Appendix K

45dB.com Noise Study and Noise Modeling Worksheets

Sound Level Assessment for

San Luis Ranch
132 Acres
Madonna Road and Dalidio Drive
San Luis Obispo, CA

requested by
Coastal Community Builders, Inc.
330 James Way
Pismo Beach, CA. 93449

February 26, 2015

45dB.com
David Lord, PH.D.
Acoustics Consulting

David Lord

P.O. Box 1406
San Luis Obispo
California 93406
tel. 805.704.8046
email: dl@45db.com

Table of Contents

List of Figures

Sound Level Assessment for

San Luis Ranch
132 Acres
Madonna Road and Dalidio Drive
San Luis Obispo, CA

1.0 Description and Criteria

This sound level assessment is for the proposed development of San Luis Ranch with regard to surrounding noise levels from all sources that have potential impact on noise sensitive uses. The possible noise sources examined in this study are vehicular traffic, as well as air traffic from San Luis Obispo County Regional Airport. In addition there are potential stationary noise sources from neighboring commercial activities and from the U.S. Post Office on Dalidio Drive. The 132 acre San Luis Ranch site is bordered by U.S. Highway 101 to the east and by Madonna Road to the north. Commercial activities, including loading docks and service garage operations occur southeast of the site. The general layout and configuration of the site, along with sound level measurement locations are shown in “Figure 1. Site Plan” on page 5.

Existing sound levels were measured on the proposed site over a 24-hour period on Friday and Saturday, January 16 - 17, 2015.

2.0 Regulatory Setting

Noise is regulated at the federal, state and local levels through regulations, policies and/or local ordinances. Local policies are generally adaptations of federal and state guidelines, adjusted to prevailing local condition. Refer to “6.0 APPENDIX I: Notes, Definitions” on page 24 for further definition of metrics and terminology.

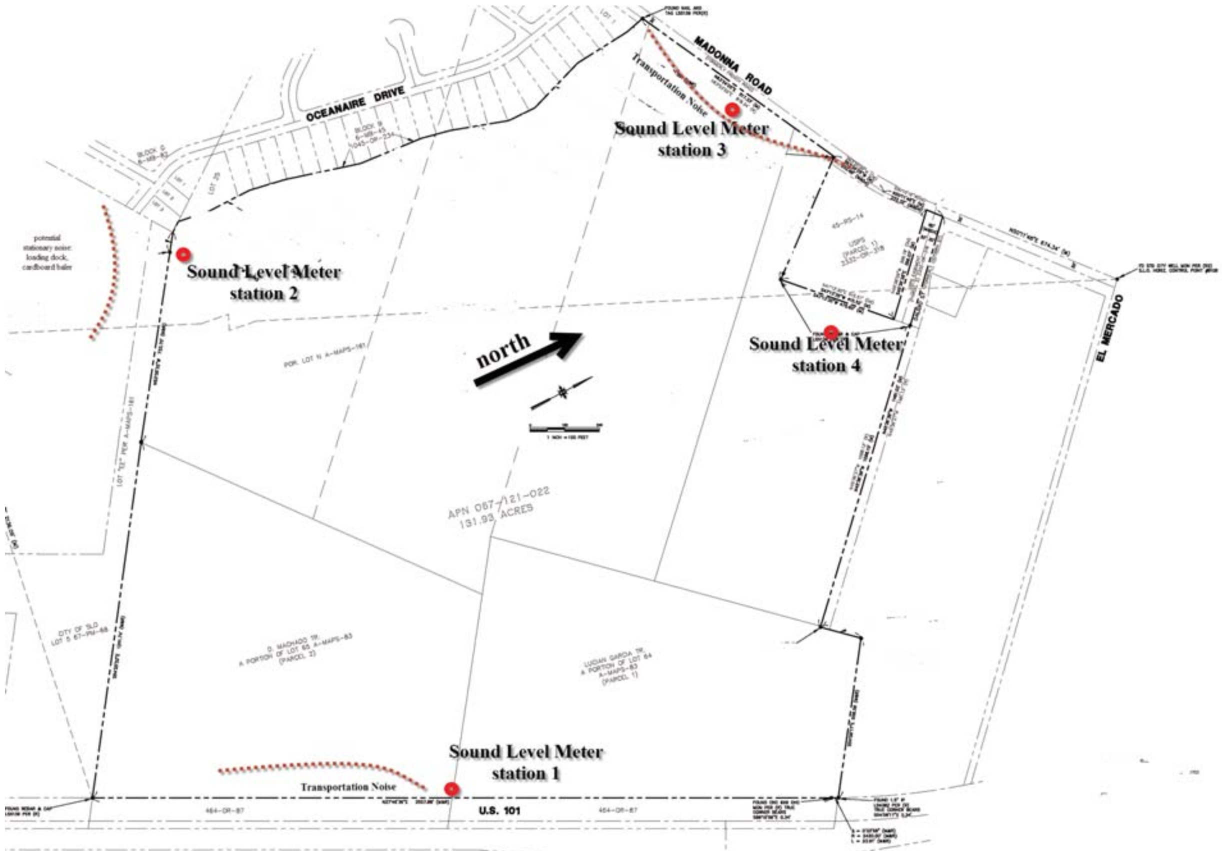
2.1 State Regulation

The State of California’s Guidelines for the Preparation and Content of Noise Element of the General Plan (1987). These guidelines reference land use compatibility standards for community noise environments as developed by the California Department of Health Services, Office of Noise Control. Sound levels up to 65 Ldn or CNEL are determined tobe normally acceptable for multi-family residential land uses. Sound levels up to 70 CNEL are normally acceptable for buildings containing professional offices or defined as business commercial. However, a detailed analysis of noise reduction requirements is recommended when new office or commercial development is proposed in areas where existing sound levels approach 70 CNEL.

The California Administrative Code (CAC), Title 24, Noise Insulation Standards. These standards establish interior noise levels for all new multi-family residences to 45 Ldn/CNEL

Figure 1. Site Plan

The plan shows adjacent roads which are potential noise sources, Madonna Road to the north and U.S. Highway 101 to the southeast. The location of four Sound Level 24-hour measurement stations around the perimeter of the site is shown.



or below. If exterior sound levels exceed 60 Ldn, CAC Title 24 and the State Building Code requires the preparation of an acoustical analysis showing that the proposed design would limit the sound level to, or below the interior 45 dBA CNEL requirement.

2.2 Local Regulation

Transportation Noise: Guidelines for transportation noise exposure are contained in *City of San Luis Obispo, General Plan Noise Element and Noise Guidebook (1996).* The maximum noise exposure standards for noise-sensitive land uses are shown in “Figure 2. Acceptable Noise Exposure” on page 7.

Stationary Noise: With regard to land use, potential noise conflict and noise mitigation measures, the maximum noise exposure permitted for stationary equipment is defined in Table 2 of the Noise Element of the General Plan, which is shown in “Figure 3. Maximum Noise Exposure” on page 8. For stationary noise sources, the Noise Element sets a limit for noise sensitive uses at the property boundary of Leq = 50 dB during daytime and Leq = 45 dB during nighttime.

Airport Land Use Plan

The location of the San Luis Ranch site is shown in “Figure 4. Airport Land Use Plan” on page 8, in relation to the Airport Land Use Plan Airport Noise Contours. The site is partially within the Projected 50 dB airport noise contour and partially within the Projected 55 dB airport noise contour.

