Environmental Noise and Vibration Assessment

Valley of the Sacred Heart Academy

Dixon, California

BAC Job # 2025-089

Prepared For:

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CEQA Checklist

NOISE AND VIBRATION **– Would the Project Result in:**	**NA – Not Applicable**	**Potentially Significant Impact**	**Less than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a) Generation of substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?				**X**	
b) Generation of excessive groundborne vibration or groundborne noise levels?				**X**	
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				**X**	

Introduction

The proposed Valley of the Sacred Heart Academy (project) is located at 209-231 East A Street in the City of Dixon, California. The project would consist of a new two-story, 11,539 square foot building and associated parking on the 0.517-acre site. The new building will accommodate 120 students plus a maximum of 8-12 teachers, staff, and/or volunteers at any one time. The project includes onsite parking and separate area for drop-off and pick-up.

Existing land uses in the immediate project vicinity consist primarily of residential uses, but also include business, commercial, and church uses. The project area and surrounding uses are shown on Figure 1. The project site plans are shown on Figure 2.

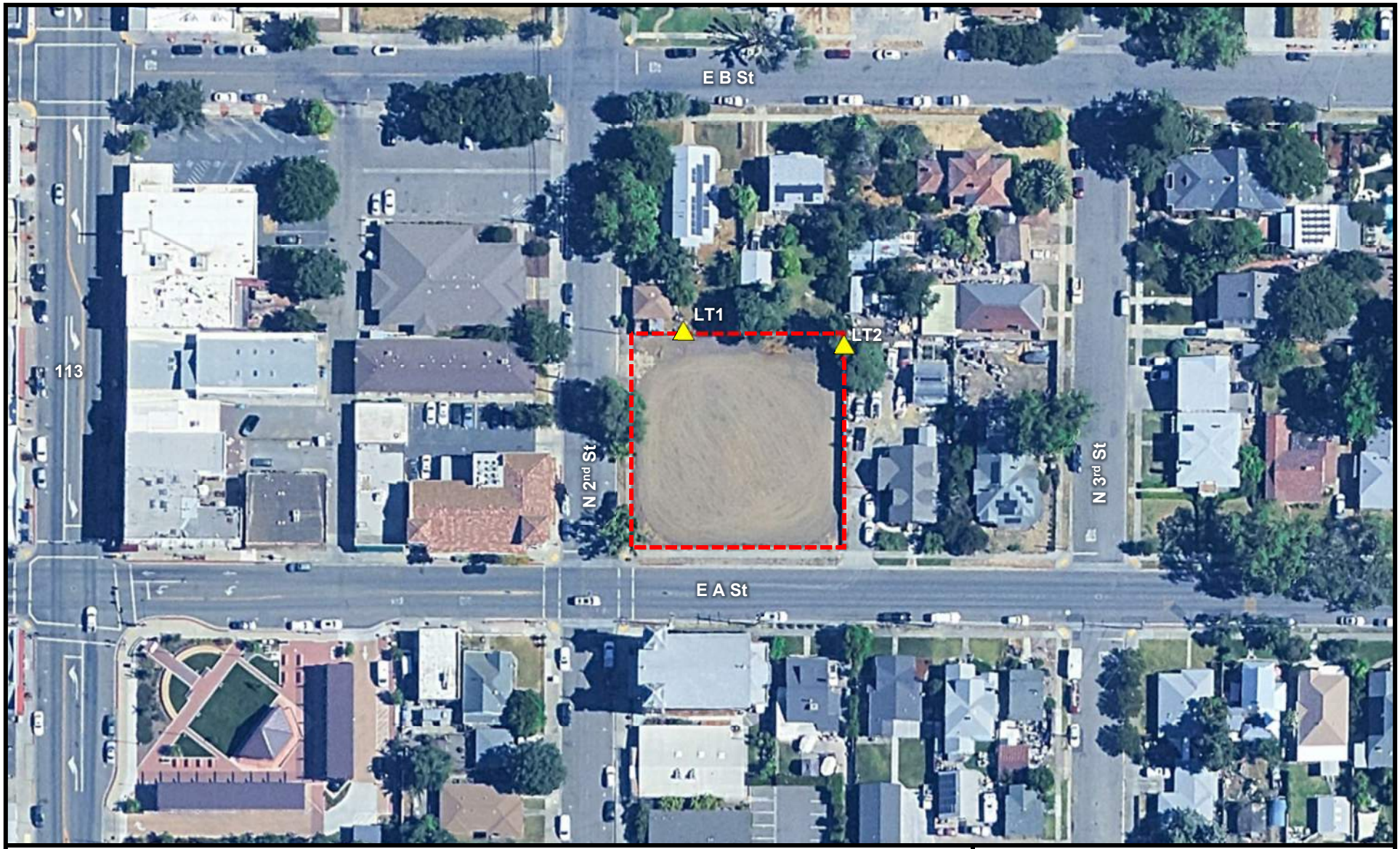
The purposes of this assessment are to quantify the existing noise and vibration environments at the existing sensitive uses surrounding the site (residences), to identify potential noise and vibration impacts resulting from the project, to identify appropriate mitigation measures where required, and to provide a quantitative and qualitative analysis of impacts associated with the project. Specifically, impacts are identified if project-related activities would cause a substantial increase in ambient noise levels at existing sensitive uses in the project vicinity, or if traffic or project-generated noise or vibration levels would exceed applicable federal, state, or local (City of Dixon) standards at existing or proposed sensitive uses.

Noise and Vibration Fundamentals

Noise

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are designated as sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz). Definitions of acoustical terminology are provided in Appendix A.

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 of pressure) 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 decibel levels correspond closely to human perception of relative loudness. Noise levels associated with common noise sources are provided in Figure 3.



Legend

Project Boundary (Approximate)

Long-Term Noise Measurement Locations

N

Scale (Feet)

0 50 100

Project Area and Noise Survey Locations

Valley of the Sacred Heart Academy
Dixon, California

Figure 1

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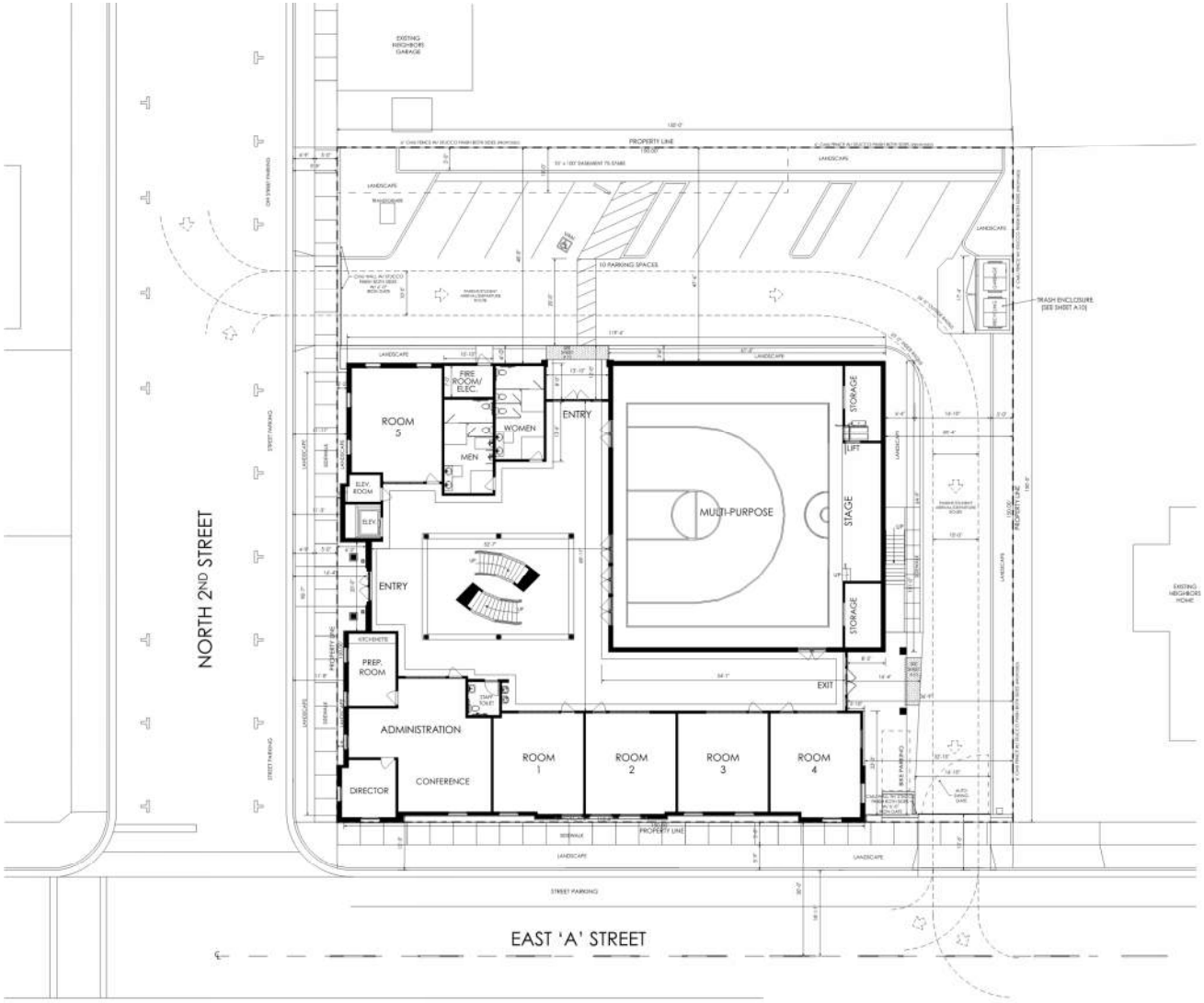


Legend

N

Scale (Feet)

