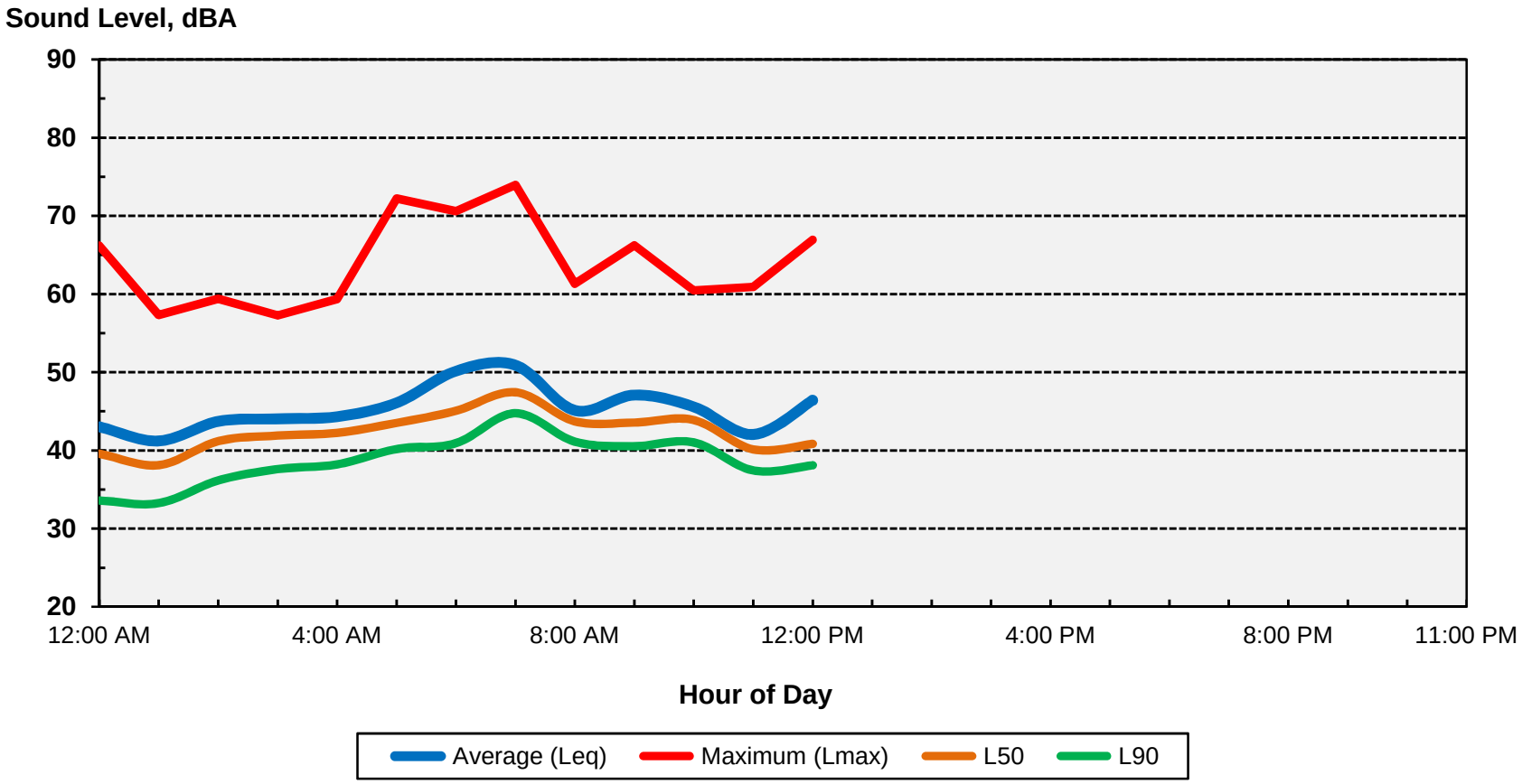
**Appendix B-5**
**Ambient Noise Monitoring Results - Site 1**
**Eliot Quarry Reclamation Plan Amendment Project**
**Monday, October 08, 2018**




**Ldn: 51 dB**

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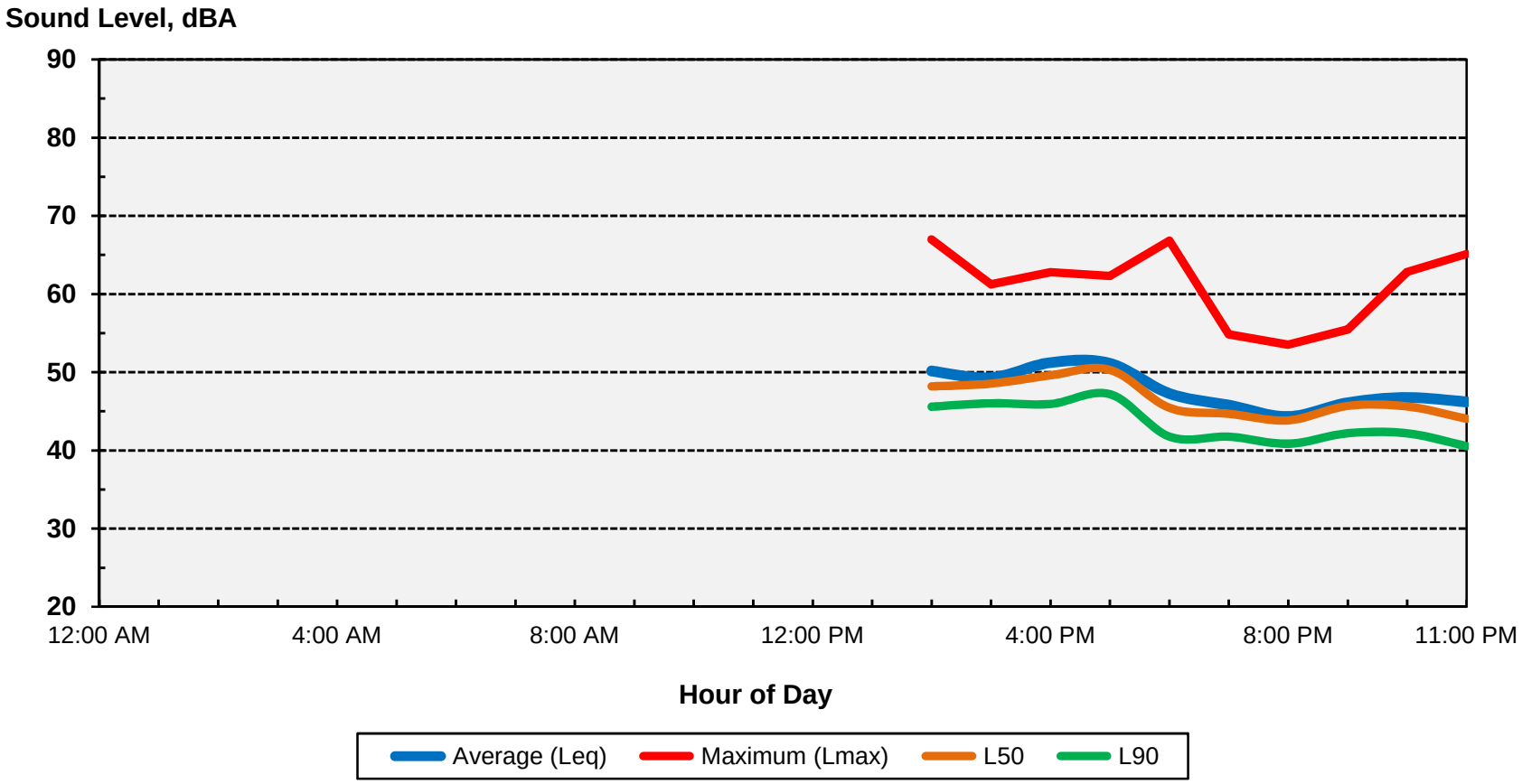
**Appendix B-6**
**Ambient Noise Monitoring Results - Site 2**
**Eliot Quarry Reclamation Plan Amendment Project**
**Thursday, October 04, 2018**




**Ldn: 48 dB**

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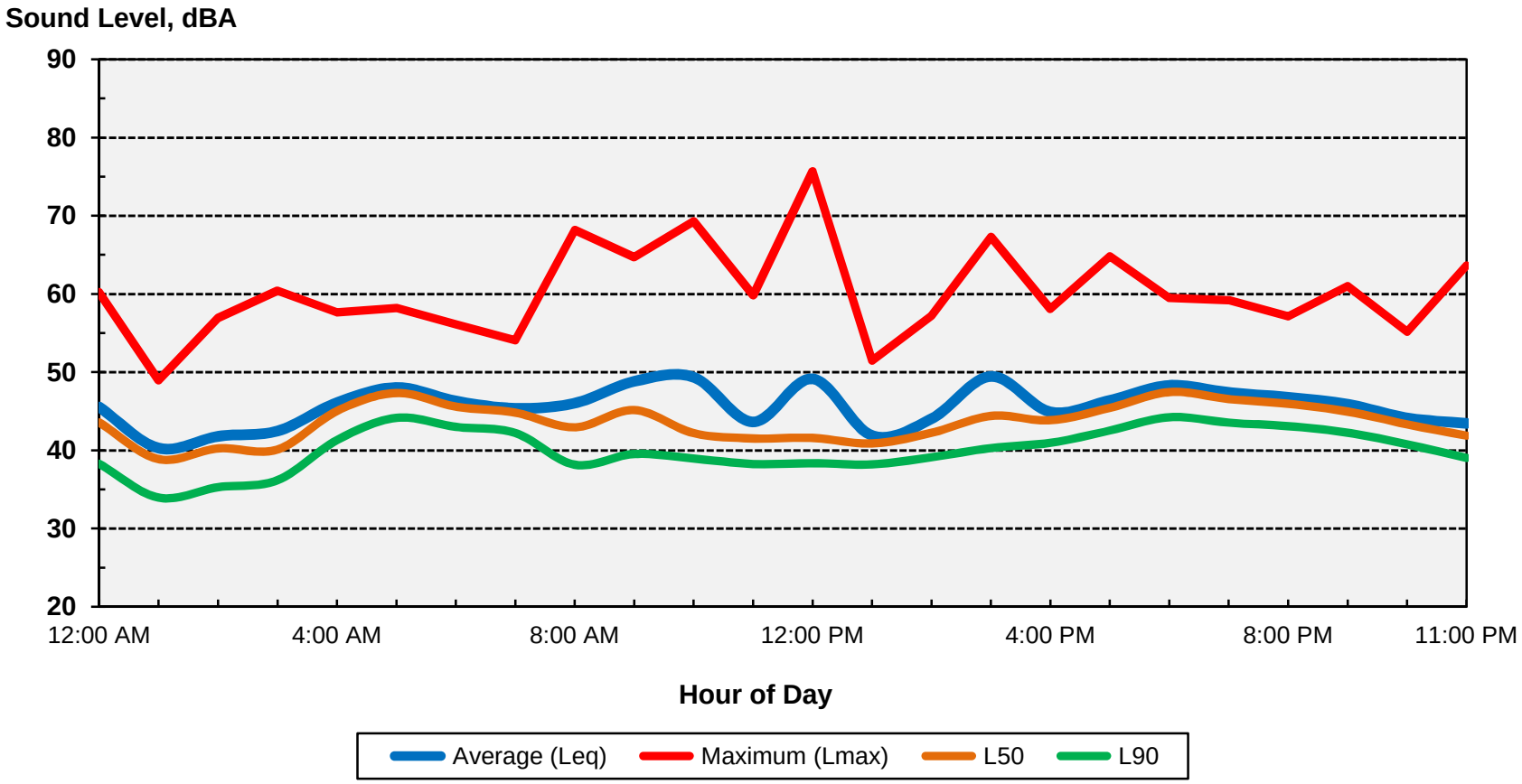
**Appendix B-7**
**Ambient Noise Monitoring Results - Site 2**
**Eliot Quarry Reclamation Plan Amendment Project**
**Friday, October 05, 2018**