3.0 Existing Sound Levels

Existing sound levels were measured across the proposed San Luis Ranch site were measured over a 24-hour period beginning at 12 noon on Friday January 16, 2015 through 12 noon January 17, 2015.

Four sound level measurement stations were chosen to represent the various potential noise sources found on this site.

(a) Station 1: Located at the southeastern site boundary and 75 feet from the nearest traffic lane of U.S. Highway 101, which is a large, linear concentrated noise source with potential impact on the site.

(b) Station 2. Located in the southwest corner of the site (see “Figure 1. Site Plan” on page 5). This location is subject to occasional low levels of stationary noise from commercial operations to the west. This measurement site offers a good opportunity to detect and measure overflight of aircraft departing and approaching San Luis Obispo County Regional Airport. Other than aircraft overflight, this is a relatively quiet location on the site, not near surface transportation or major stationary noise sources. Although there are currently some agricultural operations and activities in the vicinity, those noise sources were accounted for and were minimal during the noise measurement period.

(c) Station 3. Located near the north boundary of the property and 120 feet from the

Figure 2. Acceptable Noise Exposure

Acceptability of new noise-sensitive uses exposed to transportation noise sources.

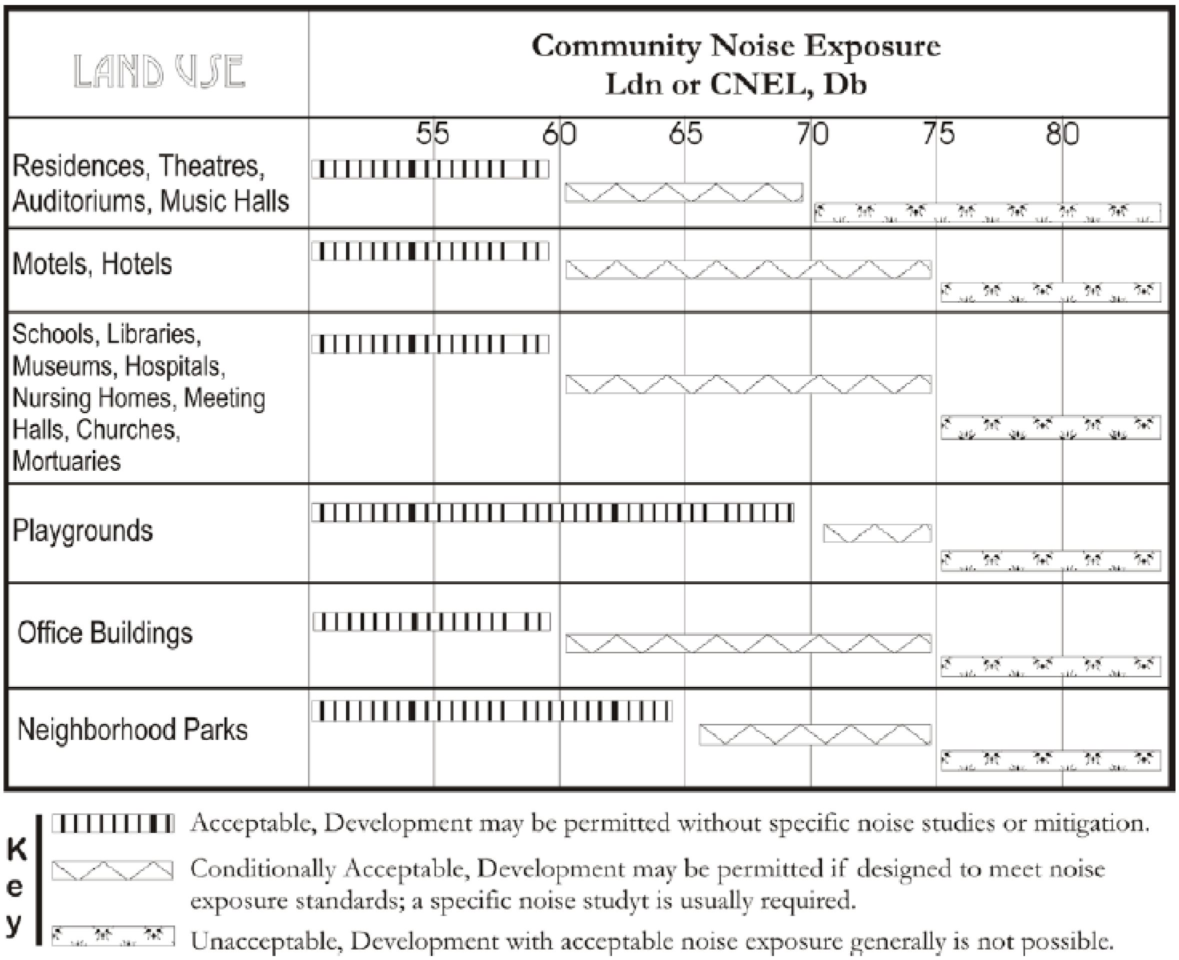


Figure 3. Maximum Noise Exposure

Table 2 from City of San Luis Obispo General Plan, Noise Element. Hourly average noise exposure shall not exceed 50 dB in daytime, 45 dB at night.

Table 2 Maximum Noise Exposure for Noise-Sensitive Uses Due to Stationary Noise Sources

Duration	Day (7a.m to 10 p.m.)	Night (10 p.m. to 7 a.m.)
Hourly L_{eg} in dB[1,2]	50	45
Maximum level in dB[1,2]	70	65
Maximum impulsive noise in dB[1,3]	65	60

[1]As determined at the property line of the receiver. When determining effectiveness of noise mitigation measures, the standards may; be applied on the receptor side of noise barriers or other property-line noise mitigation measures.

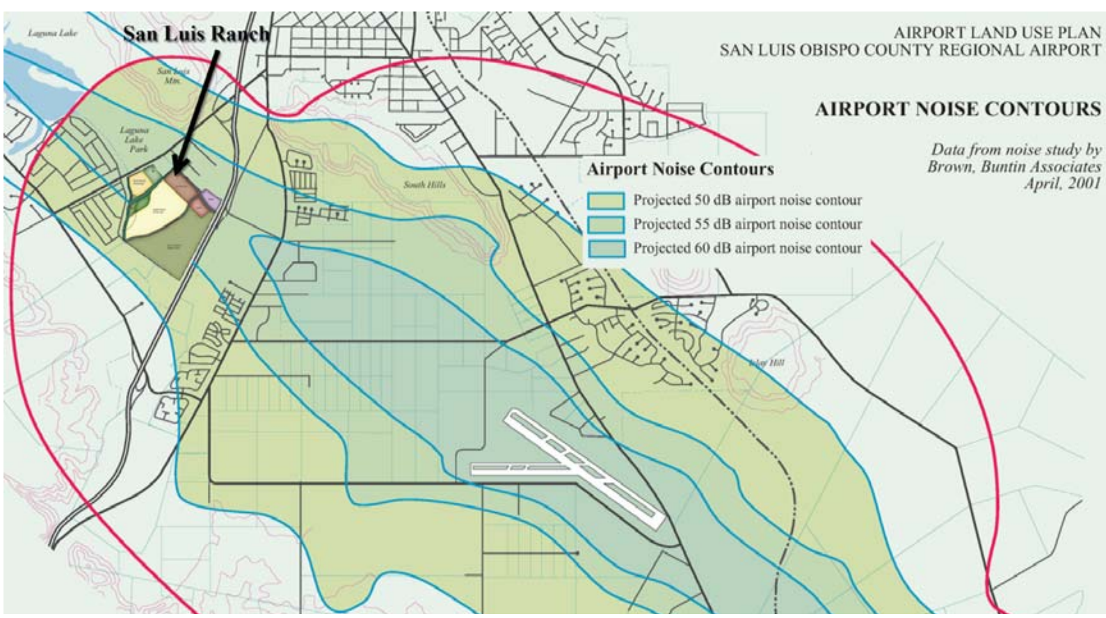
[2]Sound level measurements shall be made with slow meter response.