0 20 40

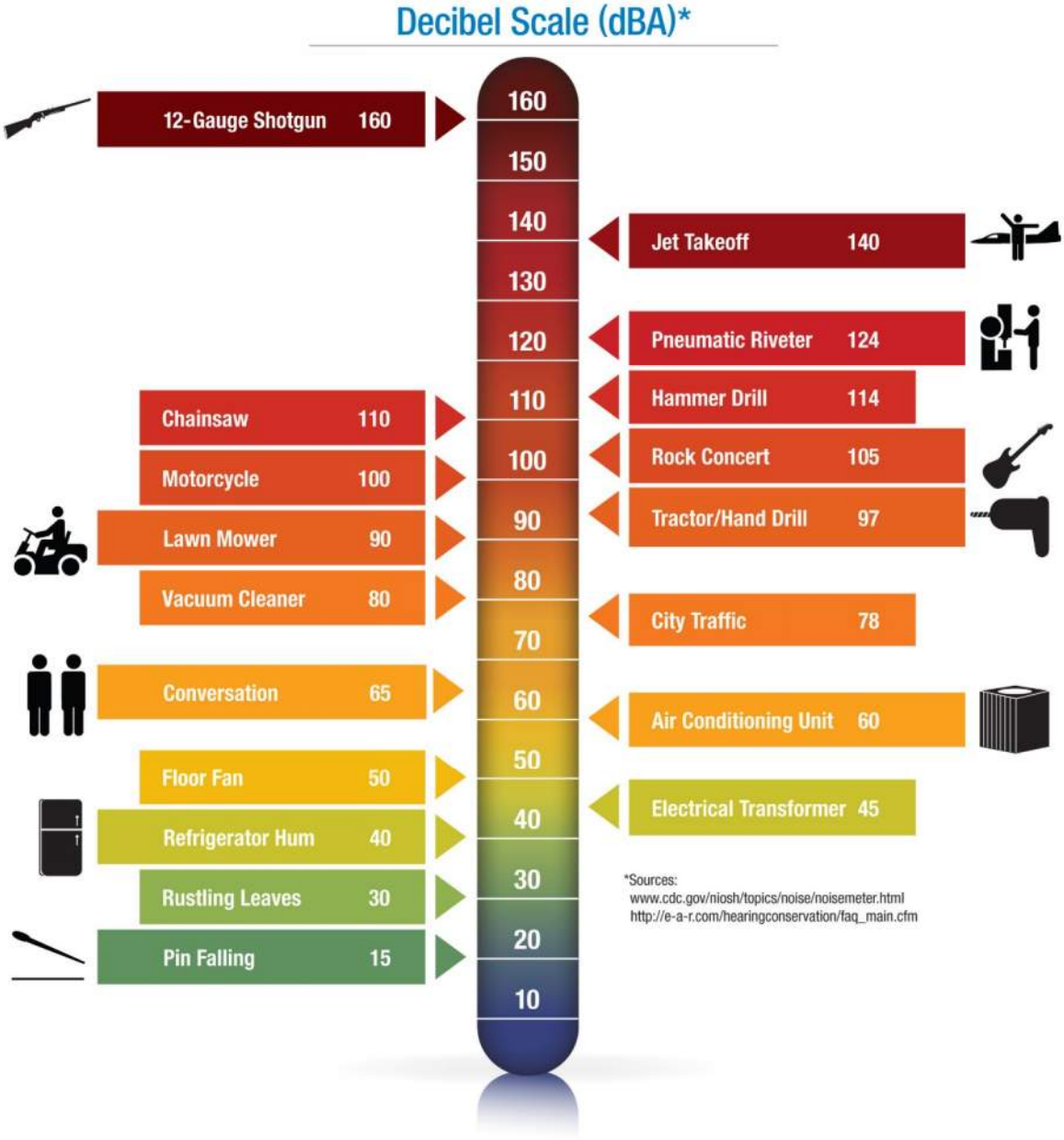
Site Plan

Valley of the Sacred Heart Academy
Dixon, California

Figure 2

BOLLARD
Acoustical Consultants

Figure 3
Noise Levels Associated with 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 filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

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

Vibration

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

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration 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 California Department of Transportation (Caltrans), Transportation and Construction-Induced Vibration Guidance Manual (April 2020), 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.

Regulatory Setting: Criteria for Acceptable Noise and Vibration Exposure

Federal

The City of Dixon does not currently have established criteria for assessing noise impacts associated with increases in ambient noise levels from project-generated noise sources. In addition, the City of Dixon does not have established, quantifiable, performance standards for the assessment of vibration impacts. As a result, the following federal noise criteria were applied to the project.

Federal Interagency Commission on Noise

The Federal Interagency Commission on Noise (FICON) has developed a graduated scale for use in the assessment of project-related noise level increases. The criteria shown in Table 1 were developed by FICON as a means of developing thresholds for impact identification for project-related noise level increases. The FICON standards have been used extensively in recent years in the preparation of the noise sections of Environmental Impact Reports that have been certified in many California cities and counties.

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

Table 1
Significance of Changes in Cumulative Noise Exposure

Ambient Noise Level Without Project (DNL or CNEL)	Change in Ambient Noise Level Due to Project
<60 dB	+5.0 dB or more
60 to 65 dB	+3.0 dB or more
>65 dB	+1.5 dB or more
Source: Federal Interagency Commission on Noise (FICON)	

Based on the FICON research, as shown in Table 1, a 5 dB increase in noise levels due to a project is required for a finding of significant noise impact where ambient noise levels without the project are less than 60 dB DNL. Where pre-project ambient conditions are between 60 and 65 dB DNL, a 3 dB increase is applied as the standard of significance. Finally, in areas already exposed to higher noise levels, specifically pre-project noise levels in excess of 65 dB DNL, a 1.5 dB increase is considered by FICON as the threshold of significance.

State of California

California Environmental Quality Act

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 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 or vibration impact if the following would occur:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or other applicable standards of other agencies; or

B. Generation of excessive groundborne vibration or groundborne noise levels; or

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

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 significant according to CEQA. Because every physical process creates noise, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change.

California Department of Transportation

The City of Dixon does not currently have adopted standards for groundborne vibration. As a result, the vibration impact criteria developed by Caltrans was applied to the project. The Caltrans criteria applicable to damage and annoyance from transient and continuous vibration typically associated with construction activities 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 2020).

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	0.20	0.10
Historic and some old buildings	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial buildings	2.00	0.50

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

PPV = Peak Particle Velocity

Source: Caltrans Transportation and Construction Vibration Guidance Manual (2020)

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	0.90	0.10
Severe	2.00	0.40

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

PPV = Peak Particle Velocity

Source: Caltrans Transportation and Construction Vibration Guidance Manual (2020)

Local

Dixon General Plan 2040

The Natural Environment Element of the Dixon General Plan 2040 contains policies to ensure that city residents are not subjected to noise beyond acceptable levels. Those General Plan policies are provided below.

Policies

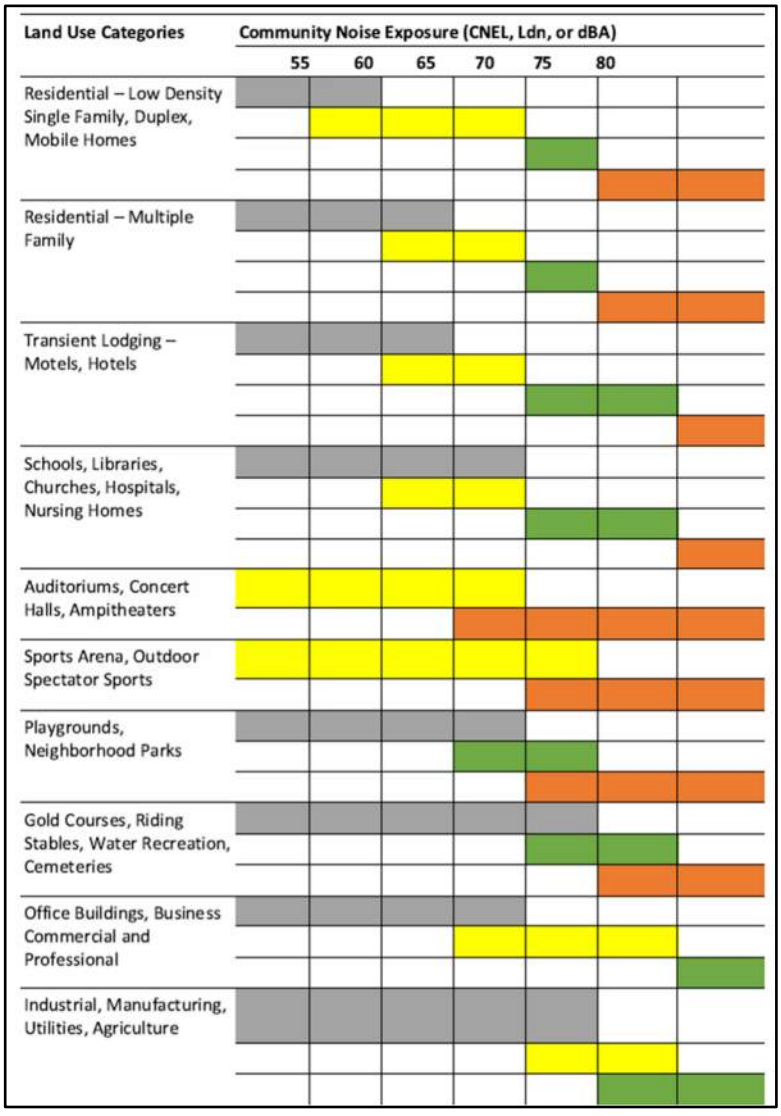
NE-5.16 Ensure that noise does not have a substantial, adverse effect on the quality of life in the community.

NE-5.17 Apply the General Plan noise and land use compatibility standards to all new residential, commercial, and mixed-use development and redevelopment, as shown in Table 4 (General Plan Table NE-2).

NE-5.18 Require acoustical studies with appropriate mitigation measures for projects that are likely to be exposed to noise levels that exceed the "normally acceptable" standard and for any other projects that are likely to generate noise in excess of these standards.