**Ldn: 52 dB**

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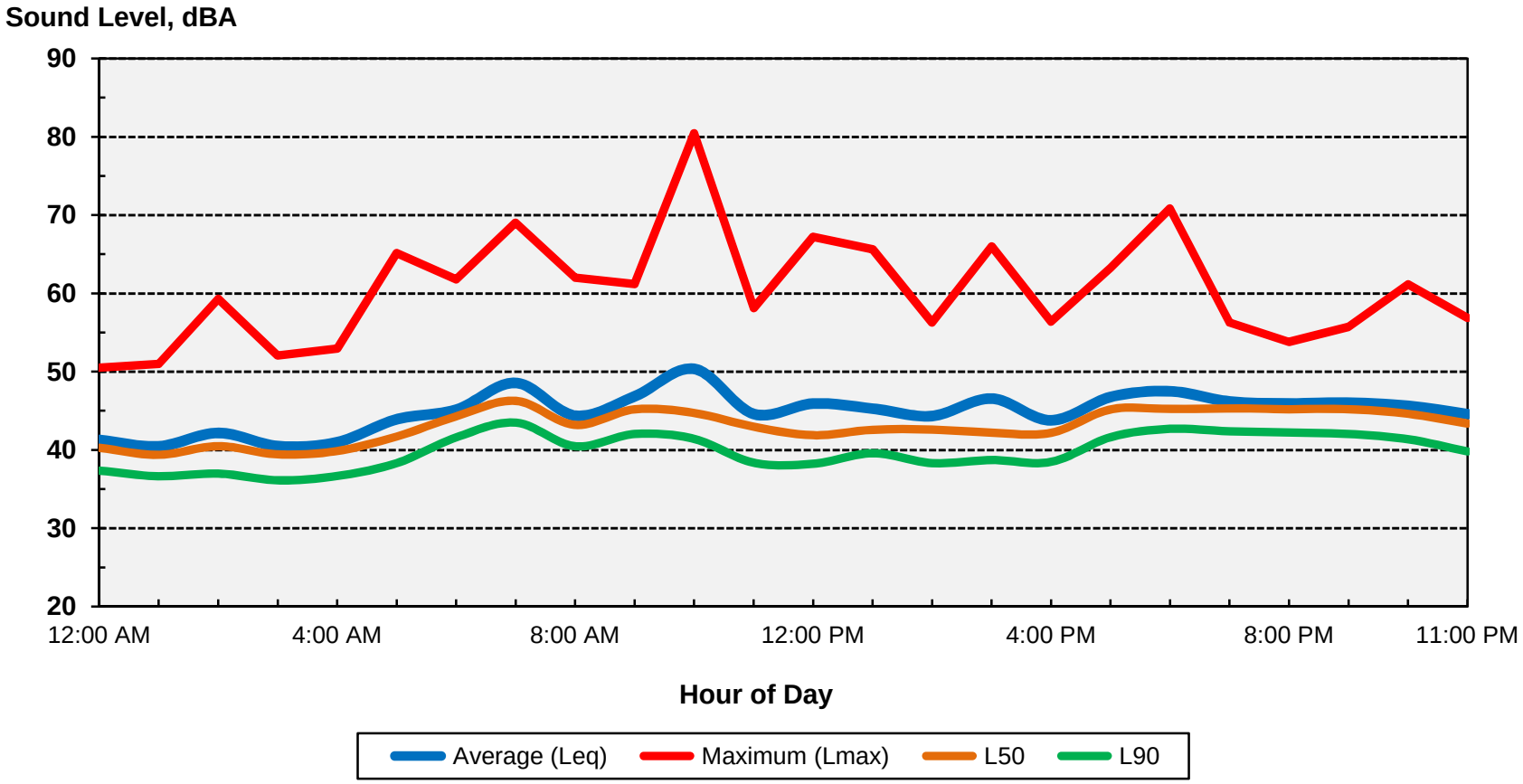
**Appendix B-8**
**Ambient Noise Monitoring Results - Site 2**
**Eliot Quarry Reclamation Plan Amendment Project**
**Saturday, October 06, 2018**




**Ldn: 50 dB**

BOLLARD
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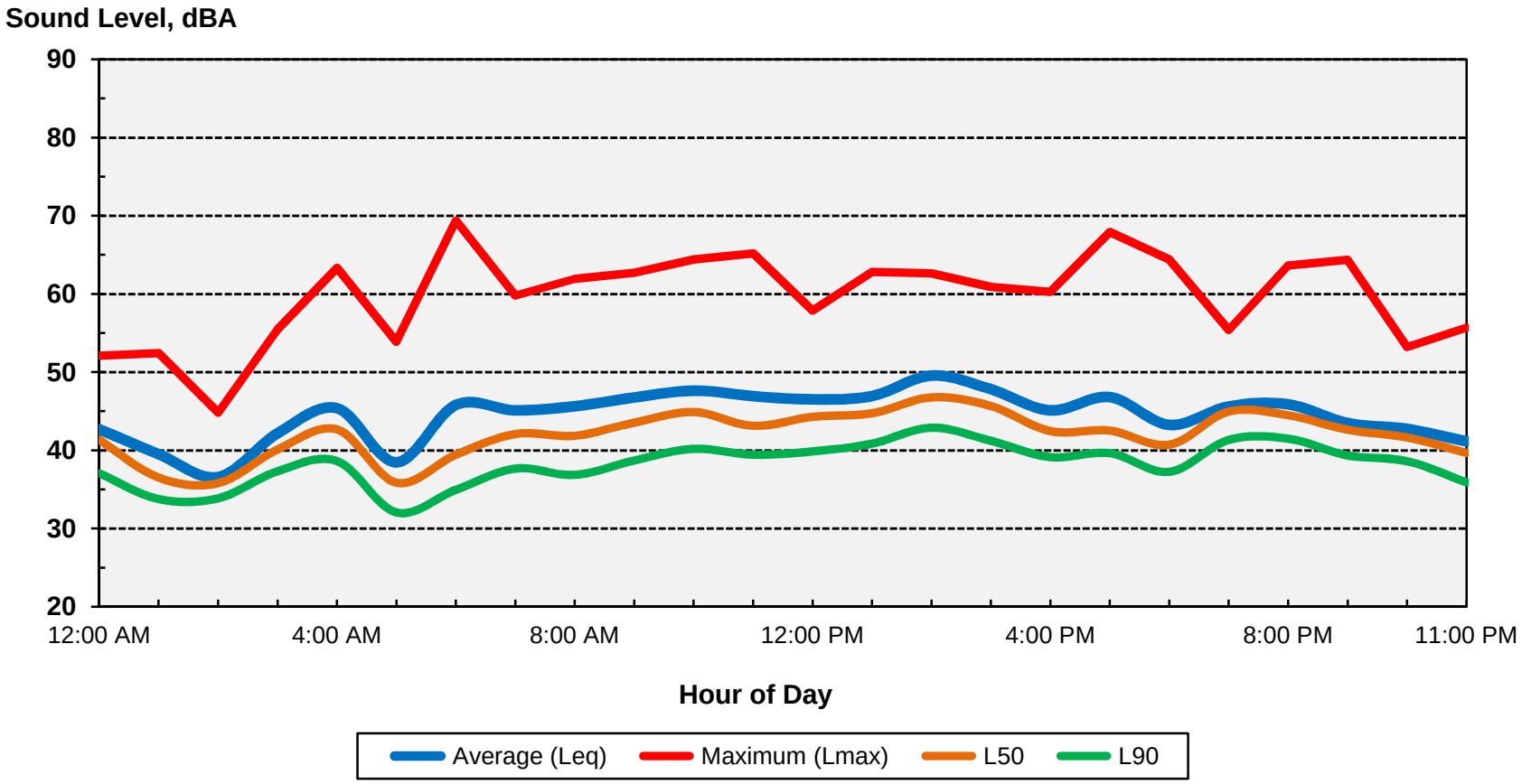
**Appendix B-9**
**Ambient Noise Monitoring Results - Site 2**
**Eliot Quarry Reclamation Plan Amendment Project**
**Sunday, October 07, 2018**