[3]Sound level measurements shall be made with fast meter response.

Source: Brown-Buntin Associates

Figure 4. Airport Land Use Plan

Location of San Luis Ranch site in relation to the Airport Land Use Plan Airport Noise Contours. The site is partially within the Projected 50 dB airport noise contour and the Projected 55 dB airport noise contour.



nearest traffic lane (eastbound) of Madonna Road.

(d) Station 4. Located next to the north boundary of the property, adjacent to the U.S. Postal Service Facility loading and staging area, with 24-hour daily operation. The major source of noise at this station is the delivery, loading and unloading of mail from the facility, which may occur at all hours.

Continuous sound level measurements at all measurement stations were begun Monday, January 27th and continued through Tuesday January 28 at each of the locations shown in "Figure 1. Site Plan" on page 5. Sound levels were spot checked around the perimeter of the site. The resulting Sound Level Contours shown in "Figure 5. Existing Sound Level Contours" on page 11, describe the existing, baseline sound levels on the site. Data from each 24-hour sound level measurement station are graphed in the following figures:

(a) Measurement Station 1: "Figure 6. Station One Sound Level" on page 12.

(b) Measurement Station 2: "Figure 9. Station Two Sound Level" on page 15.

(c) Measurement Station 3: "Figure 11. Station Three Sound Level" on page 17.

(d) Measurement Station 4: "Figure 13. Station Four Sound Level" on page 19.

The hourly Leq for each of the measurement sites was derived from measured sound level data. In addition, for each measurement location the 24-hour Ldn and CNEL values were calculated (see "6.0 APPENDIX I: Notes, Definitions" on page 24 for definitions)

4.0 Discussion and Conclusion.

The 24-hour existing sound levels on the undeveloped site are clearly shown at each of the measurement stations and in "Figure 5. Existing Sound Level Contours" on page 11. In the area of the site along Madonna road, sound levels exceed 60 dBA. Residential units planned in the multi-family residential area will require noise mitigation of any potential outdoor activity areas that are located in areas above 60 dBA. In addition, the elevations of residential units directly facing Madonna Road will require additional construction beyond ordinary construction to attenuate traffic noise in habitable spaces to CNEL = 45 dBA. This requirement will increase with elevations above the first floor. Sound attenuating construction will include improved wall / window assemblies and improved venting with higher Sound Transmission Class ratings. If windows are required to be shut to meet the interior 45 dBA requirement, then a mechanical ventilation alternative is required.

The proposed use for possible future hotel may require further acoustical study. If the hotel is to be a multi-story structure, then upper floors should be examined to assess the impact of noise from Highway 101 above the first floor level.

The measurable sound level of air traffic for flights to and from San Luis Obispo County Regional Airport is shown for a 24-hour period in "Figure 8. Station Two Sound Level" on page 14.and for a single typical hour in "Figure 9. Station Two Sound Level" on page 15.

The Ldn / CNEL value of 53 dBA for station two represents the 24-hour average sound level for air traffic. The existing sound level value is lower than the projected sound level of CNEL 55, shown in “Figure 4. Airport Land Use Plan” on page 8. Therefore, the proposed residential development is in compliance with airport land use noise thresholds.

Figure 5. Existing Sound Level Contours

Site Plan, existing site, showing sound level contours expressed as CNEL = dBA.

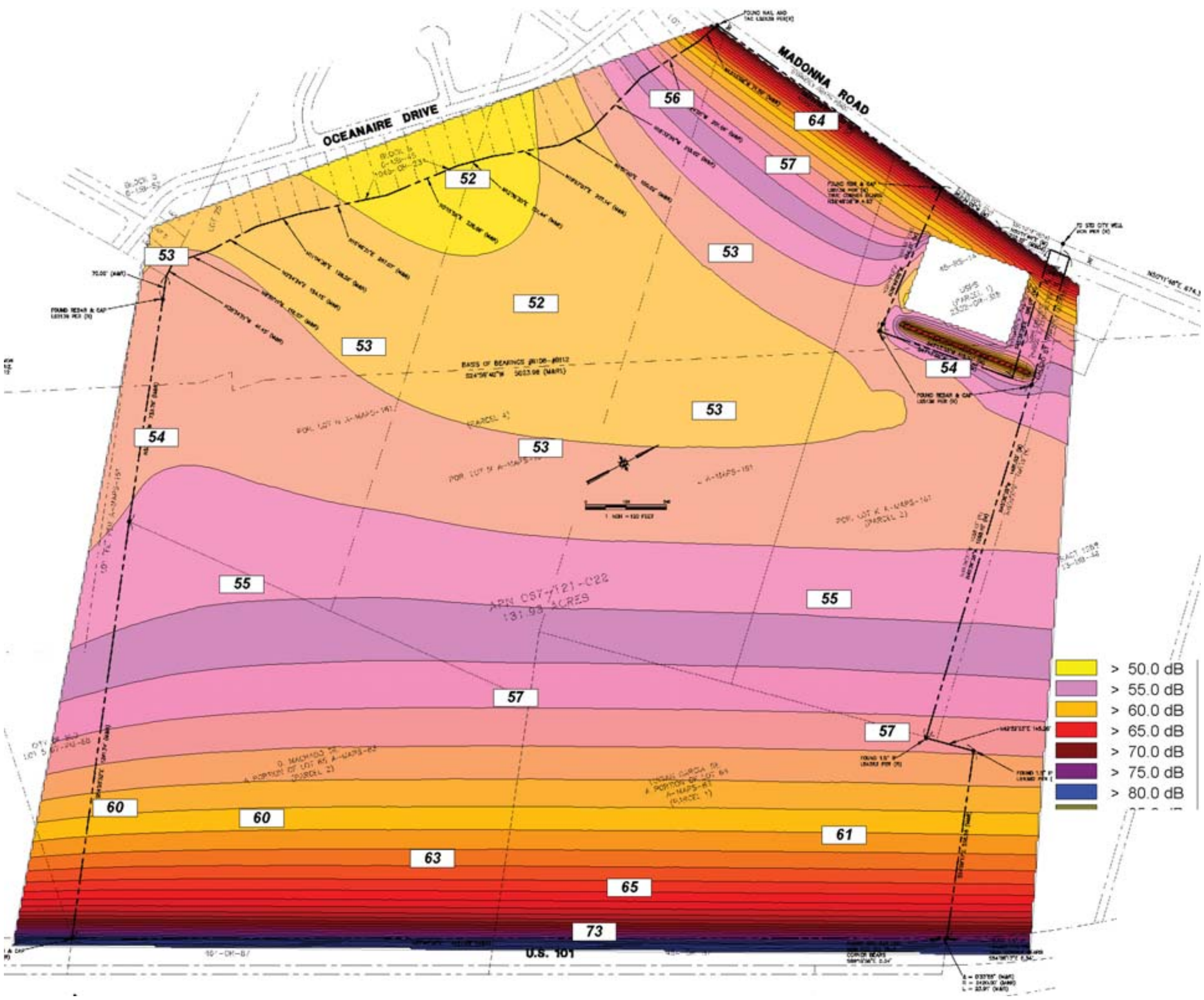


Figure 6. Station One Sound Level

Station One Sound Level, measured every 10 seconds over a 24-hour period. The sound level meter is located 75 feet west of nearest traffic lane. Peak sound levels are generally identified as motorcycles or trucks. Sound levels are dBA, slow meter setting