NE-5.19 Require that new noise-producing uses are located sufficiently far away from noise-sensitive receptors and/or include adequate noise mitigation, such as screening, barriers, sound enclosures, noise insulation, and/or restrictions on hours of operation.

Table 4
Community Noise Compatibility Matrix



Dixon Municipal Code (DMC)

The provisions of the Dixon Municipal Code which would be generally applicable to this project are reproduced below.

18.17.110(A) Noise performance standards.

No land use shall generate sound exceeding the maximum levels permitted in the following table when such are measured in any zoning districts listed in this table.

Zoning District	Maximum Sound Pressure Level in Decibels
Residential Districts	55
"RL"	60
Commercial and Mixed Use	70
Industrial Districts	75

18.17.110(B) Noise performance standards – Correction factors.

The following correction factors, when applicable, shall be applied to the maximum sound pressure levels given in DMC 18.110(A).

Time and Operation of Type of Noise	Correction in Maximum Permitted Decibels
Emission only between 7:00 a.m. and 10:00 p.m.	+5
Noise of unusual impulsive character (e.g., hammering)	-5
Noise of unusual periodic character (e.g., screeching)	-5

18.17.110(C) Noise performance standards – Exceptions.

The following sounds, upon compliance with stated conditions, may exceed the maximum sound pressure levels given in DMC 18.17.110(A).

1. Time signals produced by places of employment or worship and school recess signals providing no one sound exceeds five seconds in duration and no one series of sounds exceeds 24 seconds in duration.

2. Sounds from transportation equipment used exclusively in the movement of goods and people to and from a given premises, temporary construction, or demolition work.

3. Sounds made in the interests of public safety.

18.17.120 Vibration performance standards.

No use shall be operated in a manner which produces vibrations discernible without instruments at any point on the property line of the lot on which the use is located.

Environmental Setting – Existing Ambient Noise and Vibration Environment

Noise-Sensitive Land Uses in the Project Vicinity

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the primary intended use of the land. Places where people live, sleep, worship, and study are generally considered to be sensitive to noise because intrusive noise can be disruptive to these activities.

The nearest noise-sensitive land uses which would potentially be affected by the project consist of residential uses to the immediate north and east of the site (sharing a property line). The project area and surrounding land uses are shown in Figure 1.

Existing Overall Ambient Noise Environment within the Project Vicinity

The existing ambient noise environment within the project area is defined primarily by noise from traffic on East A Street, and to a lesser extent by traffic on 2nd Street. To quantify the existing ambient noise environment in the immediate vicinity of the nearest sensitive receptors, BAC conducted long-term (96-hour) ambient noise level measurements from Saturday, August 23rd through Tuesday, August 26th, 2025. The noise survey locations are shown in Figure 1, identified as sites LT-1 and LT-2. 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 long-term noise level measurements. The meters were calibrated immediately before and after use with an LDL Model CA200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all specifications of the American National Standards Institute requirements for Type 1 sound level meters (ANSI S1.4). The ambient noise level survey results are summarized below in Table 5. The detailed results of the ambient noise survey are contained in tabular and graphic format in Appendices C and D, respectively.

Table 5
Summary of Long-Term Noise Survey Measurement Results – August 23-26, 2025[1]

Site Description[2]	Date	DNL	Average Measured Hourly Noise Levels (dBA)[3]			
			Daytime[3]		Nighttime[4]	
			L_{eq}	L_{max}[5]	L_{eq}	L_{max}
LT-1: Northwestern project property boundary adjacent to residences	8/23/25	54	50	70	47	68
	8/24/25	53	50	69	46	68
	8/25/25	54	51	70	47	67
	8/26/25	55	51	72	47	66
LT-2: Northeastern Site Corner adjacent to residences	8/23/25	56	52	72	49	68
	8/24/25	54	49	69	47	69
	8/25/25	54	51	70	47	66
	8/26/25	56	51	73	49	68

[1] Detailed summaries of the noise monitoring results are provided in Appendices C and D.
[2] Long-term noise survey locations are shown in Figure 1.
[3] Daytime hours: 7:00 a.m. to 10:00 p.m.
[4] Nighttime hours: 10:00 p.m. to 7:00 a.m.
[5] Lmax = the highest (maximum) measured sound level recorded at any time during each one-hour monitoring period. The Lmax column in Table 5 presents the daytime and nighttime averages of the measured hourly maximum noise levels.

Source: Bollard Acoustical Consultants, Inc. (2025)

As indicated in Table 5, measured day-night average (DNL) and average measured hourly noise levels were fairly consistent at sites LT-1 and LT-2 throughout the entire monitoring period, and below the City's 60 dBA DNL standard considered acceptable for residential uses.

Existing Ambient Vibration Environment

During BAC site visits on August 22nd and 27th, 2025, vibration levels were below the threshold of perception at the project site. As a result, the baseline vibration environment is considered to be negligible.

Impacts and Mitigation Measures

Thresholds of Significance

For the purposes of this report, a noise and vibration impact is considered significant if the project would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or other applicable standards of other agencies?
- Generation of excessive groundborne vibration or groundborne noise levels?

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

The following criteria based on standards established by the Federal Interagency Commission on Noise (FICON), Caltrans, City of Dixon General Plan and Dixon Municipal Code were used to evaluate the significance of environmental noise and vibration resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the Dixon General Plan or Municipal Code.

- A significant impact would be identified if off-site traffic noise exposure or on-site activities generated by the project would substantially increase noise levels at existing sensitive receptors in the vicinity. A substantial increase would be identified relative to the FICON standards provided in Table 1.

- A significant impact would be identified if project construction activities or proposed on-site operations would expose sensitive receptors to excessive groundborne vibration levels. Specifically, an impact would be identified if groundborne vibration levels due to these sources would exceed the Caltrans vibration impact criteria.

Noise Impacts Associated with Project-Generated Increases in Off-Site Traffic

Impact 1: Increases in Existing and Cumulative Traffic Noise Levels due to the Project

Project traffic will enter the school site via North 2nd Street and exit the site via East "A" Street. A one-way internal circulation route will connect the two site accesses. To assess noise impacts due to project-related traffic increases on East "A" Street and North 2nd Street, BAC utilized the trip generation information contained within the project Transportation Study (T.KEAR March 6, 2025). Specifically, traffic volumes on these two roadways, both with and without the project, were analyzed to arrive at the traffic noise level increases resulting from the project. Specifically, AM, Mid-Day, and PM peak hour traffic volumes were compared for the existing and existing plus project conditions, as well as the cumulative no-project and cumulative plus project conditions. The peak hour traffic volumes and computed traffic noise level increases resulting from project traffic are provided in Table 6.

Table 6
Existing and Cumulative Peak Hour Traffic Volumes and Noise Level Increases Resulting from the Project

			Peak Hour Traffic Volumes								
			No Project			Plus Project			Increase in DBA due to School		
Scenario	**Roadway**	**Description**	**AM**	**Mid-Day**	**PM**	**AM**	**Mid-Day**	**PM**	**AM**	**Mid-Day**	**PM**
Existing	East A St.	West of 2nd Street	653	605	427	699	666	434	0.3	0.4	0.1
		2nd St. to School Driveway	554	507	364	580	580	374	0.2	0.6	0.1
		East of School Driveway	554	507	364	562	512	365	0.1	0.0	0.0
	2nd St.	East A Street to School Driveway	106	106	80	141	154	88	1.2	1.6	0.4
		North of School Driveway	106	106	80	110	106	81	0.2	0.0	0.1
Cumulative	East A St.	West of 2nd Street	813	759	579	865	820	586	0.3	0.3	0.1
		2nd St. to School Driveway	705	639	502	731	712	512	0.2	0.5	0.1
		East of School Driveway	705	639	502	713	644	503	0.0	0.0	0.0
	2nd St.	East A Street to School Driveway	119	133	108	154	183	116	1.1	1.4	0.3
		North of School Driveway	119	133	108	123	133	109	0.1	0.0	0.0

Source: Project Traffic Study (T.KEAR) and Bollard Acoustical Consultants, Inc. (BAC) .

According to the FICON criteria provided in Table 1, a 5 dB DNL increase in noise levels due to a project is required for a finding of significant noise impact where ambient noise levels without the project are less than 60 dB DNL. As indicated by Table 6, the project-related increase in traffic volumes is relatively small compared to existing and cumulative no-project conditions. As a result, the corresponding increase in local traffic noise levels would similarly be small, ranging from 0.0 to 1.6 dBA. The computed project-related increases in traffic noise levels are below the applicable 5 dB increase significance criterion established by FICON. As a result, this impact is identified as being ***less than significant***.

Off-Site Noise Impacts Associated with On-Site Noise Sources

Noise sources commonly associated with school uses include playing fields, mechanical equipment, on-site traffic circulation, parking lot activities, etc. However, for this project no outdoor playing fields or hard courts are proposed. Those areas will be located inside the building within the gymnasium area. Also, the project plans indicate that the mechanical equipment would be located within a dedicated equipment room, which would also contain the noise within the building. As a result, the main operational noise sources will consist of on-site circulation (student drop-off & pick-up), and parking lot activities. As a result, the focus of the on-site operational noise impact analysis is on these two noise sources.

Impact 2: On-Site Vehicle Circulation Noise Affecting Existing Sensitive Uses

According to the project traffic study, the highest level of on-site circulation would occur during the mid-day peak hour, when the project would reportedly experience 58 vehicle movements on the internal pick-up / drop-off roadway. The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to predict the noise levels associated with this degree of on-site circulation. Given the site design, vehicles on this internal roadway would be travelling at very low speeds, likely consisting of stop-start movements during student pick-up hours. In addition to the low vehicle speeds, it was further assumed that the vehicle mix would be essentially 100% passenger cars during this mid-day pick-up period. The distances from the on-site circulation route to the nearest sensitive receptors was scaled using aerial imagery.

Based on these assumptions, the worst-case on-site traffic circulation noise level exposure is predicted to be below 40 dBA Leq at the nearest residential property line to the east, including shielding provided by the proposed 6-foot-tall masonry sound barrier along the northern and eastern property boundaries of the project site.