**Ldn: 50 dB**

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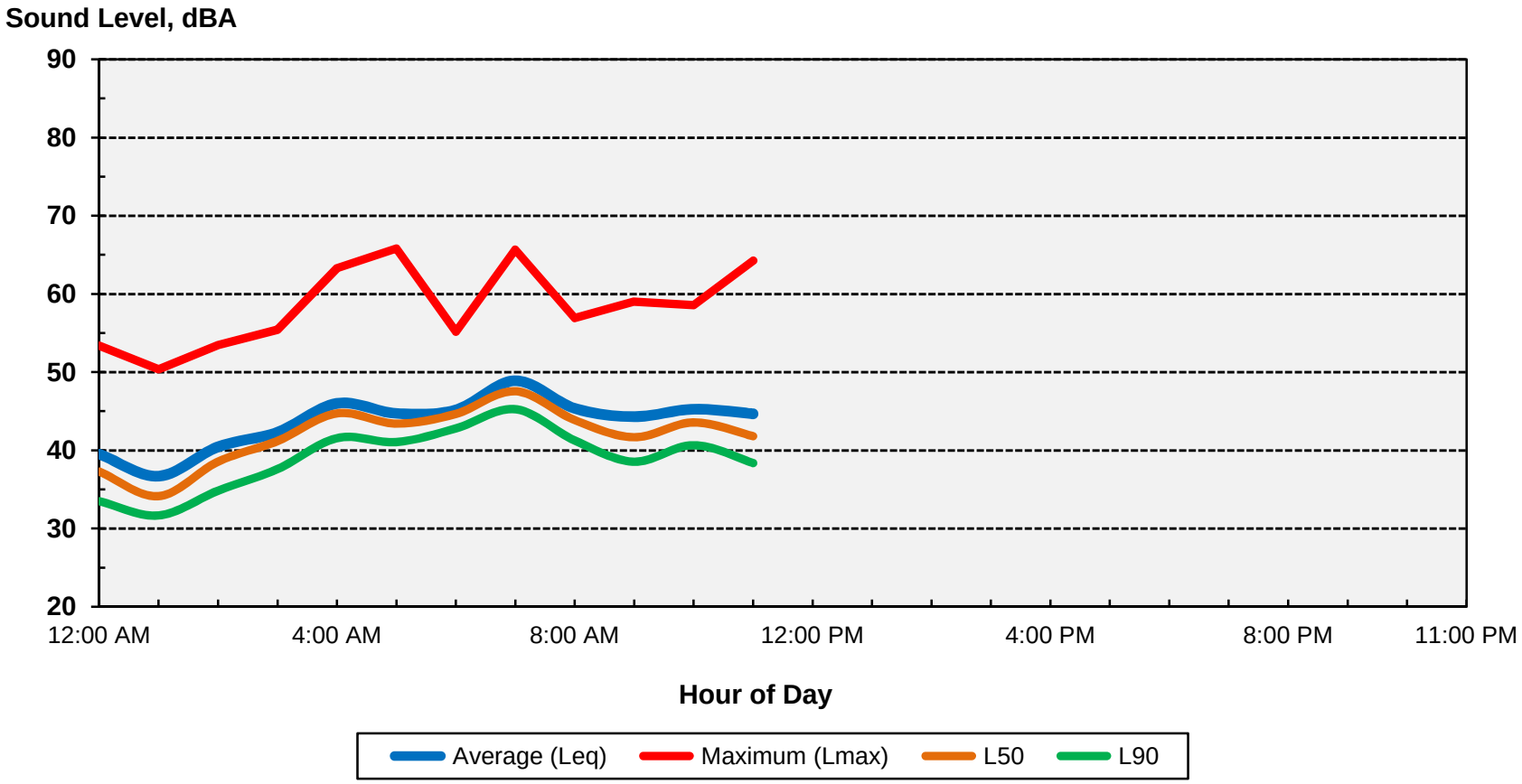
**Appendix B-10**
**Ambient Noise Monitoring Results - Site 2**
**Eliot Quarry Reclamation Plan Amendment Project**
**Monday, October 08, 2018**




**Ldn: 48 dB**

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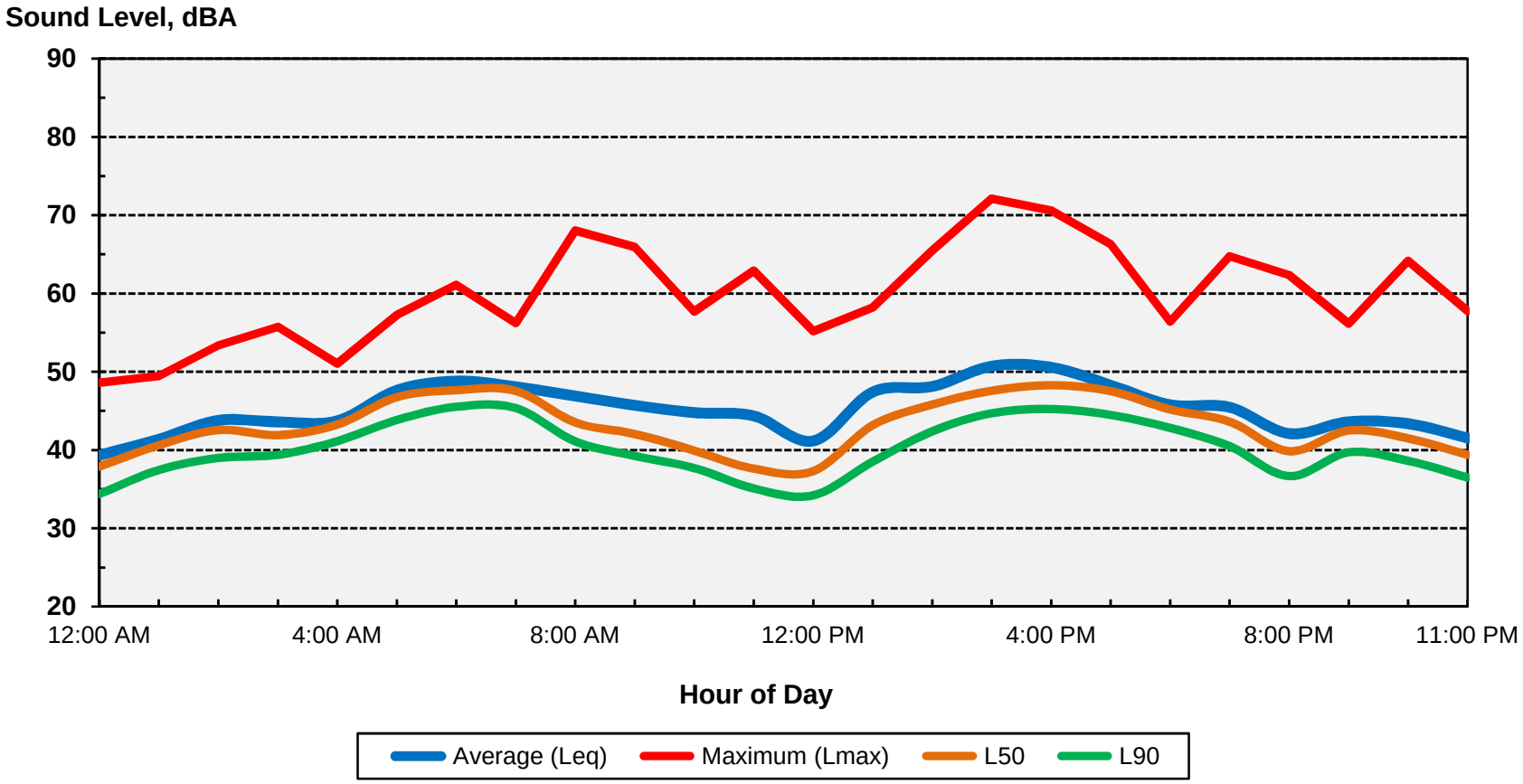
**Appendix B-11**
**Ambient Noise Monitoring Results - Site 3**
**Eliot Quarry Reclamation Plan Amendment Project**
**Thursday, September 27, 2018**




**Ldn: 54 dB**

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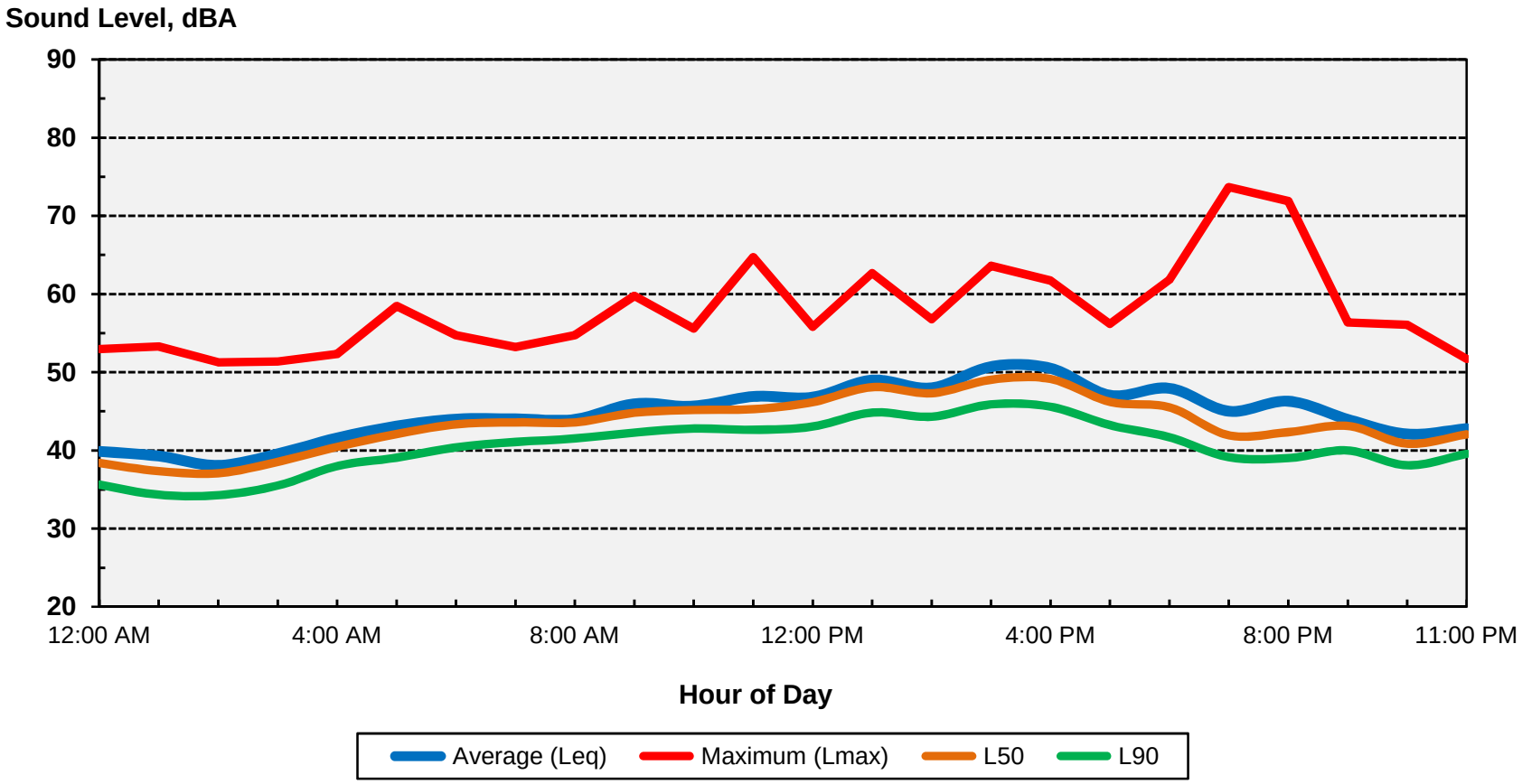
**Appendix B-12**
**Ambient Noise Monitoring Results - Site 3**
**Eliot Quarry Reclamation Plan Amendment Project**
**Friday, September 28, 2018**