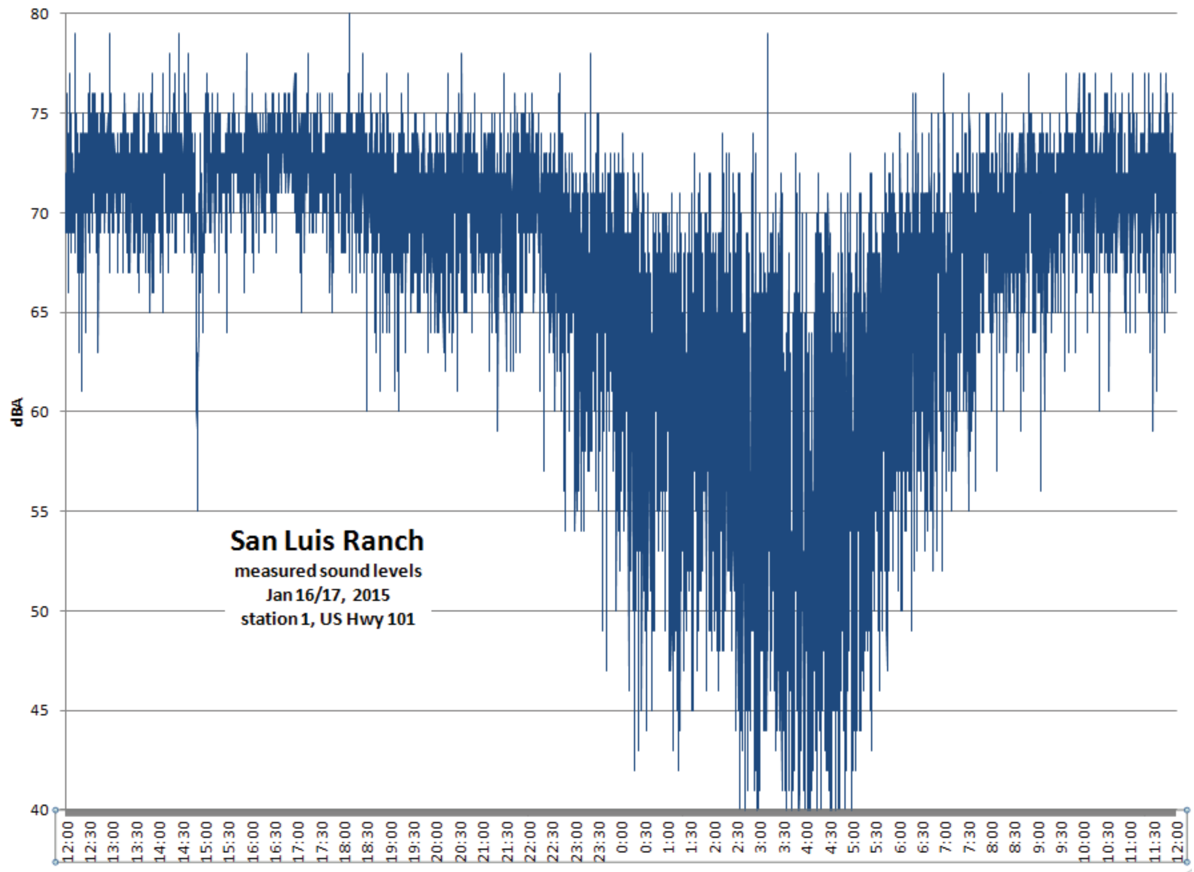


Figure 7. Station One hourly Leq

Station One Sound Levels, expressed as hourly Leq over a 24-hour period. The calculated LDN/ CNEL for the 24-hour period is 74 dBA, including calculated penalties for evening and nighttime noise.

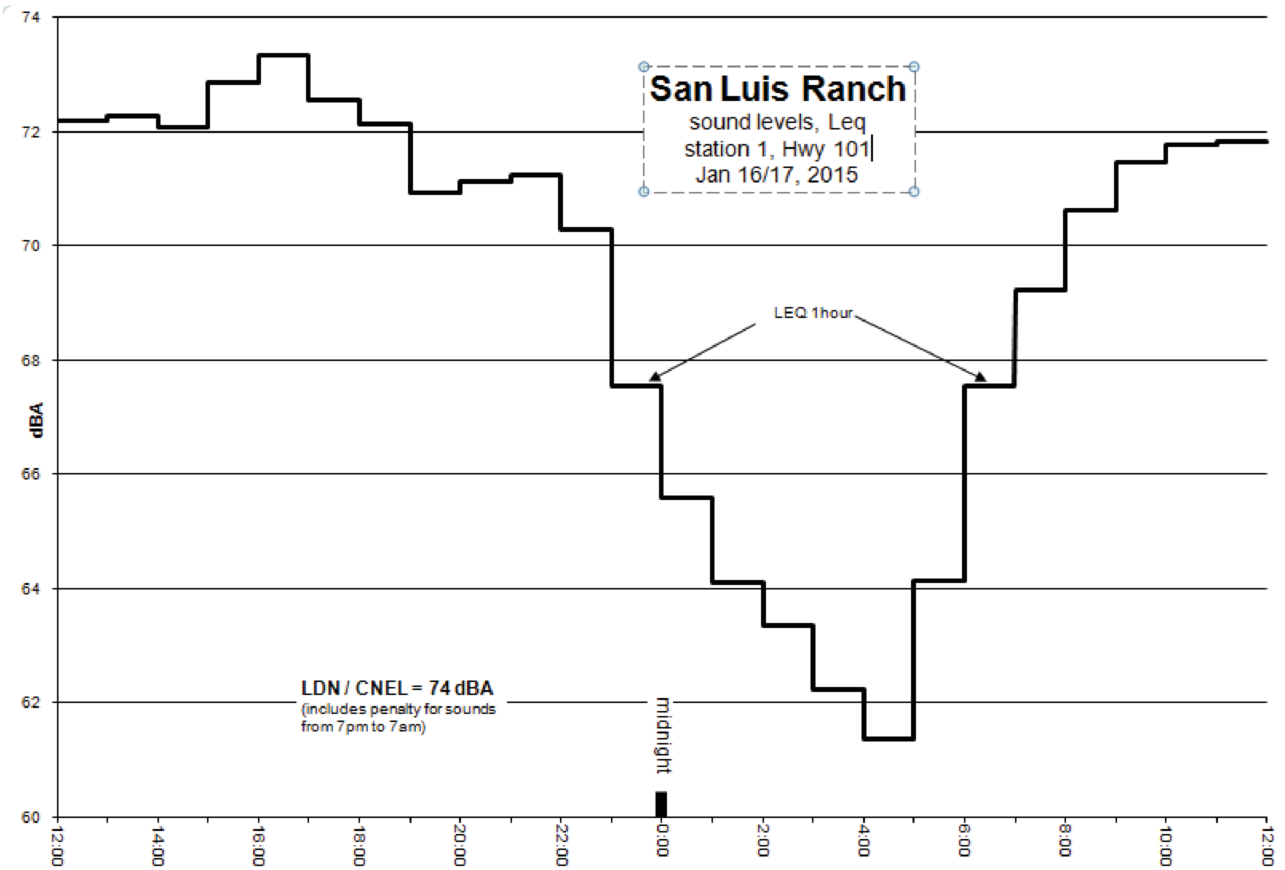


Figure 8. Station Two Sound Level

Station Two Sound Level, measured every 10 seconds over a 24-hour period. The sound level meter is located adjacent to the property line in the southwest corner of the site, in a quiet location. Peak sound levels are generally identified as propellor and jet aircraft. Sound levels are dBA, slow meter setting