The Dixon Municipal Code provides noise level limits that would be applicable to non-transportation noise sources, such as those occurring on the project site. Specifically, Section 18.17.110 of the Municipal Code establishes “maximum sound pressure levels” for various receiving zoning districts. For the purposes of this analysis, the Municipal Code’s “maximum sound pressure levels” have been interpreted as the highest (maximum) allowable hourly average (L_{eq}) sound level. The application of the L_{eq} sound level descriptor for project-generated non-transportation noise sources would be consistent with application of the General Plan’s day-night-average (DNL) noise level to transportation noise sources.

The predicted worst-case on-site circulation noise levels of less than 40 dBA Leq at the nearest residential property line is well below the applicable Dixon Municipal Code 55 dB L_{eq} daytime exterior noise level standard. This level is also well below the 49-52 dBA Leq measured range of daytime ambient noise levels at the nearest residences (see Table 5).

Because noise exposure from proposed on-site vehicle circulation is predicted to satisfy applicable Dixon Municipal Code noise level standards at the nearest existing sensitive land uses, and because noise level exposure from on-site vehicle circulation is not expected to significantly increase ambient noise levels at those uses, this impact is identified as being ***less than significant.***

Impact 3: Parking Lot Activity Noise Affecting Existing Sensitive Uses

According to the project site plan, the project proposes 10 on-site parking spaces. Conservatively, assuming each parking space was to both fill and empty during a busy peak hour, the total number of hourly parking operations would compute to 20.

BAC noise measurement data for parking lot activity indicates that individual parking lot movements (vehicles arriving/departing, engines starting/stopping, car doors opening/closing), typically generate a Sound Exposure Level of 70 dBA SEL at a reference distance of 50 feet. Based on this sound exposure level at the relatively close proximity of the parking spaces to the northern site boundary, the hourly average parking lot noise level at that property line computes to approximately 48 dBA Leq, including shielding provided by the proposed property boundary sound wall.

The predicted worst-case on-site parking lot movement noise levels of approximately 48 dBA Leq at the nearest residential property line is well below the applicable Dixon Municipal Code 55 dB L_{eq} daytime exterior noise level standard. This level is also consistent with the 49-52 dBA Leq measured range of daytime ambient noise levels at the nearest residences (see Table 5).

Because noise exposure from proposed on-site parking lot activity is predicted to satisfy applicable Dixon Municipal Code noise level standards at the nearest existing sensitive land uses, and because noise level exposure from on-site vehicle circulation is not expected to significantly increase ambient noise levels at those uses, this impact is identified as being ***less than significant.***

Noise Impacts Associated with Project Construction Activities

Impact 4: Project Construction Noise Levels at Existing Sensitive Uses

During project construction, heavy equipment would be used for grading, excavation, paving, and building construction, which would increase ambient noise levels when in use. It should be noted, however, that the site appears to have some degree of grading previously completed. Noise levels would vary depending on the type of equipment used, how it is operated, and how well it is maintained. Noise exposure at any single point outside the project work area would also vary depending upon the proximity of equipment activities to that point.

Table 7 includes the range of maximum noise levels for equipment commonly used in general construction projects at full-power operation at a distance of 50 feet, as well as at a distance of 25 feet, which generally represents the distance from the project site to the nearest existing residence. Not all of these construction activities would be required of this project. In addition, construction would reportedly be limited to the hours of 8 a.m. to 5 p.m.

Table 7
Construction Equipment Reference and Projected Noise Levels

Equipment Description	Maximum Noise Level at 50 Feet (dB)	Predicted Maximum Noise Level at 25 Feet (dB)
Air compressor	80	86
Backhoe	80	86
Ballast equalizer	82	88
Ballast tamper	83	89
Compactor	82	88
Concrete mixer	85	91
Concrete pump	82	88
Concrete vibrator	76	82
Crane, mobile	83	89
Dozer	85	91
Generator	82	91
Grader	85	88
Impact wrench	85	91
Loader	80	91
Paver	85	86
Pneumatic tool	85	91
Pump	77	91
Saw	76	83
Scarifier	83	82
Scraper	85	89
Shovel	82	91
Spike driver	77	88
Tie cutter	84	83
Tie handler	80	90
Tie inserter	85	86
Truck	84	91

Source: Federal Transit Administration Noise and Vibration Impact Assessment Manual, Table 7-1 (2020)

Comparison of the maximum construction equipment noise levels shown on Table 7 against baseline ambient data provided in Table 5 indicates that the project construction would likely result in short-term increases in ambient noise levels in the immediate project vicinity. However, as noted in the Regulatory Setting Section of this report, Section 18.17.110(C) of the Dixon Municipal Code permits levels exceeding the City's noise standards for temporary construction projects. Because project construction would be temporary, limited to the hours of 8 a.m. to 5 p.m., and is technically considered exempt by the City of Dixon Municipal Code, noise impacts associated with construction activities are identified as being ***less than significant***.

Vibration Impacts Associated with Project Activities

Impact 5: Project Construction and Operations Vibration at Existing Sensitive Uses

During project construction, heavy equipment would be used for grading, excavation, paving, and building construction, which would generate localized vibration in the immediate vicinity of the construction. The nearest existing sensitive receptors have been identified as residential structures (north and east of the project) located approximately 25 feet from construction activities which would occur within the project area. Table 8 includes the range of vibration levels for equipment commonly used in general construction projects at a distance of 25 feet.

Table 8
Vibration Source Levels for Construction Equipment and Predicted Levels at 40 Feet

Equipment	Maximum Vibration Level at 25 Feet (PPV)[1]
Large bulldozer	0.089
Hoe ram	0.089
Loaded trucks	0.076
Backhoe	0.051
Excavator	0.051
Grader	0.051
Loader	0.051
Jackhammer	0.035
Small bulldozer	0.003

[1] PPV = Peak Particle Velocity
Source: 2020 FTA Transit Noise and Vibration Impact Assessment Manual and BAC calculations

As shown in Table 8, vibration levels generated from on-site construction activities at the nearest existing sensitive structures located approximately 25 feet away (residences) are predicted to be well below the strictest Caltrans thresholds for damage to residential structures of 0.30 in/sec PPV shown in Table 2. Further, construction activities are not expected to result in adverse human response relative to the vibration annoyance criteria as defined by Caltrans in Table 3. Therefore, on-site construction within the project area is not expected to result in excessive groundborne vibration levels at nearby existing sensitive uses. Because vibration levels due to the project will satisfy the applicable Caltrans groundborne impact vibration criteria, this impact is identified as being ***less than significant***.

Impact 6: Aircraft Noise Impacts at the Project Site

According to the Dixon General Plan, the City is located within the airport influence area of Travis AFB, which is located approximately 11 miles to the southwest; however, the project site is not located within any of the CNEL noise contours for Travis AFB (see Figure 2 of the Travis AFB LUCP[1]). Therefore, impacts related to aircraft operations affecting the project site are considered ***less than significant***.

[1] https://content.solanocounty.gov/sites/default/files/2025-05/Travis%20AFB%20LUCP%20%282024%29_0.pdf

Conclusions

This analysis concludes that, with the construction of the proposed 6-foot tall masonry sound barrier along the northern and eastern site boundaries, noise impacts related to the project are predicted to be less than significant.

This concludes BAC's noise and vibration assessment of the Valley of the Sacred Heart Academy Project in Dixon, California. Please contact BAC at (530) 537-2328 or paulb@bacnoise.com with 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 West

B Site LT-1 Facing North

C Site LT-2 Facing South

D Project Site Facing East Towards LT-2

Microphone Location

Noise Survey Photographs

Valley of the Sacred Heart Academy
Dixon, California

Appendix B

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Appendix C-1
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Saturday, August 23, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	44	70	41	39
1:00 AM	43	66	40	39
2:00 AM	41	59	39	38
3:00 AM	41	66	39	38
4:00 AM	41	60	40	38
5:00 AM	51	74	42	40
6:00 AM	50	71	44	42
7:00 AM	49	67	46	44
8:00 AM	50	67	47	45
9:00 AM	49	66	46	42
10:00 AM	50	68	47	41
11:00 AM	51	70	48	43
12:00 PM	50	62	48	44
1:00 PM	52	77	47	44
2:00 PM	50	69	48	45
3:00 PM	54	83	48	45
4:00 PM	53	75	49	47
5:00 PM	50	65	47	45
6:00 PM	49	63	46	44
7:00 PM	51	79	46	44
8:00 PM	49	64	47	44
9:00 PM	49	69	45	42
10:00 PM	50	76	43	42
11:00 PM	47	68	43	42

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	54	49	50	51	41	47
Lmax (Maximum)	83	62	70	76	59	68
L50 (Median)	49	45	47	44	39	41
L90 (Background)	47	41	44	42	38	40

Computed DNL, dB	54
% Daytime Energy	79%
% Nighttime Energy	21%

GPS Coordinates
38°26'45.79"N
121°49'15.67"W

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Appendix C-2
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Sunday, August 24, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	47	70	41	40
1:00 AM	44	65	40	39
2:00 AM	42	64	40	39
3:00 AM	47	71	40	38
4:00 AM	42	62	40	39
5:00 AM	48	73	40	38
6:00 AM	49	73	44	40
7:00 AM	48	67	44	42
8:00 AM	49	68	46	44
9:00 AM	49	69	44	40
10:00 AM	49	69	45	40
11:00 AM	48	64	46	41
12:00 PM	50	76	46	43
1:00 PM	49	70	46	43
2:00 PM	51	71	48	45
3:00 PM	50	67	48	45
4:00 PM	51	66	48	46
5:00 PM	52	68	48	45
6:00 PM	49	64	46	44
7:00 PM	51	75	47	45
8:00 PM	50	73	47	45
9:00 PM	48	71	45	43
10:00 PM	49	66	46	44
11:00 PM	45	70	42	41

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	52	48	50	49	42	46
Lmax (Maximum)	76	64	69	73	62	68
L50 (Median)	48	44	46	46	40	41
L90 (Background)	46	40	43	44	38	40