**Ldn: 49 dB**

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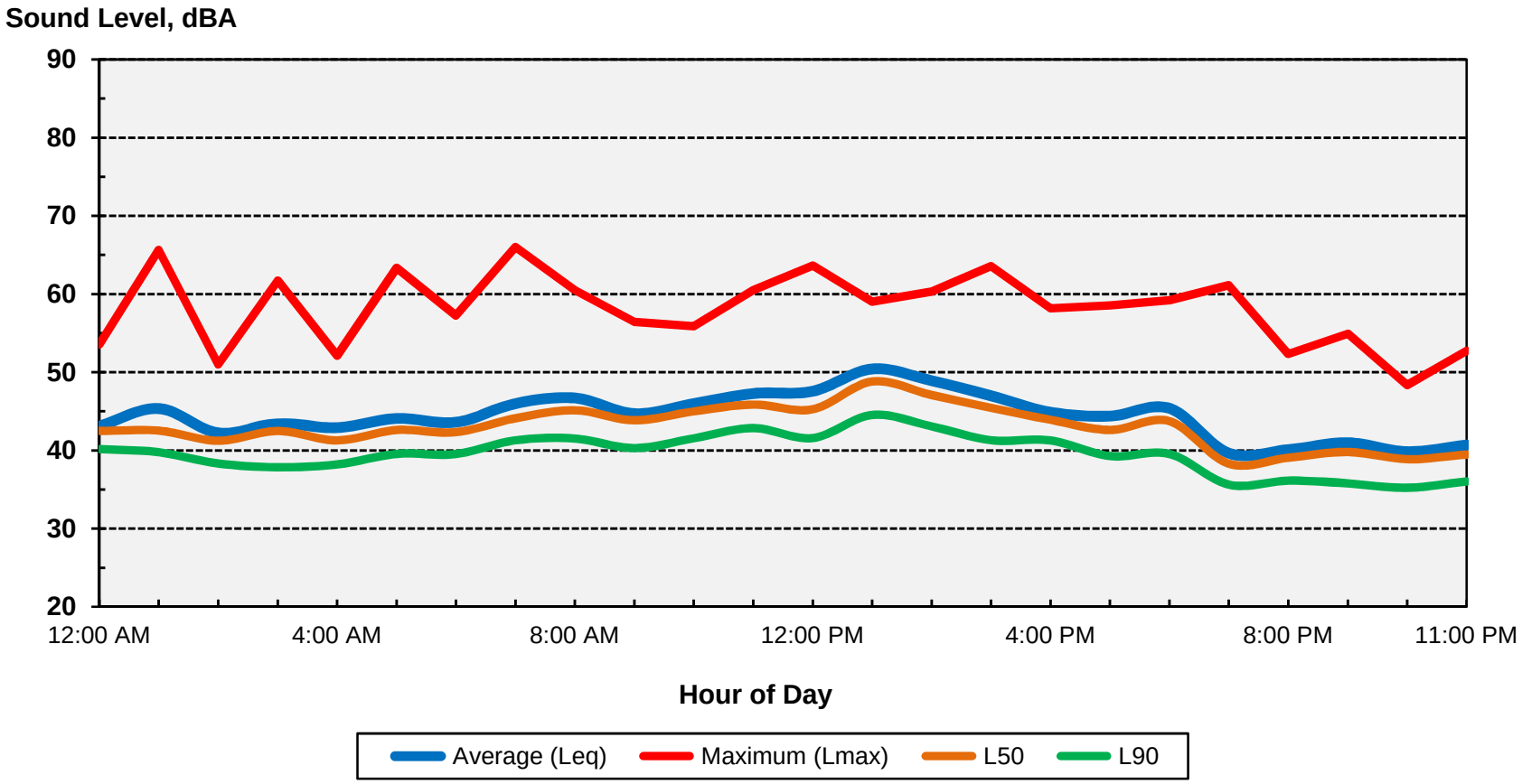
**Appendix B-13**
**Ambient Noise Monitoring Results - Site 3**
**Eliot Quarry Reclamation Plan Amendment Project**
**Saturday, September 29, 2018**




**Ldn: 50 dB**

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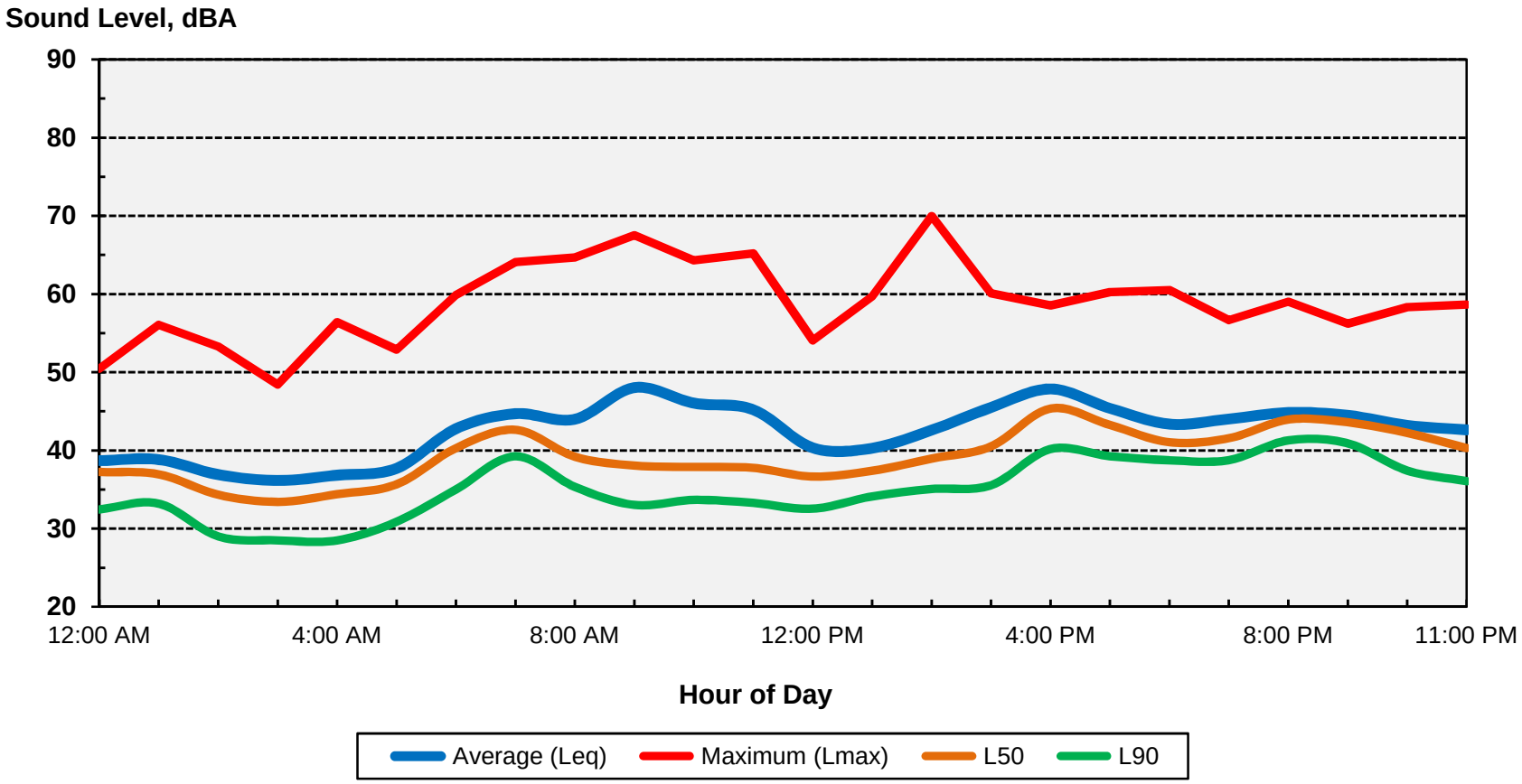
Acoustical Consultants

**Appendix B-14**
**Ambient Noise Monitoring Results - Site 3**
**Eliot Quarry Reclamation Plan Amendment Project**
**Sunday, September 30, 2018**




**Ldn: 48 dB**

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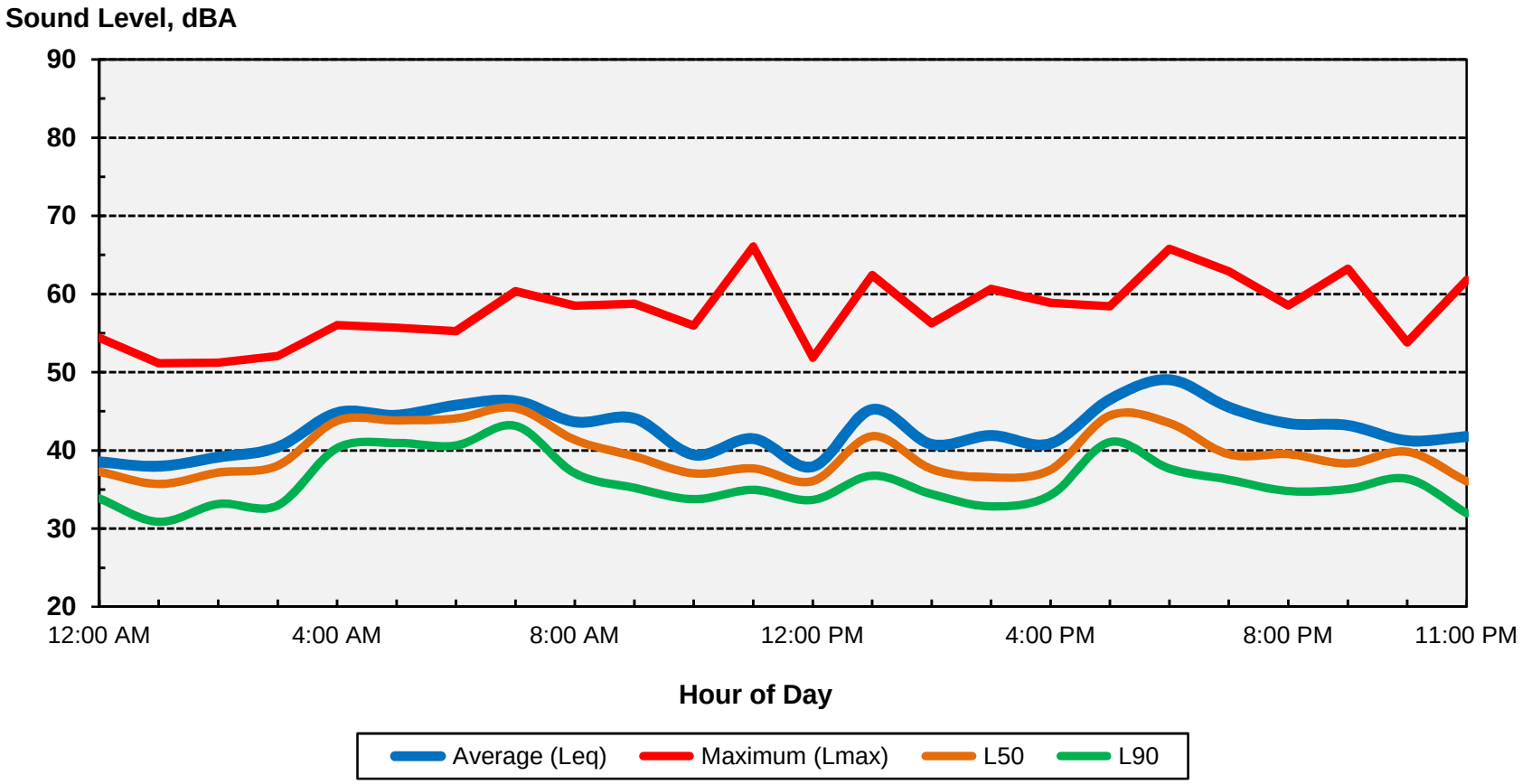
Acoustical Consultants