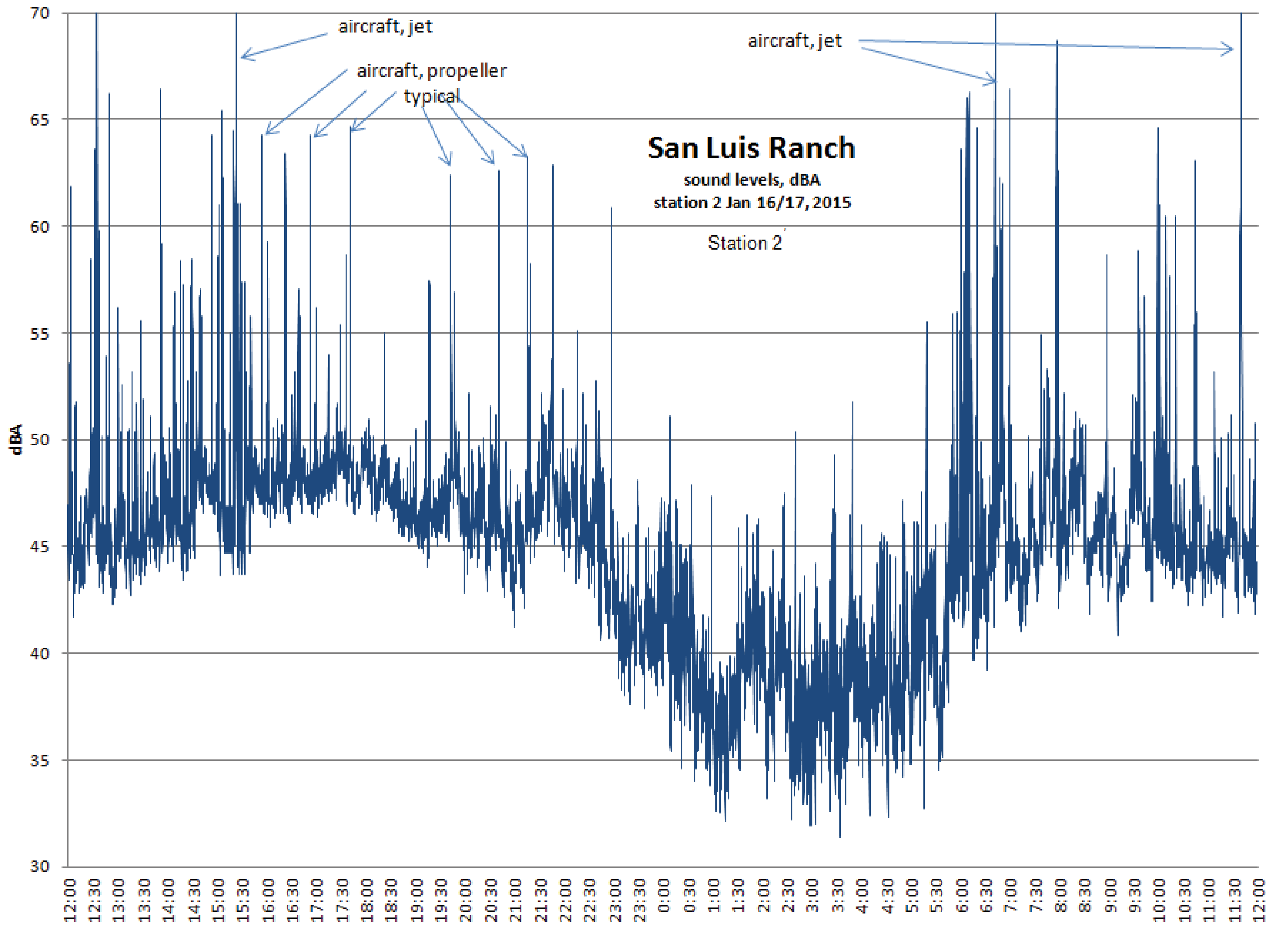


Figure 9. Station Two Sound Level

Station Two Sound Level, measured every 10 seconds over a one-hour period from 1600 to 1700 on January 16th, 2015. Leq for this hour is 49 dBA (see Leq values in “Figure 10. Station Two hourly Leq” on page 16). The sound level meter is located adjacent to the property line in the southwest corner of the site, in a quiet location. Shown are the duration and intensity of three overflights. Peak sound levels are identified as propellor aircraft. Sound levels are dBA, slow meter setting