Computed DNL, dB	53
% Daytime Energy	78%
% Nighttime Energy	22%

GPS Coordinates
38°26'45.79"N
121°49'15.67"W

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Appendix C-3
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Monday, August 25, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	45	68	41	39
1:00 AM	42	56	41	39
2:00 AM	43	67	41	39
3:00 AM	47	71	41	40
4:00 AM	47	67	44	42
5:00 AM	50	70	47	45
6:00 AM	51	72	47	45
7:00 AM	52	65	50	47
8:00 AM	52	70	50	44
9:00 AM	48	64	45	41
10:00 AM	50	69	45	41
11:00 AM	50	69	45	41
12:00 PM	50	71	46	42
1:00 PM	50	67	47	44
2:00 PM	51	72	48	44
3:00 PM	53	71	50	46
4:00 PM	52	75	49	45
5:00 PM	51	68	49	45
6:00 PM	52	75	49	46
7:00 PM	52	74	49	46
8:00 PM	49	72	47	44
9:00 PM	48	74	43	41
10:00 PM	47	69	42	40
11:00 PM	43	59	41	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)	53	48	51	51	42	47
Lmax (Maximum)	75	64	70	72	56	67
L50 (Median)	50	43	47	47	41	43
L90 (Background)	47	41	44	45	39	41

Computed DNL, dB	54
% Daytime Energy	80%
% Nighttime Energy	20%

GPS Coordinates
38°26'45.79"N
121°49'15.67"W

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Appendix C-4
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Tuesday, August 26, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	42	57	41	37
1:00 AM	43	57	42	41
2:00 AM	48	71	42	40
3:00 AM	48	75	41	40
4:00 AM	48	68	44	42
5:00 AM	48	66	45	44
6:00 AM	49	65	46	44
7:00 AM	52	68	49	46
8:00 AM	52	71	50	45
9:00 AM	51	71	47	43
10:00 AM	51	69	46	41
11:00 AM	49	70	46	42
12:00 PM	50	74	49	45
1:00 PM	52	71	49	45
2:00 PM	52	74	50	46
3:00 PM	54	76	51	48
4:00 PM	51	75	49	45
5:00 PM	51	68	49	45
6:00 PM	53	78	49	45
7:00 PM	51	68	48	46
8:00 PM	51	73	47	45
9:00 PM	49	72	44	42
10:00 PM	45	62	43	41
11:00 PM	50	74	41	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)	54	49	51	50	42	47
Lmax (Maximum)	78	68	72	75	57	66
L50 (Median)	51	44	48	46	41	43
L90 (Background)	48	41	45	44	37	41

Computed DNL, dB	55
% Daytime Energy	81%
% Nighttime Energy	19%

GPS Coordinates
38°26'45.79"N
121°49'15.67"W

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Appendix C-5
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Saturday, August 23, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	43	65	41	39
1:00 AM	42	59	40	38
2:00 AM	41	59	39	37
3:00 AM	40	59	39	37
4:00 AM	41	58	40	38
5:00 AM	51	76	42	40
6:00 AM	51	74	45	43
7:00 AM	50	72	46	44
8:00 AM	50	63	48	46
9:00 AM	48	71	46	43
10:00 AM	50	74	45	41
11:00 AM	53	77	46	42
12:00 PM	55	68	52	48
1:00 PM	50	74	46	42
2:00 PM	49	70	46	43
3:00 PM	56	85	49	44
4:00 PM	57	84	49	46
5:00 PM	49	68	46	44
6:00 PM	48	66	46	44
7:00 PM	51	79	46	44
8:00 PM	49	67	47	44
9:00 PM	49	67	47	45
10:00 PM	55	85	46	44
11:00 PM	49	74	47	43

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	57	48	52	55	40	49
Lmax (Maximum)	85	63	72	85	58	68
L50 (Median)	52	45	47	47	39	42
L90 (Background)	48	41	44	44	37	40

Computed DNL, dB	56
% Daytime Energy	77%
% Nighttime Energy	23%

GPS Coordinates
38°26'45.70"N
121°49'14.24"W

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Appendix C-6
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Sunday, August 24, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	47	71	42	40
1:00 AM	42	61	40	38
2:00 AM	42	63	40	38
3:00 AM	49	73	40	37
4:00 AM	41	61	40	37
5:00 AM	50	77	41	38
6:00 AM	49	72	44	40
7:00 AM	48	71	44	42
8:00 AM	48	65	46	44
9:00 AM	49	73	43	40
10:00 AM	47	70	43	39
11:00 AM	52	69	45	41
12:00 PM	51	74	46	42
1:00 PM	47	70	44	41
2:00 PM	48	65	46	42
3:00 PM	48	66	46	42
4:00 PM	50	65	48	43
5:00 PM	52	72	47	43
6:00 PM	47	63	45	43
7:00 PM	51	74	46	44
8:00 PM	50	72	47	45
9:00 PM	48	69	45	43
10:00 PM	48	66	45	43
11:00 PM	48	80	43	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)	52	47	49	50	41	47
Lmax (Maximum)	74	63	69	80	61	69
L50 (Median)	48	43	45	45	40	41
L90 (Background)	45	39	42	43	37	39

Computed DNL, dB	54
% Daytime Energy	73%
% Nighttime Energy	27%

GPS Coordinates
38°26'45.70"N
121°49'14.24"W

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Appendix C-7
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Monday, August 25, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	46	73	40	39
1:00 AM	42	52	41	39
2:00 AM	42	59	41	39
3:00 AM	47	73	42	39
4:00 AM	47	69	44	42
5:00 AM	49	66	47	46
6:00 AM	52	71	47	45
7:00 AM	52	71	50	47
8:00 AM	50	65	48	44
9:00 AM	47	69	45	42
10:00 AM	49	72	45	40
11:00 AM	50	69	45	40
12:00 PM	57	83	45	41
1:00 PM	47	63	45	41
2:00 PM	49	67	47	42
3:00 PM	51	72	48	44
4:00 PM	50	68	48	44
5:00 PM	49	69	47	43
6:00 PM	51	72	48	45
7:00 PM	50	71	47	44
8:00 PM	48	67	46	43
9:00 PM	49	77	42	40
10:00 PM	47	71	42	40
11:00 PM	42	57	40	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)	57	47	51	52	42	47
Lmax (Maximum)	83	63	70	73	52	66
L50 (Median)	50	42	46	47	40	43
L90 (Background)	47	40	43	46	39	41

Computed DNL, dB	54
% Daytime Energy	79%
% Nighttime Energy	21%

GPS Coordinates
38°26'45.70"N
121°49'14.24"W

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Appendix C-8
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Tuesday, August 26, 2025

Hour	Leq	Lmax	L50	L90
12:00 AM	41	51	40	37
1:00 AM	42	55	41	39
2:00 AM	50	76	42	40
3:00 AM	50	80	42	40
4:00 AM	49	73	45	42
5:00 AM	47	67	46	44
6:00 AM	49	68	46	44
7:00 AM	51	71	49	46
8:00 AM	50	68	49	45
9:00 AM	50	72	46	43
10:00 AM	50	73	45	41
11:00 AM	49	70	45	41
12:00 PM	49	74	47	44
1:00 PM	51	69	49	45
2:00 PM	55	81	50	46
3:00 PM	52	73	50	46
4:00 PM	51	75	47	44
5:00 PM	50	72	47	43
6:00 PM	52	77	46	43
7:00 PM	50	70	47	44
8:00 PM	49	71	46	44
9:00 PM	50	79	43	41
10:00 PM	44	61	42	40
11:00 PM	54	80	42	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)	55	49	51	54	41	49
Lmax (Maximum)	81	68	73	80	51	68
L50 (Median)	50	43	47	46	40	43
L90 (Background)	46	41	44	44	37	41

Computed DNL, dB	56
% Daytime Energy	73%
% Nighttime Energy	27%

GPS Coordinates
38°26'45.70"N
121°49'14.24"W

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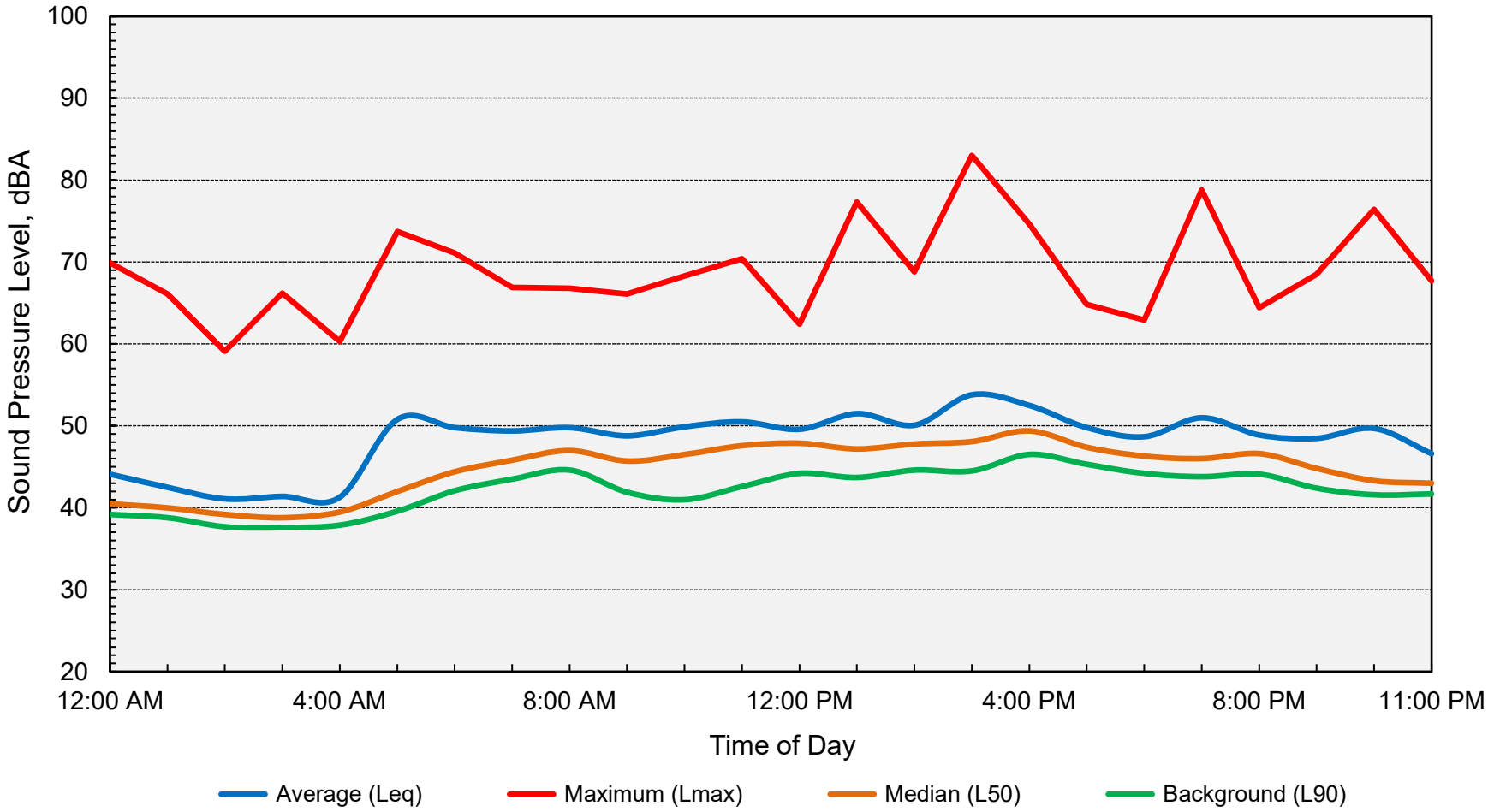
Appendix D-1
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Saturday, August 23, 2025