**Appendix B-15**
**Ambient Noise Monitoring Results - Site 3**
**Eliot Quarry Reclamation Plan Amendment Project**
**Monday, October 01, 2018**




**Ldn: 49 dB**

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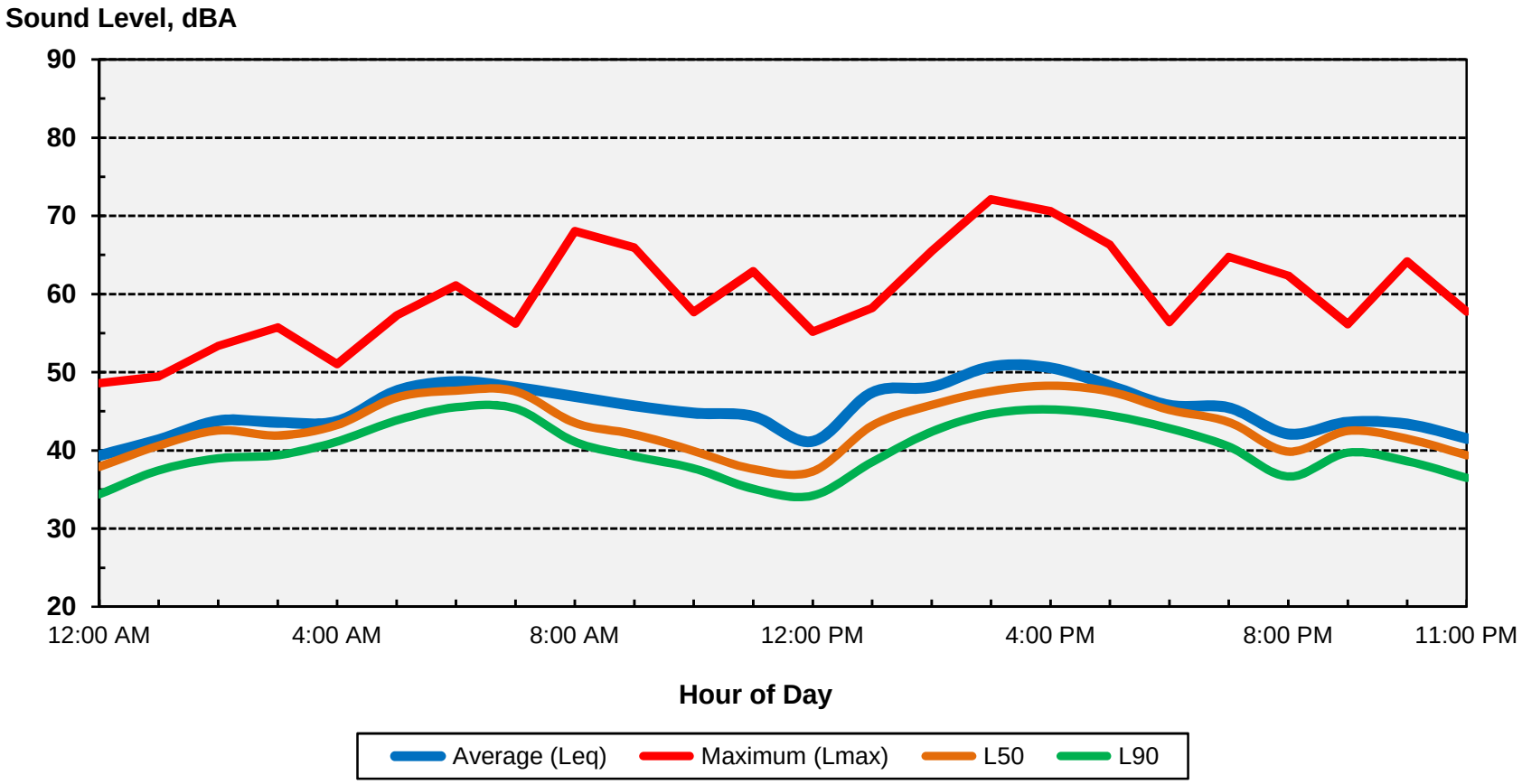
**Appendix B-16**
**Ambient Noise Monitoring Results - Site 4**
**Eliot Quarry Reclamation Plan Amendment Project**
**Thursday, September 27, 2018**




**Ldn: 62 dB**

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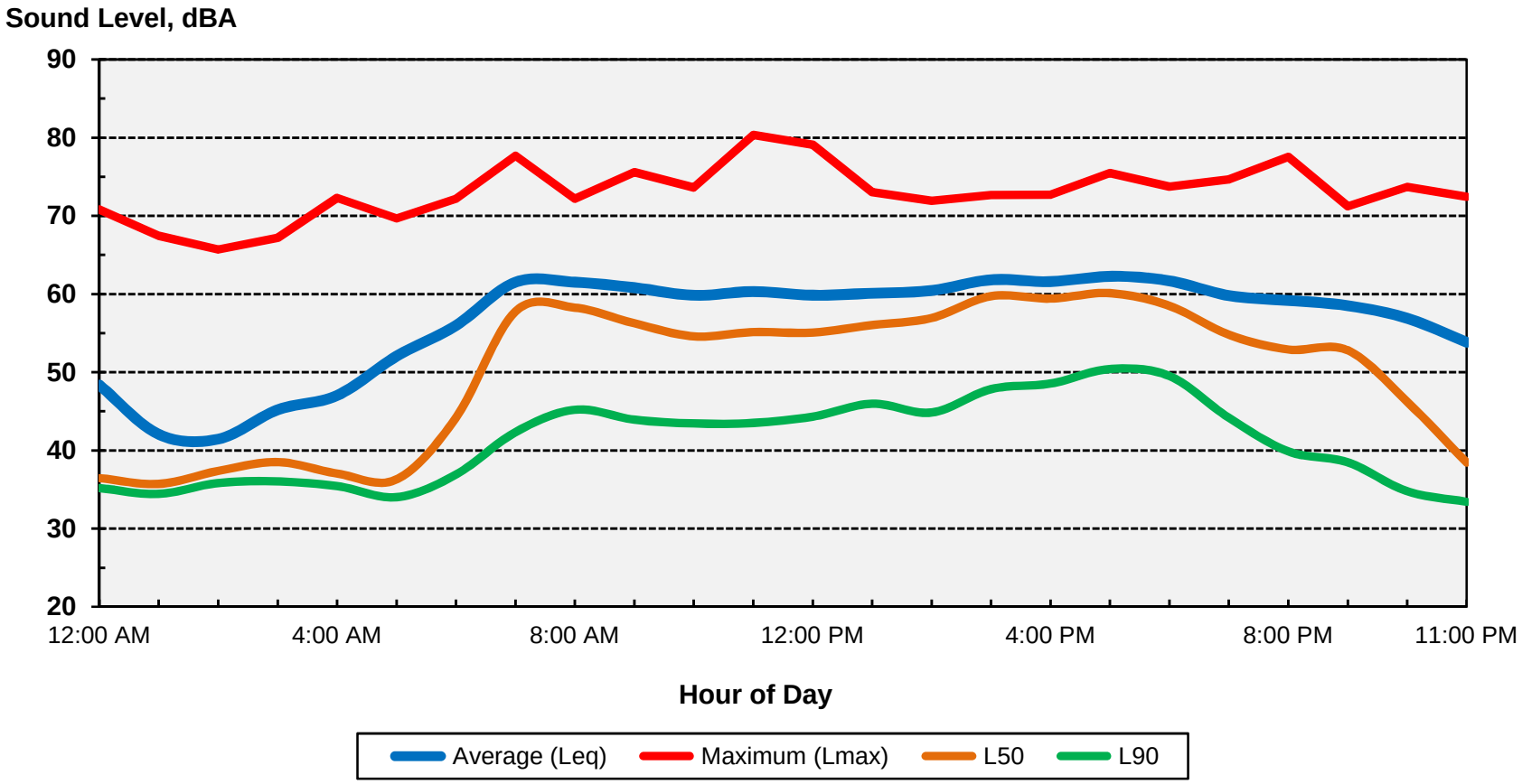
**Appendix B-17**
**Ambient Noise Monitoring Results - Site 4**
**Eliot Quarry Reclamation Plan Amendment Project**
**Friday, September 28, 2018**