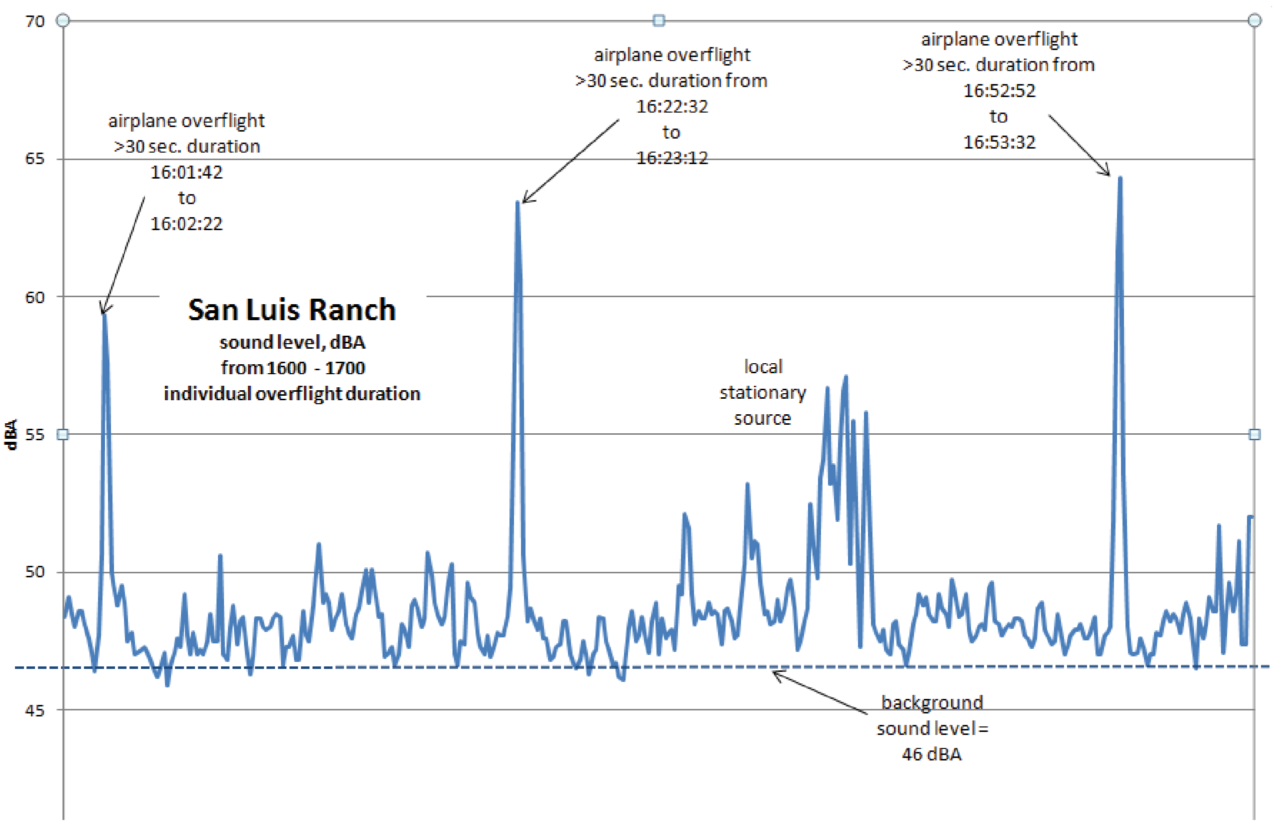


Figure 10. Station Two hourly Leq

Station Two Sound Levels, expressed as hourly Leq over a 24-hour period. The calculated LDN/ CNEL for the 24-hour period is 64 dBA, including calculated penalties for evening and nighttime noise.

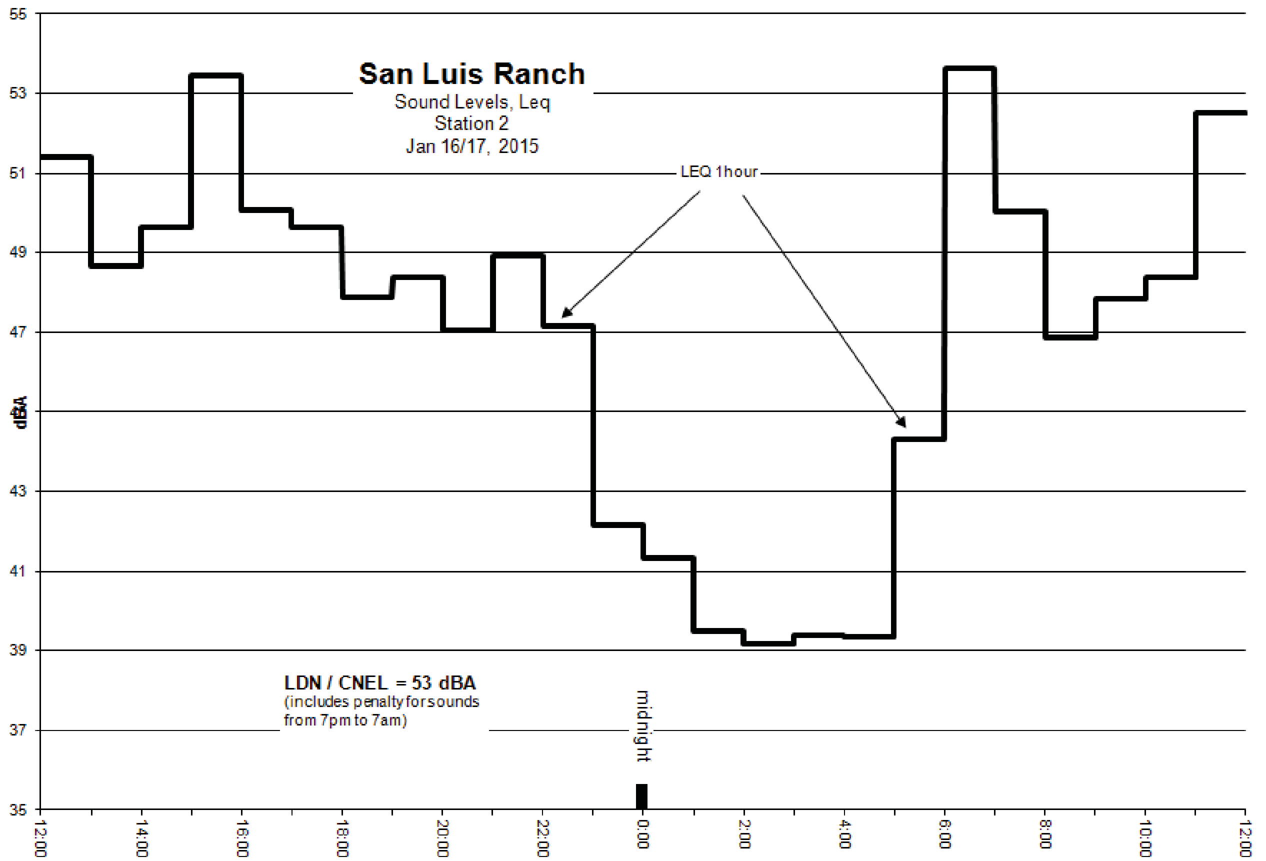


Figure 11. Station Three Sound Level

Station Three Sound Level, measured every 10 seconds over a 24-hour period. The sound level meter is located 125 feet south of nearest traffic lane. Peak sound levels are generally identified as motorcycles or trucks. Sound levels are dBA, slow meter setting.