Computed DNL = 54 dB

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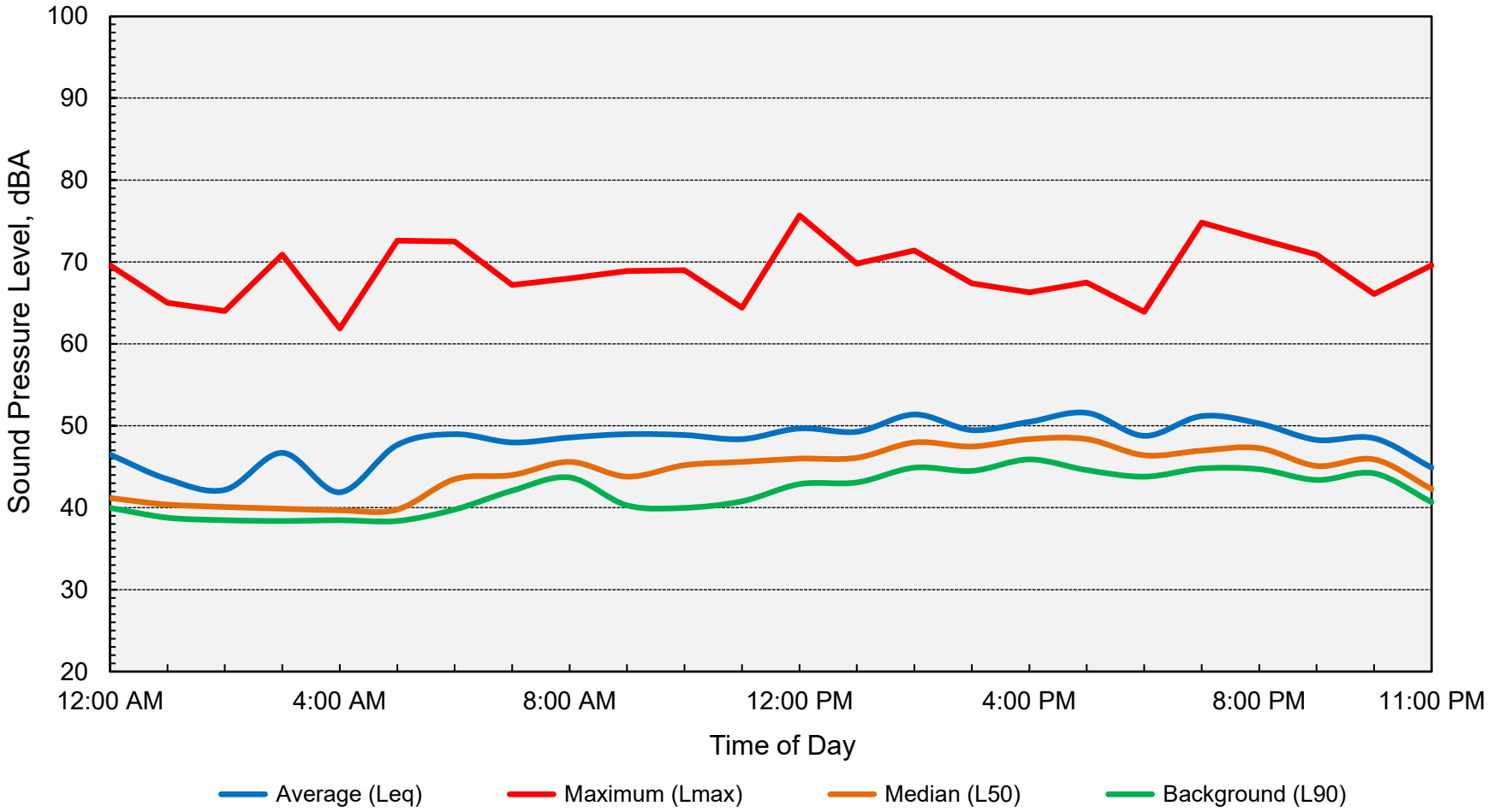
Appendix D-2
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Sunday, August 24, 2025



Computed DNL = 53 dB

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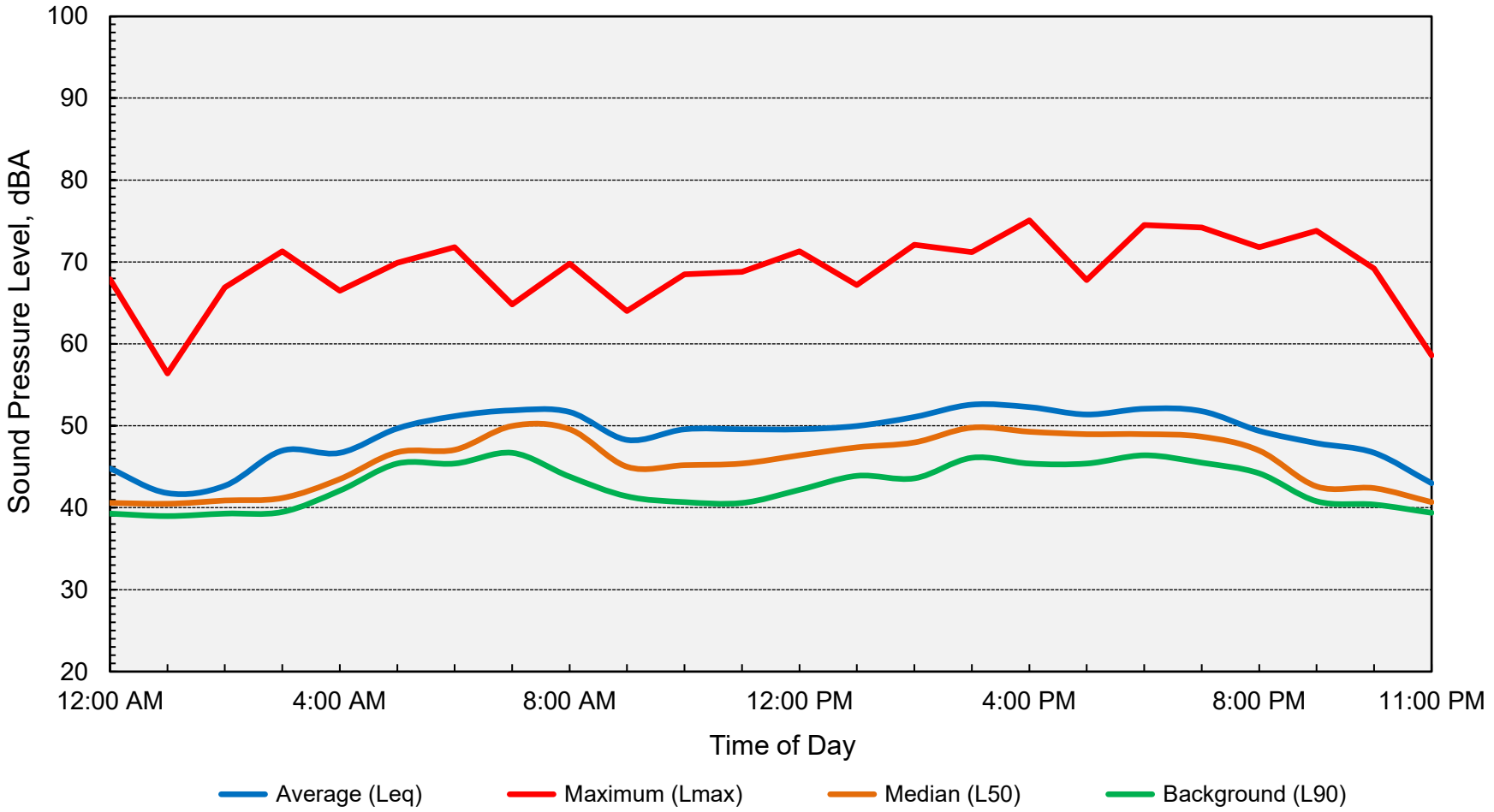
Appendix D-3
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Monday, August 25, 2025