**Ldn: 61 dB**

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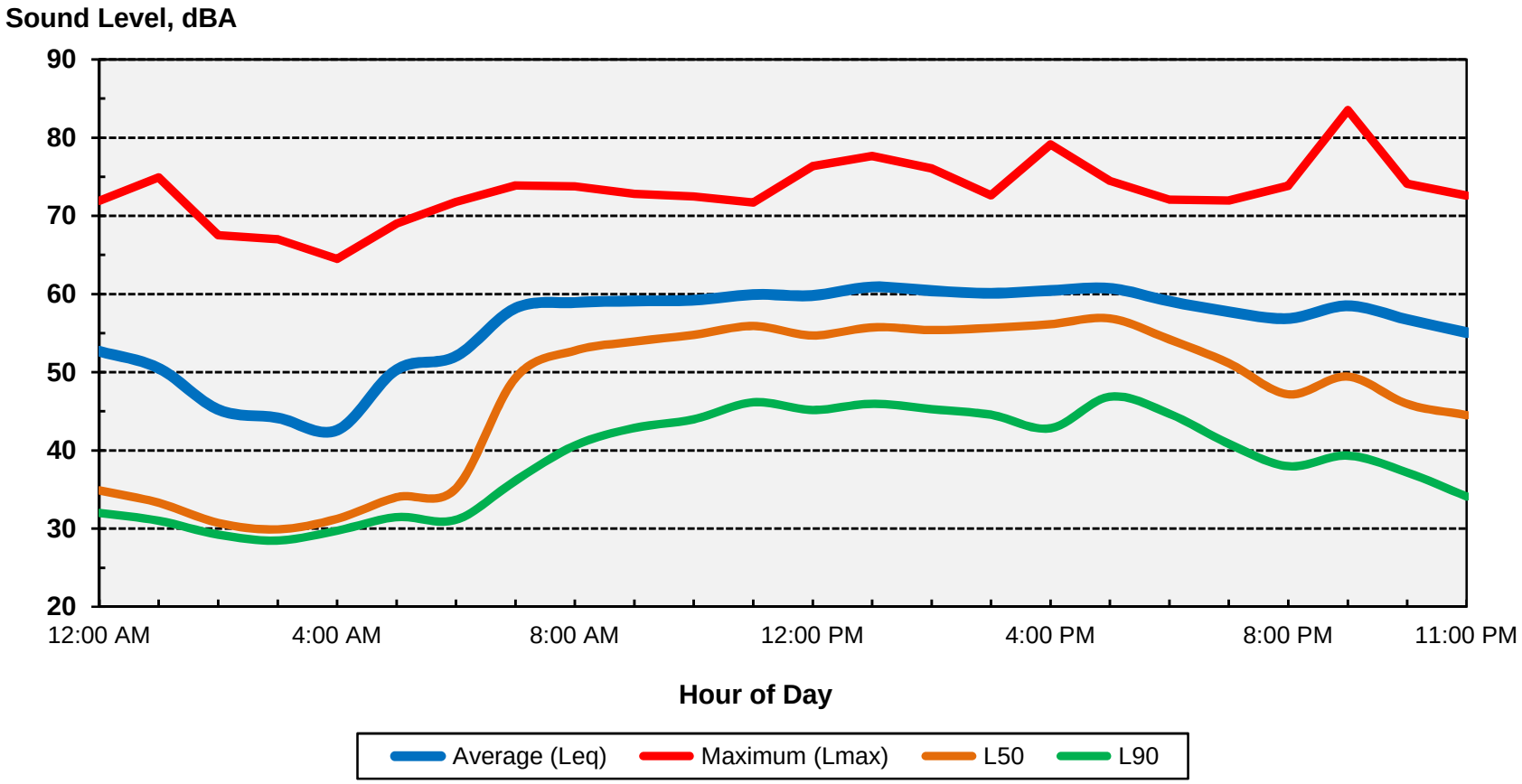
**Appendix B-18**
**Ambient Noise Monitoring Results - Site 4**
**Eliot Quarry Reclamation Plan Amendment Project**
**Saturday, September 29, 2018**




**Ldn: 61 dB**

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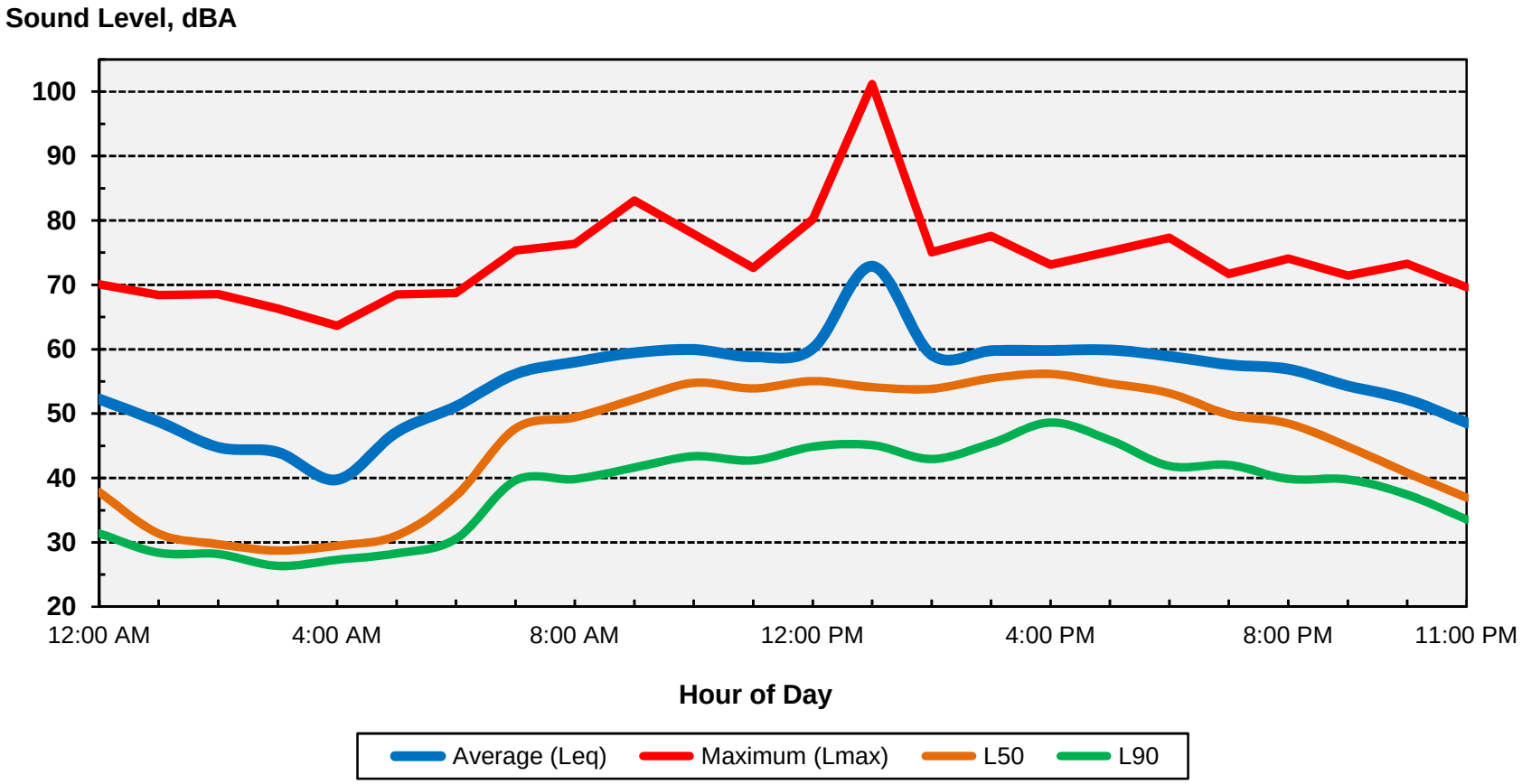
**Appendix B-19**
**Ambient Noise Monitoring Results - Site 4**
**Eliot Quarry Reclamation Plan Amendment Project**
**Sunday, September 30, 2018**




**Ldn: 62 dB**

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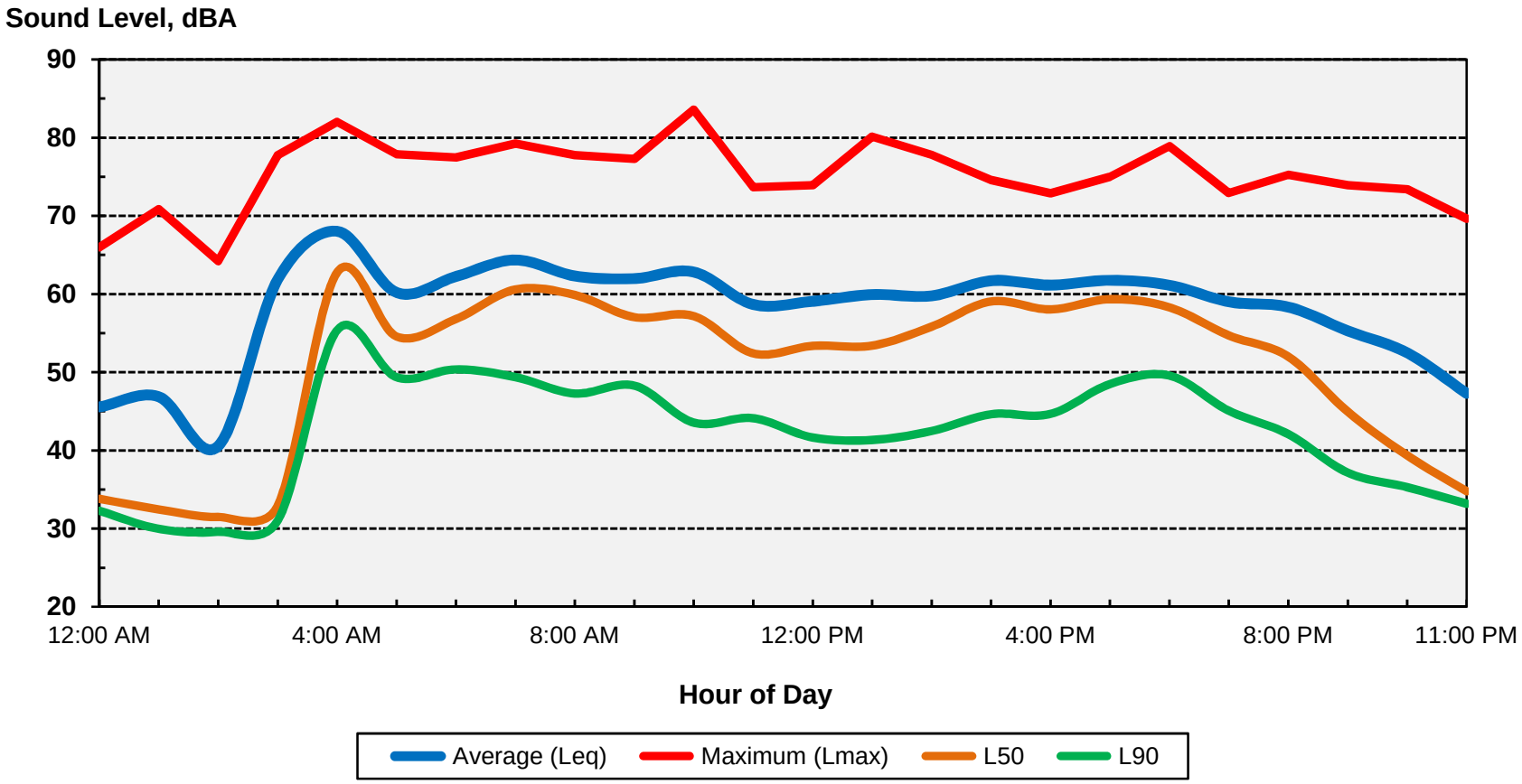
**Appendix B-20**
**Ambient Noise Monitoring Results - Site 4**
**Eliot Quarry Reclamation Plan Amendment Project**
**Monday, October 01, 2018**