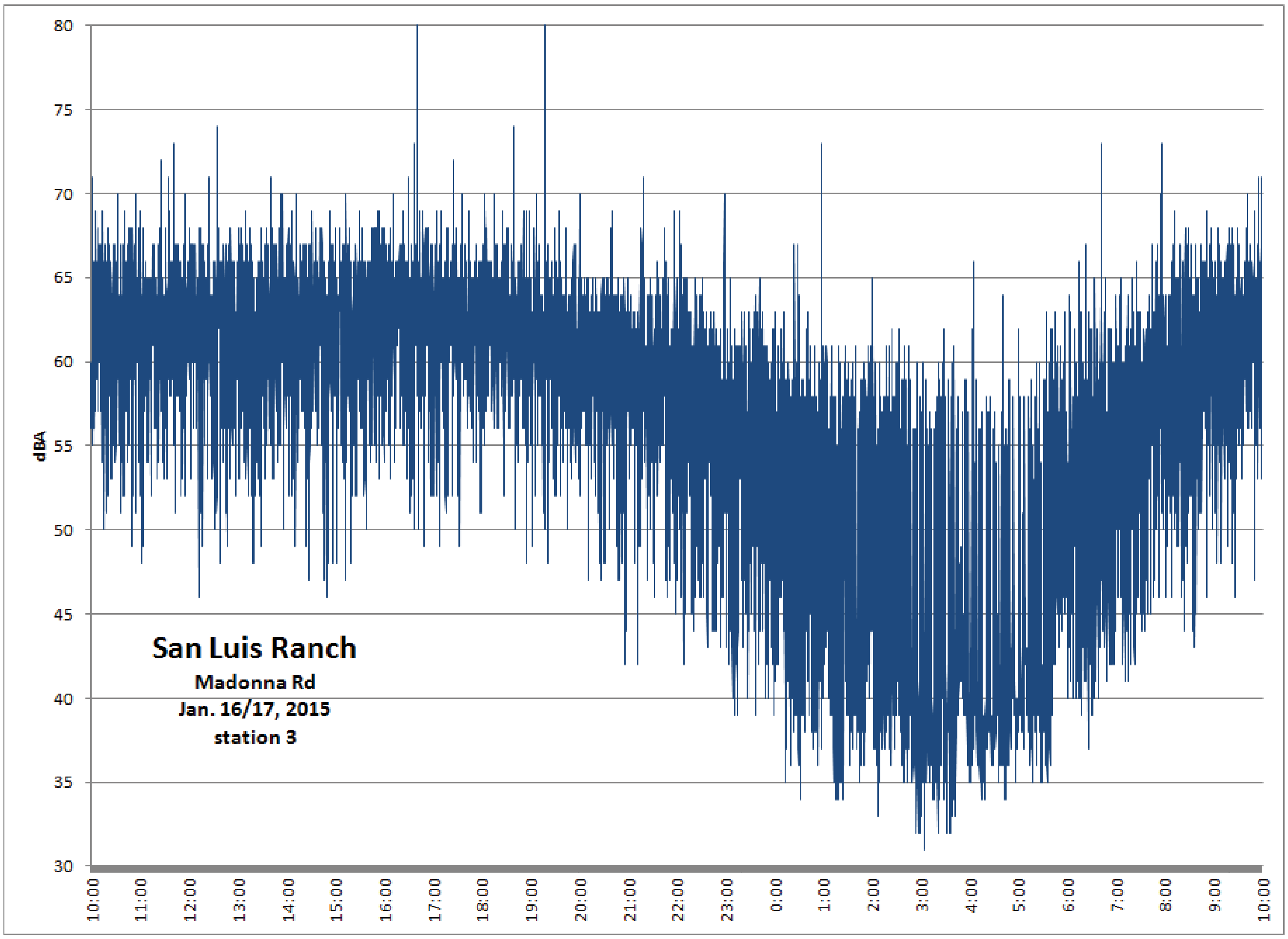


Figure 12. Station Three hourly Leq

Station Three Sound Levels, expressed as hourly Leq over a 24-hour period. The calculated LDN/CNEL for the 24-hour period is 64 dBA, including calculated penalties for evening and nighttime noise.

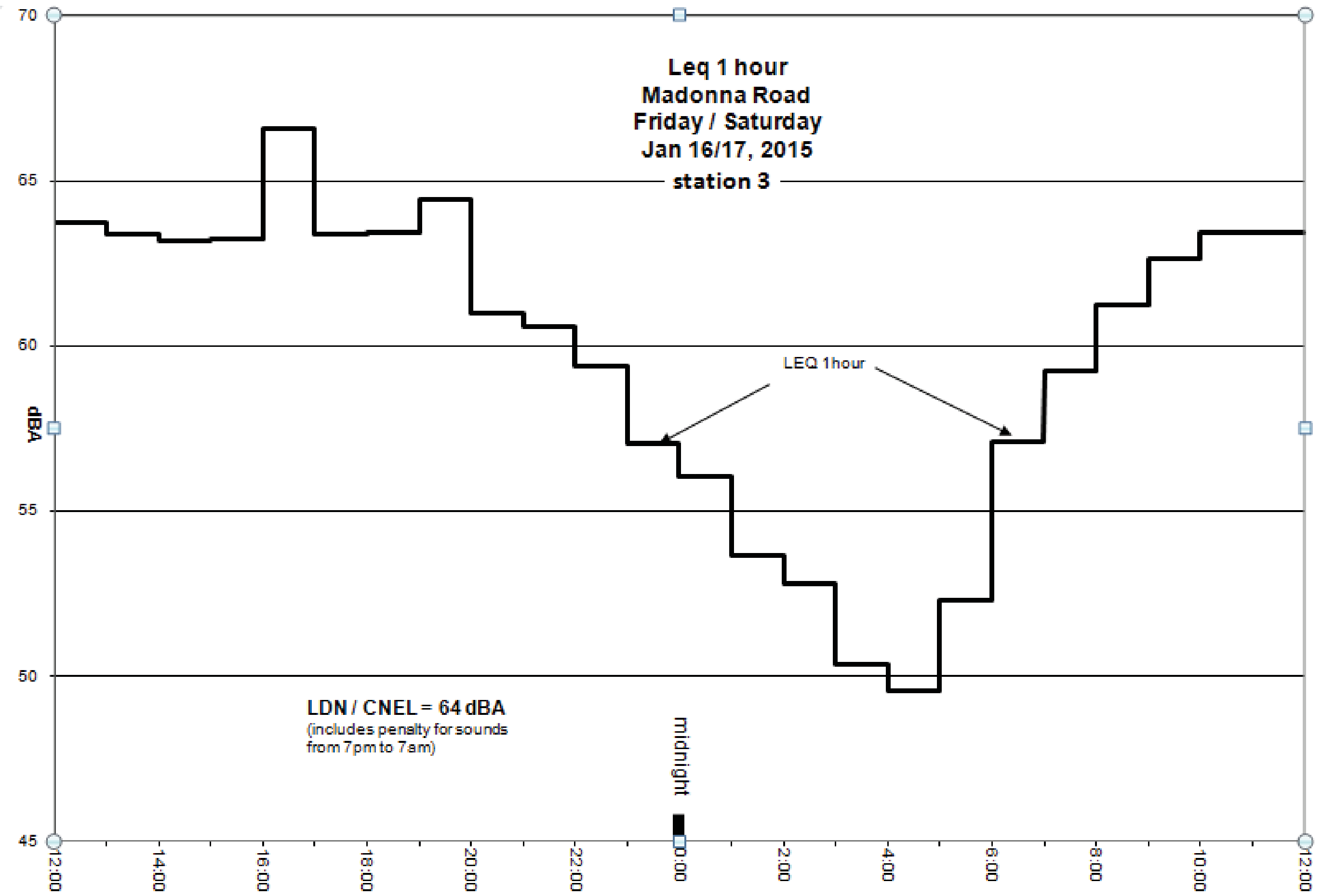


Figure 13. Station Four Sound Level

Station four Sound Levels, measured every 10 seconds over a 24-hour period. The sound level meter is located 10 feet south of U.S. Post Office shared boundary. Peak sound levels are generally identified as arriving and departing delivery vehicles. Sound levels are dBA, slow meter setting.