Computed DNL = 54 dB

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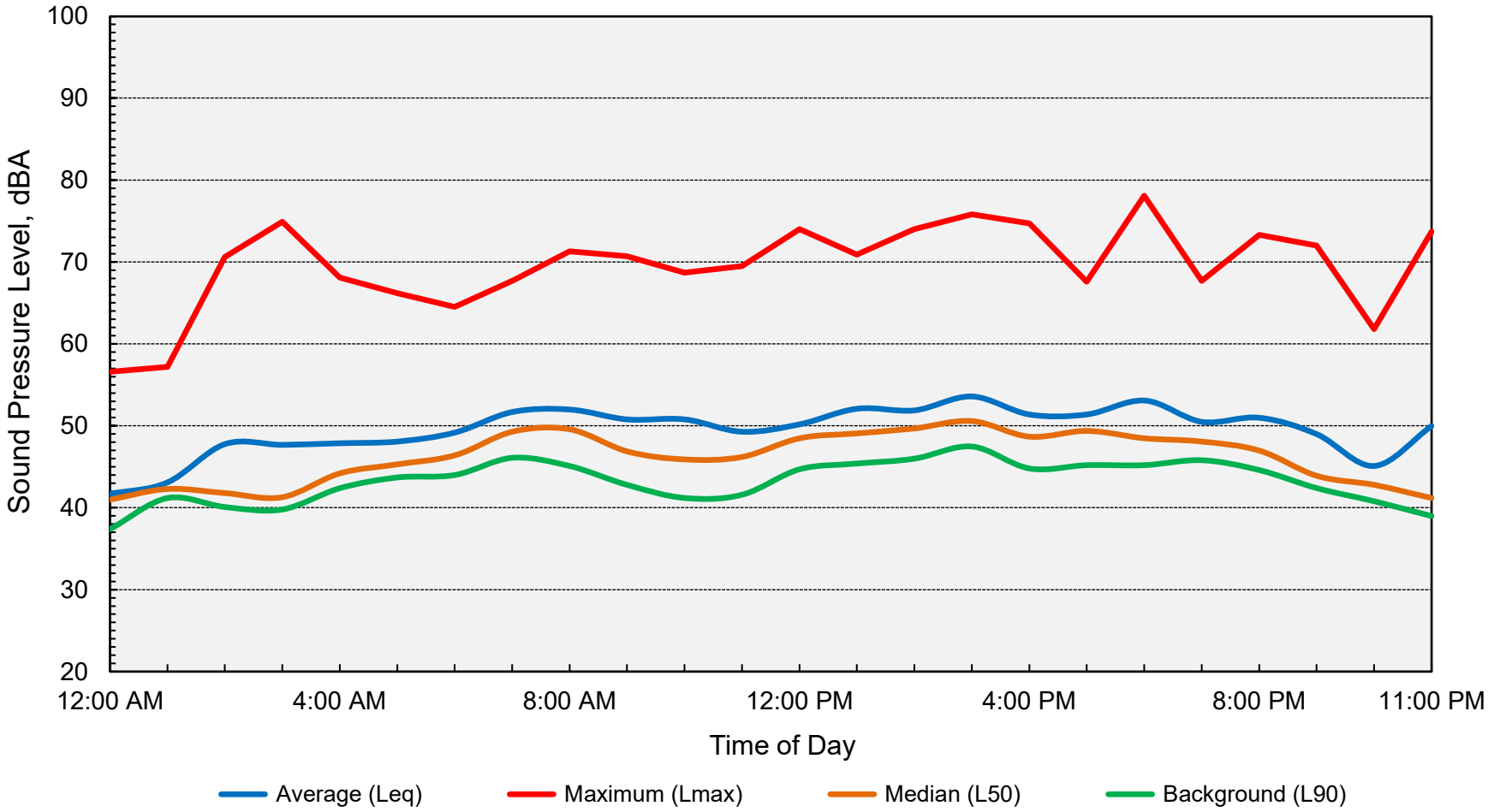
Appendix D-4
Long-Term Ambient Noise Monitoring Results, LT-1
Valley of the Sacred Heart Academy - Dixon, California
Tuesday, August 26, 2025



Computed DNL = 55 dB

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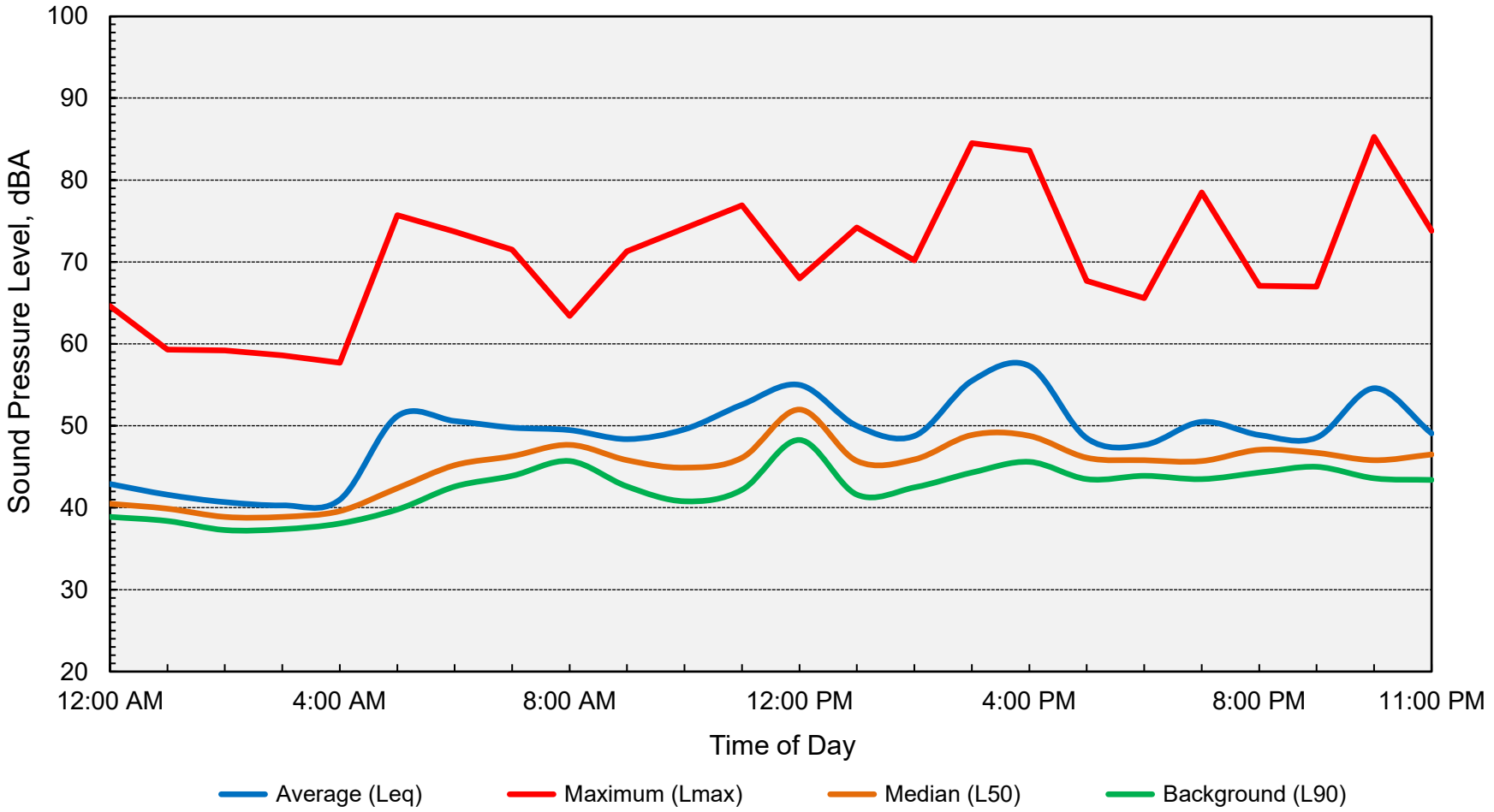
Appendix D-5
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Saturday, August 23, 2025



Computed DNL = 56 dB

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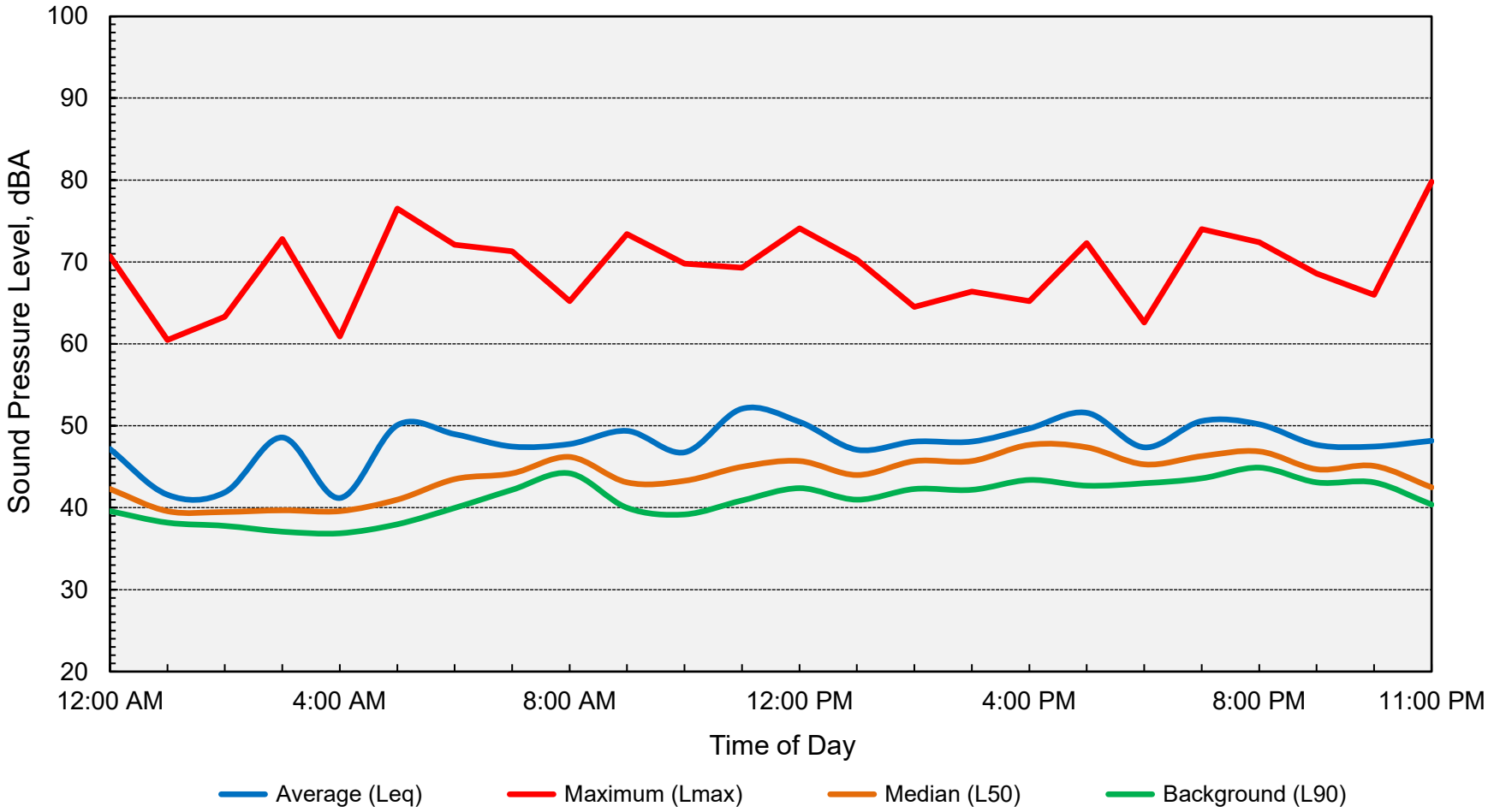
Appendix D-6
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Sunday, August 24, 2025