**Ldn: 67 dB**

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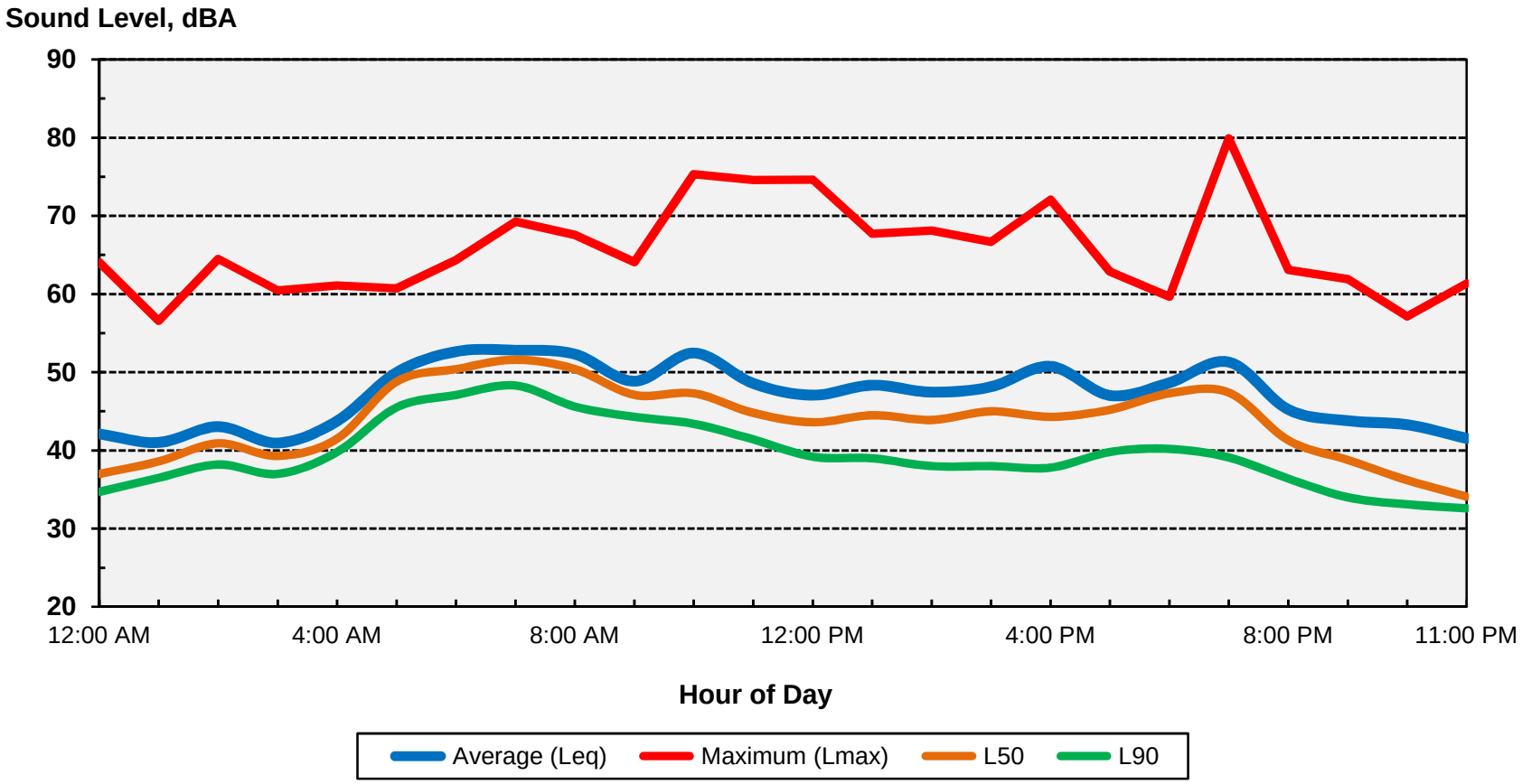
**Appendix B-21**
**Ambient Noise Monitoring Results - Site 5**
**Eliot Quarry Reclamation Plan Amendment Project**
**Thursday, September 27, 2018**




**Ldn: 54 dB**

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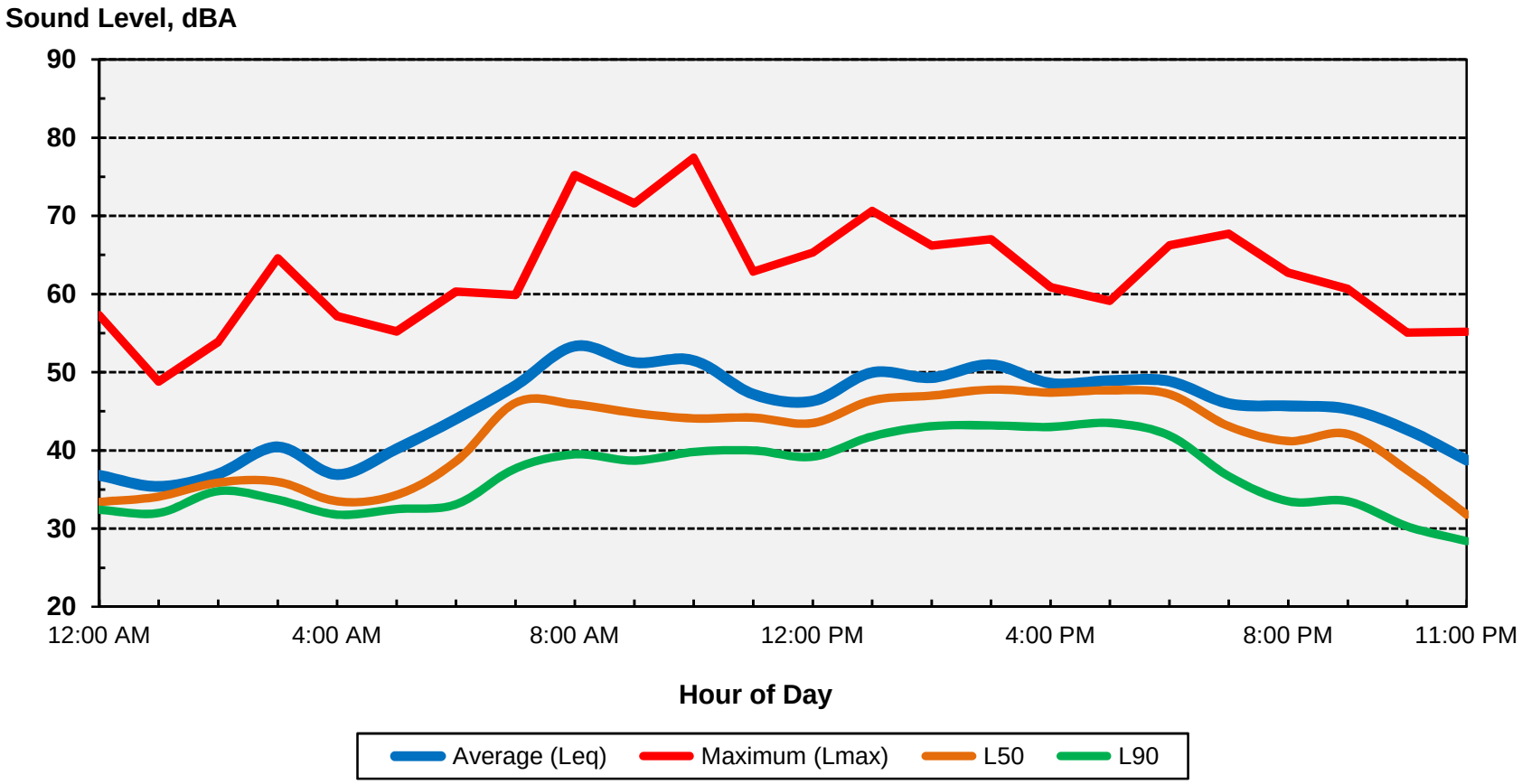
**Appendix B-22**
**Ambient Noise Monitoring Results - Site 5**
**Eliot Quarry Reclamation Plan Amendment Project**
**Friday, September 28, 2018**




**Ldn: 50 dB**

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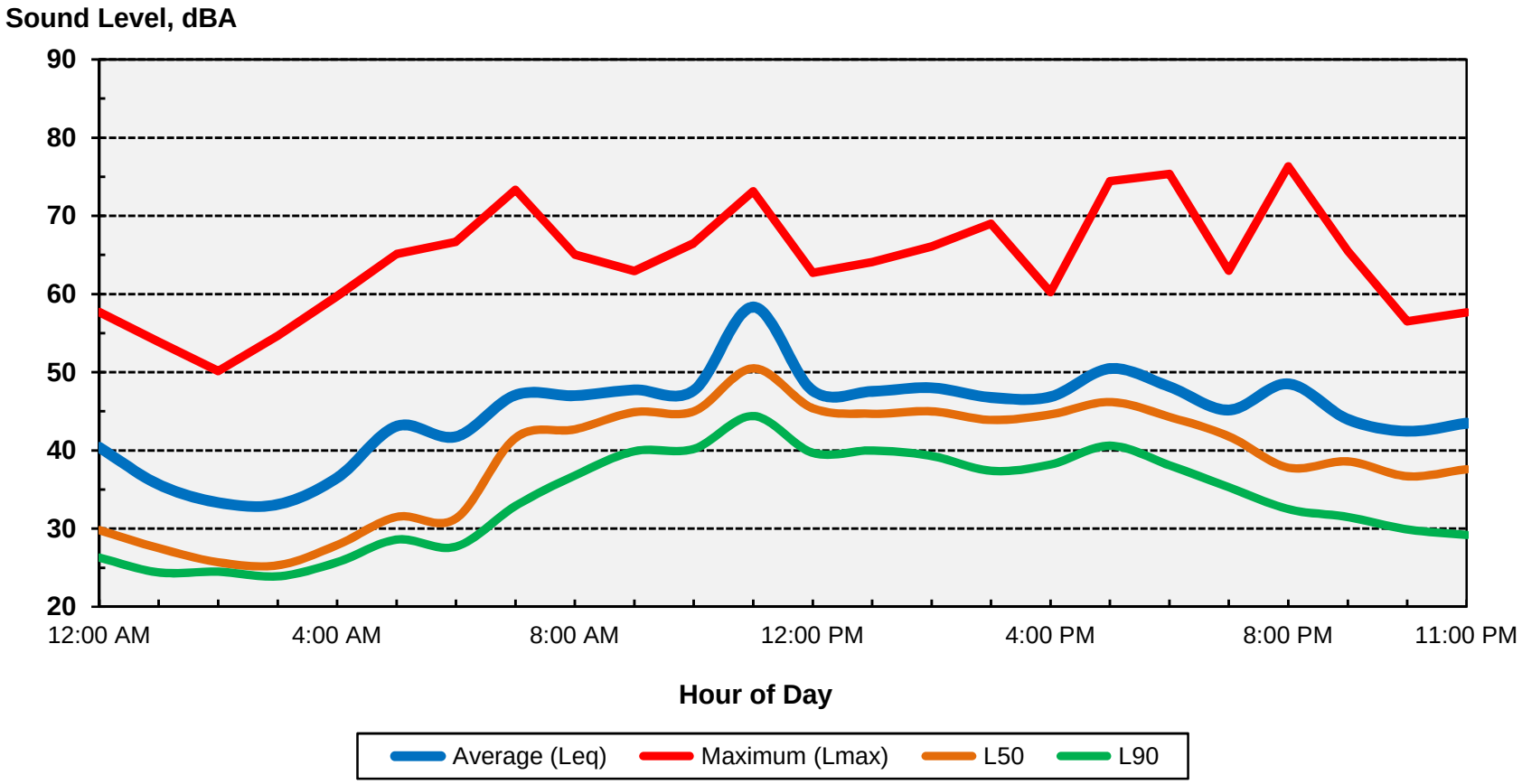
**Appendix B-23**
**Ambient Noise Monitoring Results - Site 5**
**Eliot Quarry Reclamation Plan Amendment Project**
**Saturday, September 29, 2018**




**Ldn: 50 dB**

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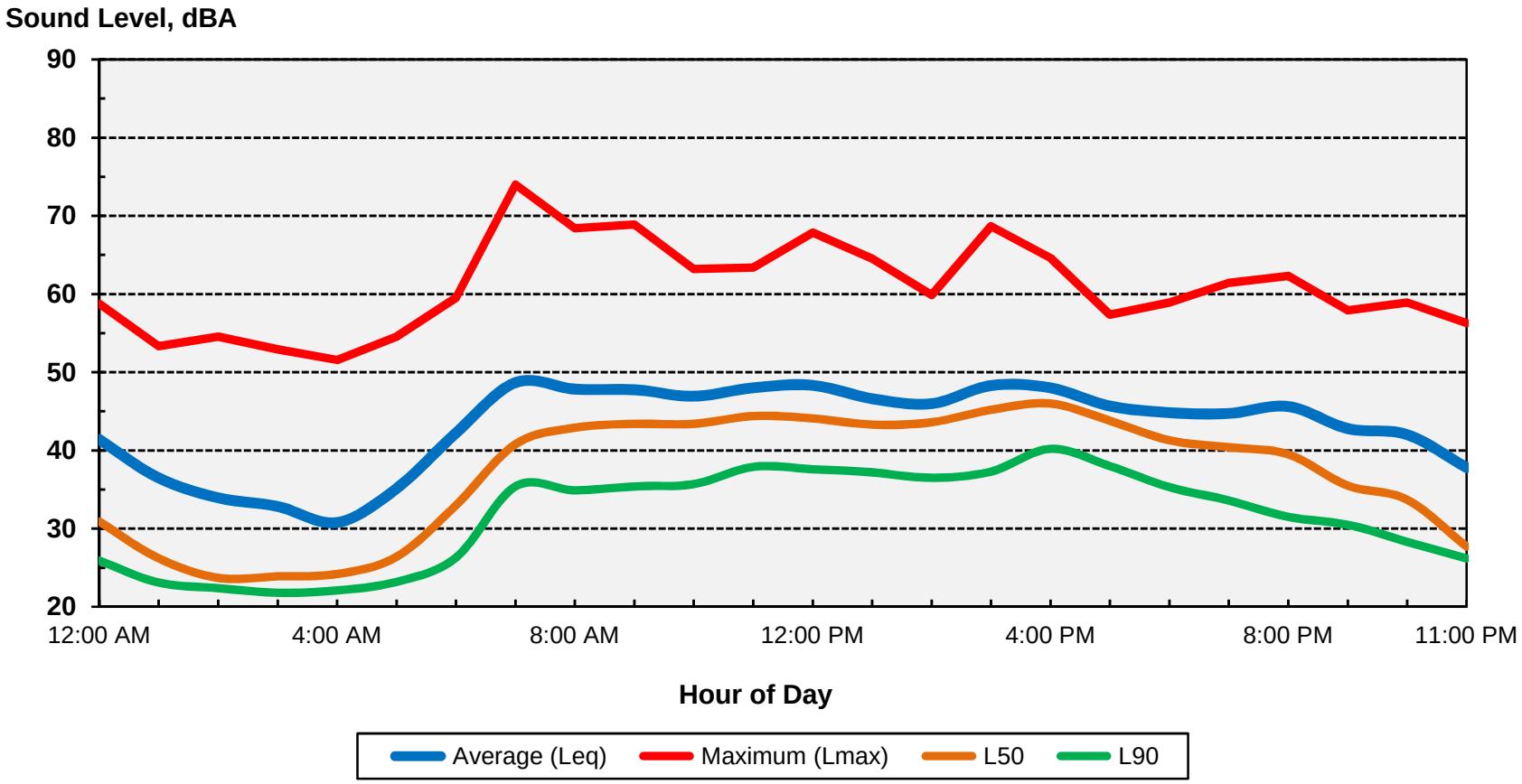
**Appendix B-24**
**Ambient Noise Monitoring Results - Site 5**
**Eliot Quarry Reclamation Plan Amendment Project**
**Sunday, September 30, 2018**




**Ldn: 48 dB**

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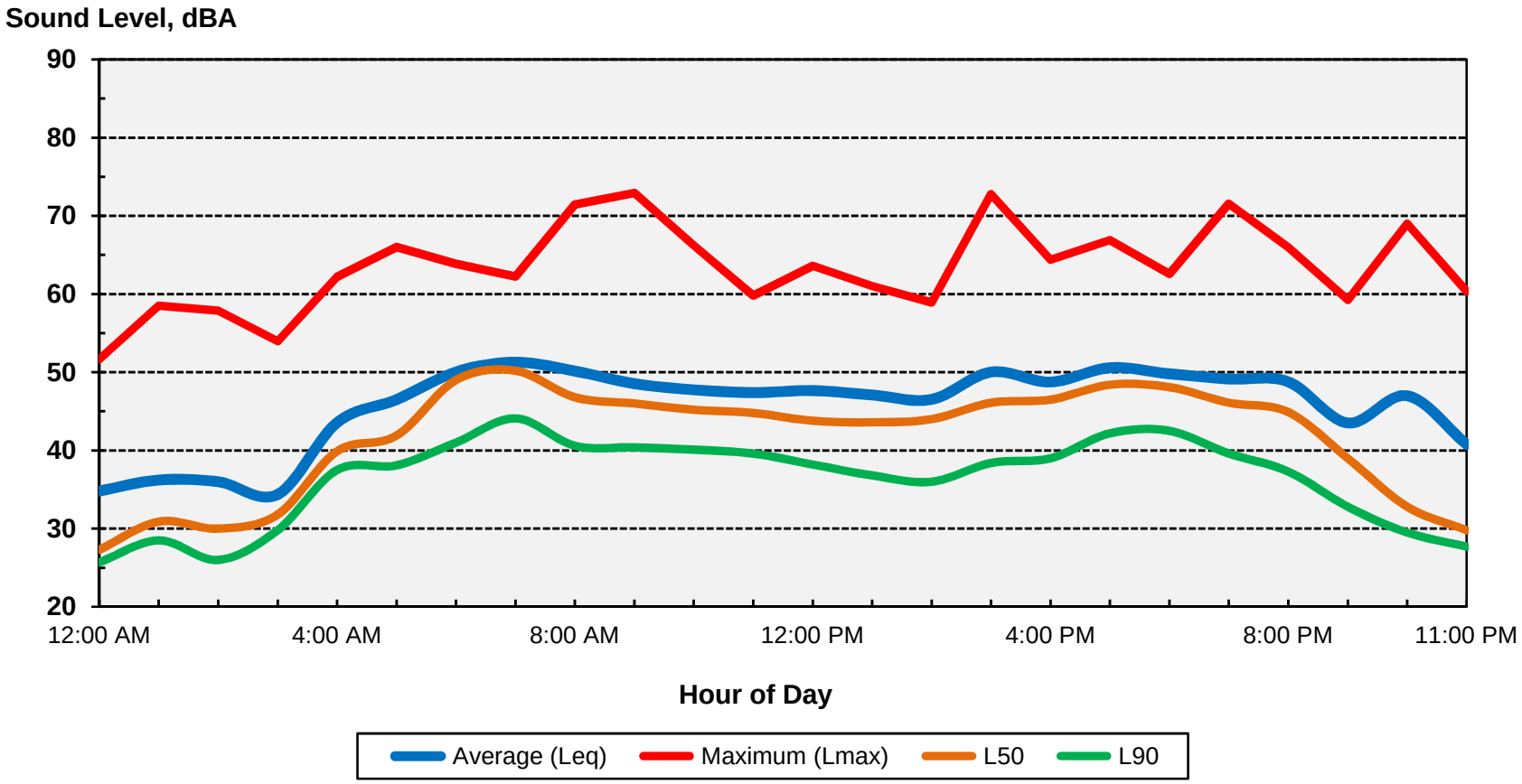
**Appendix B-25**
**Ambient Noise Monitoring Results - Site 5**
**Eliot Quarry Reclamation Plan Amendment Project**
**Monday, October 01, 2018**




**Ldn: 52 dB**

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