Computed DNL = 54 dB

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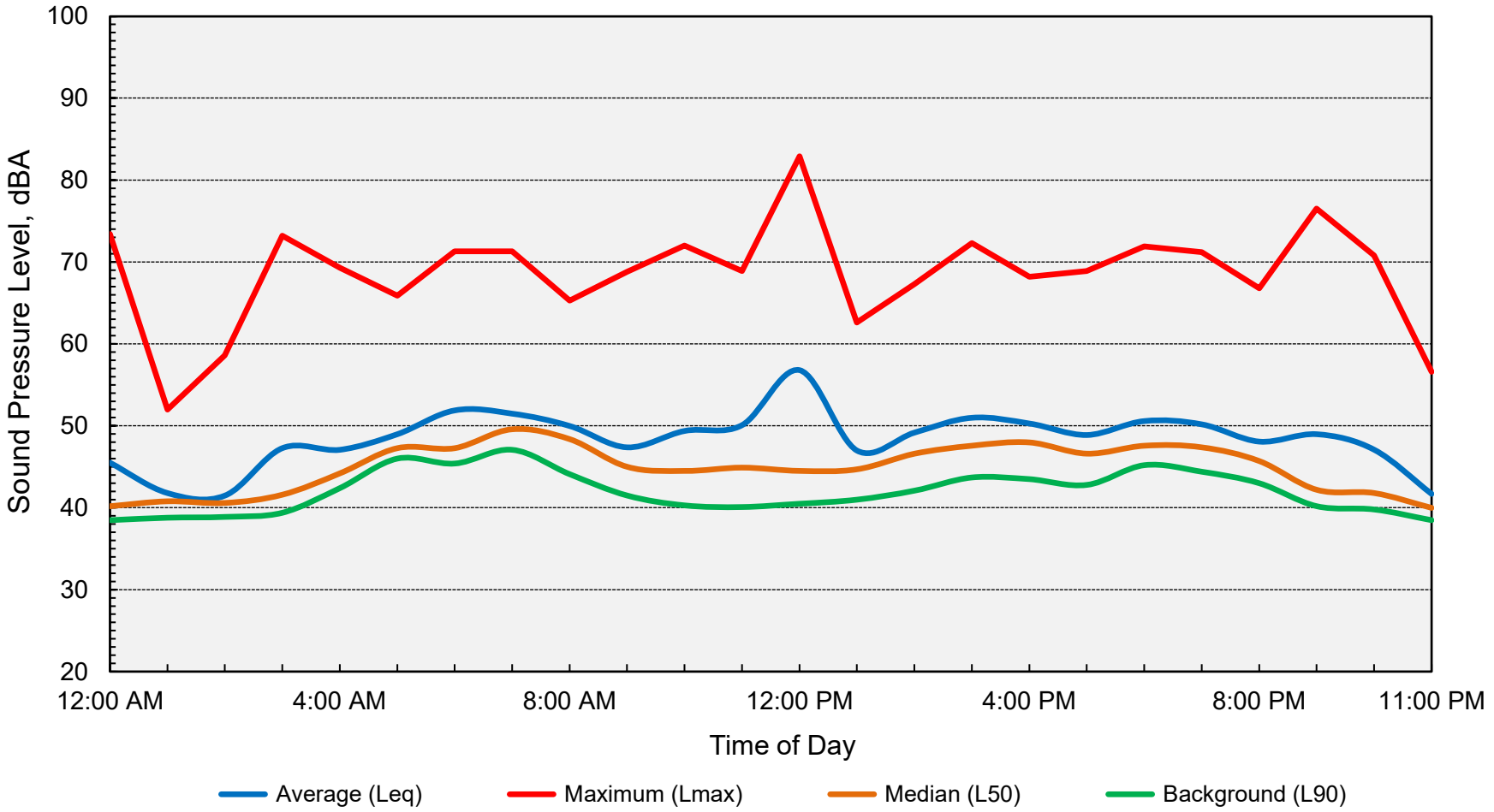
Appendix D-7
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Monday, August 25, 2025



Computed DNL = 54 dB

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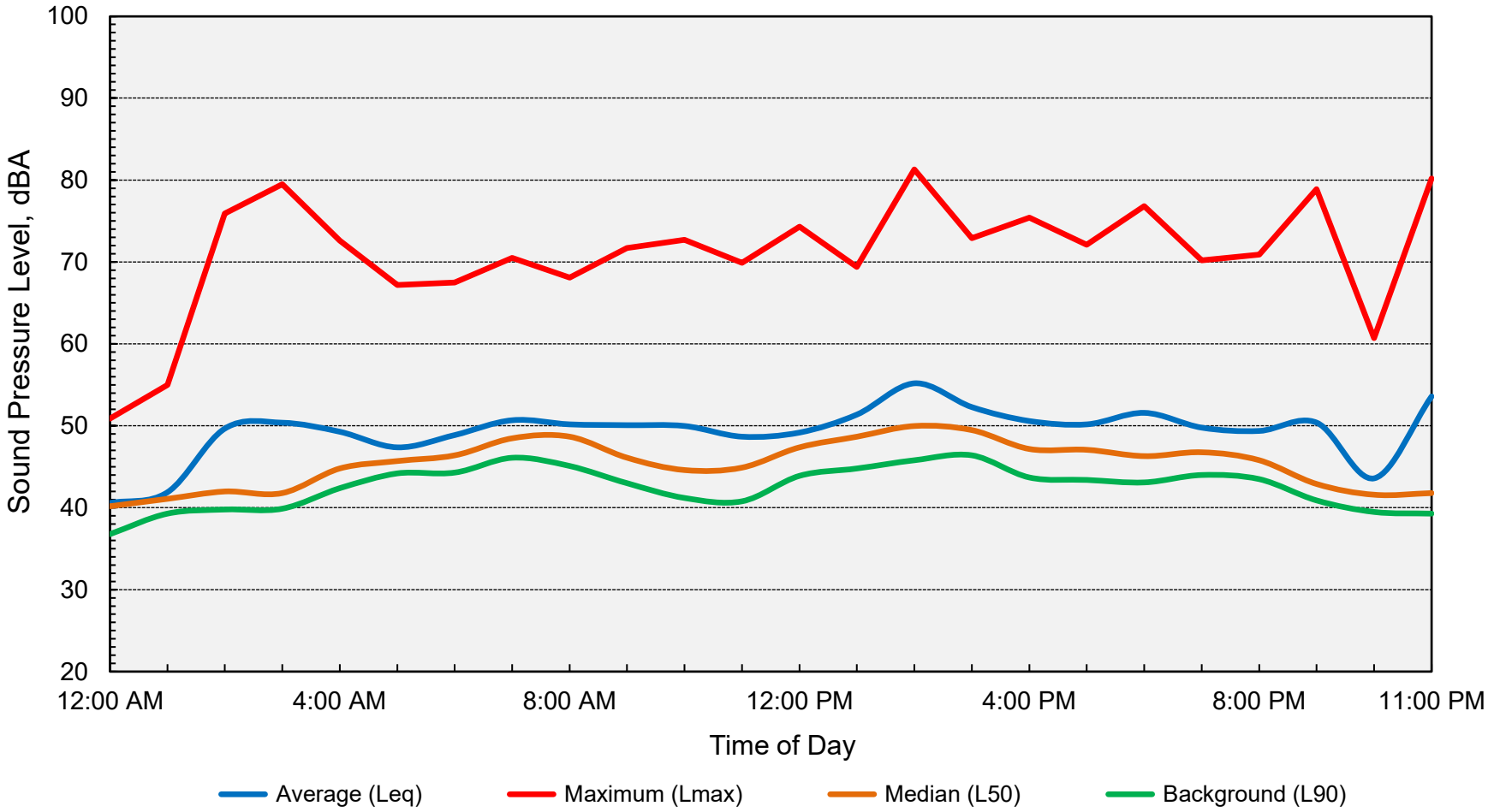
Appendix D-8
Long-Term Ambient Noise Monitoring Results, LT-2
Valley of the Sacred Heart Academy - Dixon, California
Tuesday, August 26, 2025



Computed DNL = 56 dB

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