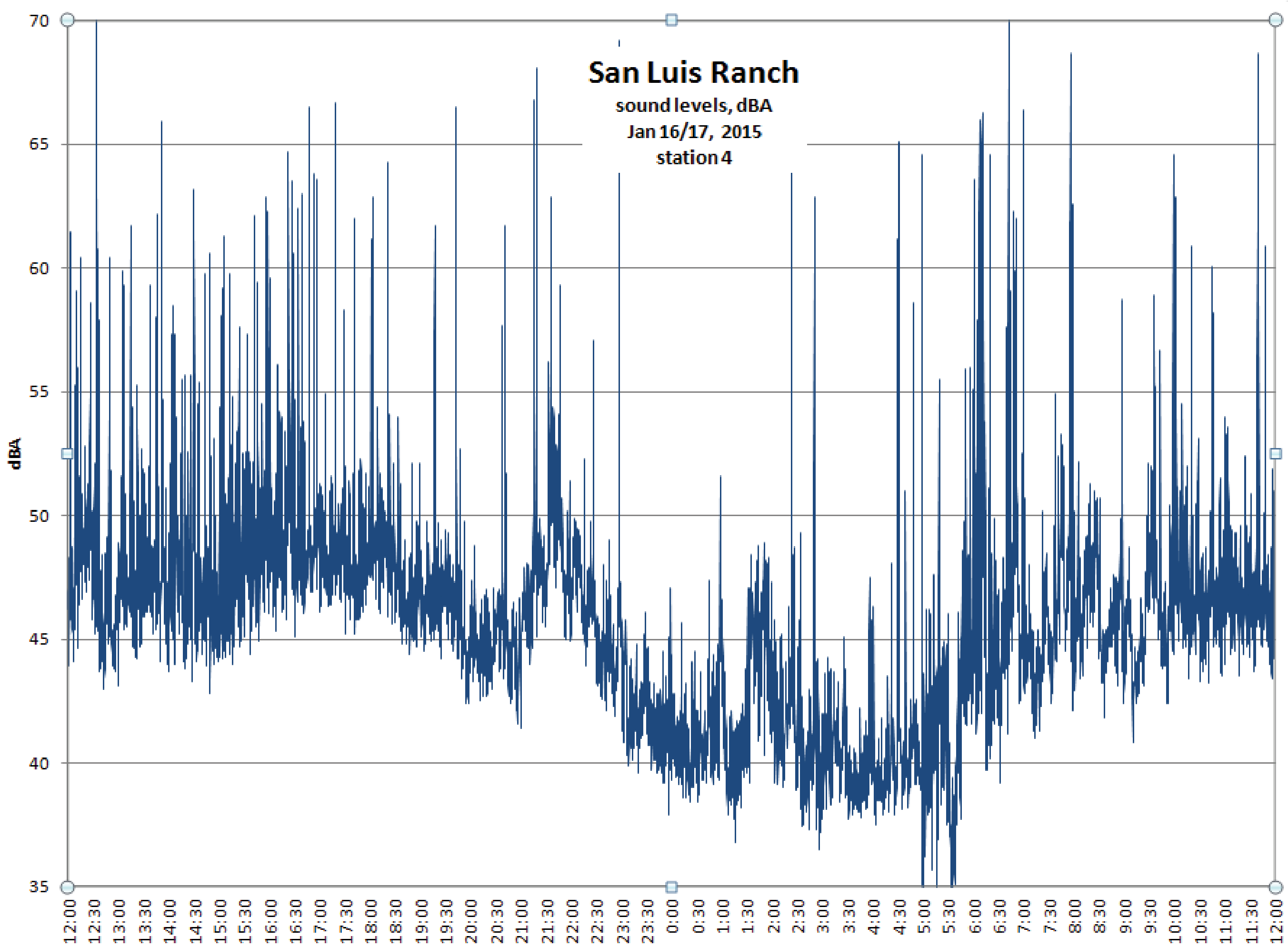


Figure 14. Station Four hourly Leq

Station Four Sound Levels, expressed as hourly Leq over a 24-hour period. The calculated LDN/CNEL for the 24-hour period is 54 dBA, including calculated penalties for evening and nighttime noise.

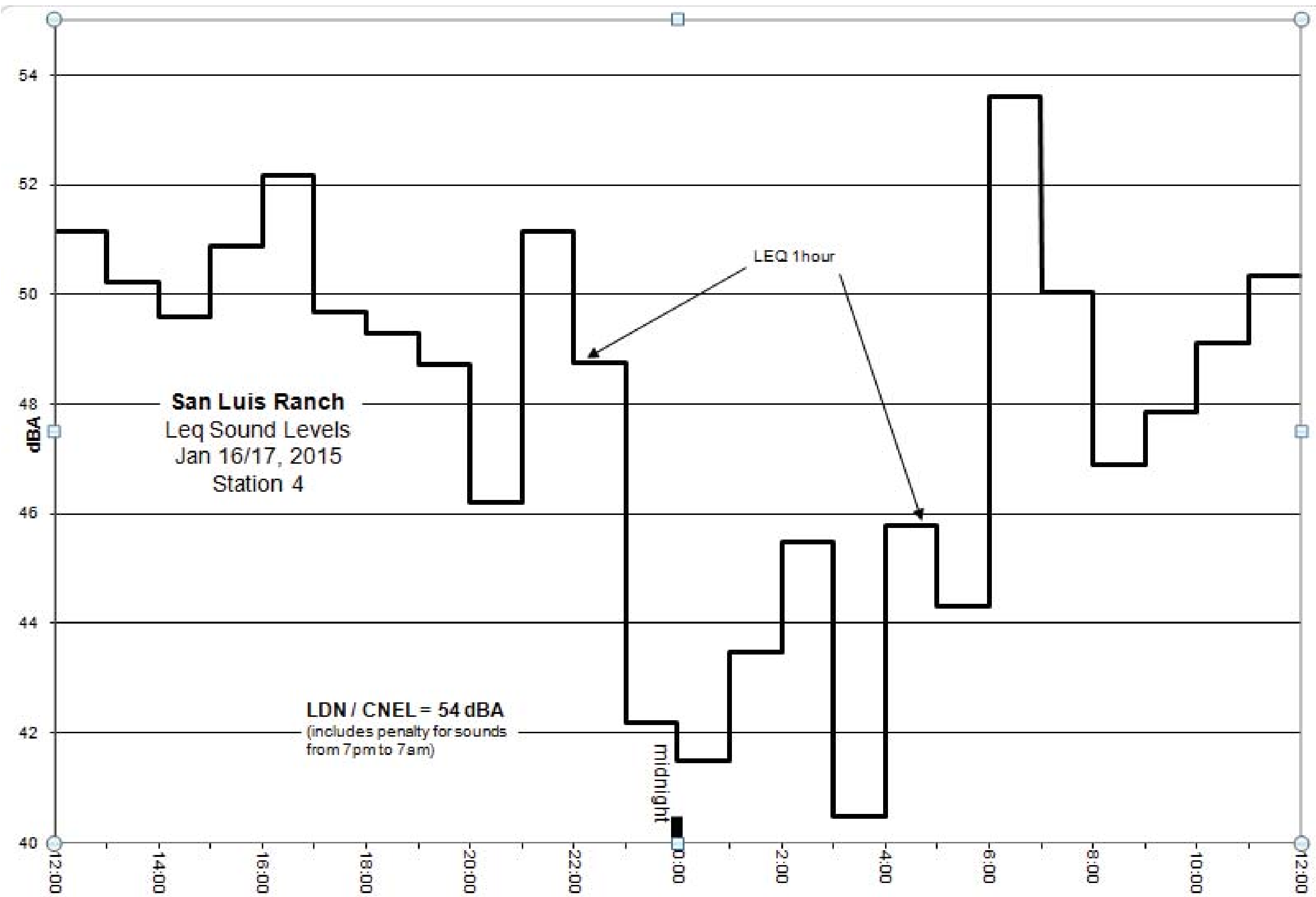


Figure 15. Weather Data, January 16, 2015

Atmospheric conditions that may affect sound level measurements are shown. Wind speed above 10 mph on the afternoon of January 16, 2015 from 9:30 am to 6:30 pm may have caused a small increase in sound levels below 45 dBA, measured during that time. There would be no effect on sound levels measured above 50 dBA.

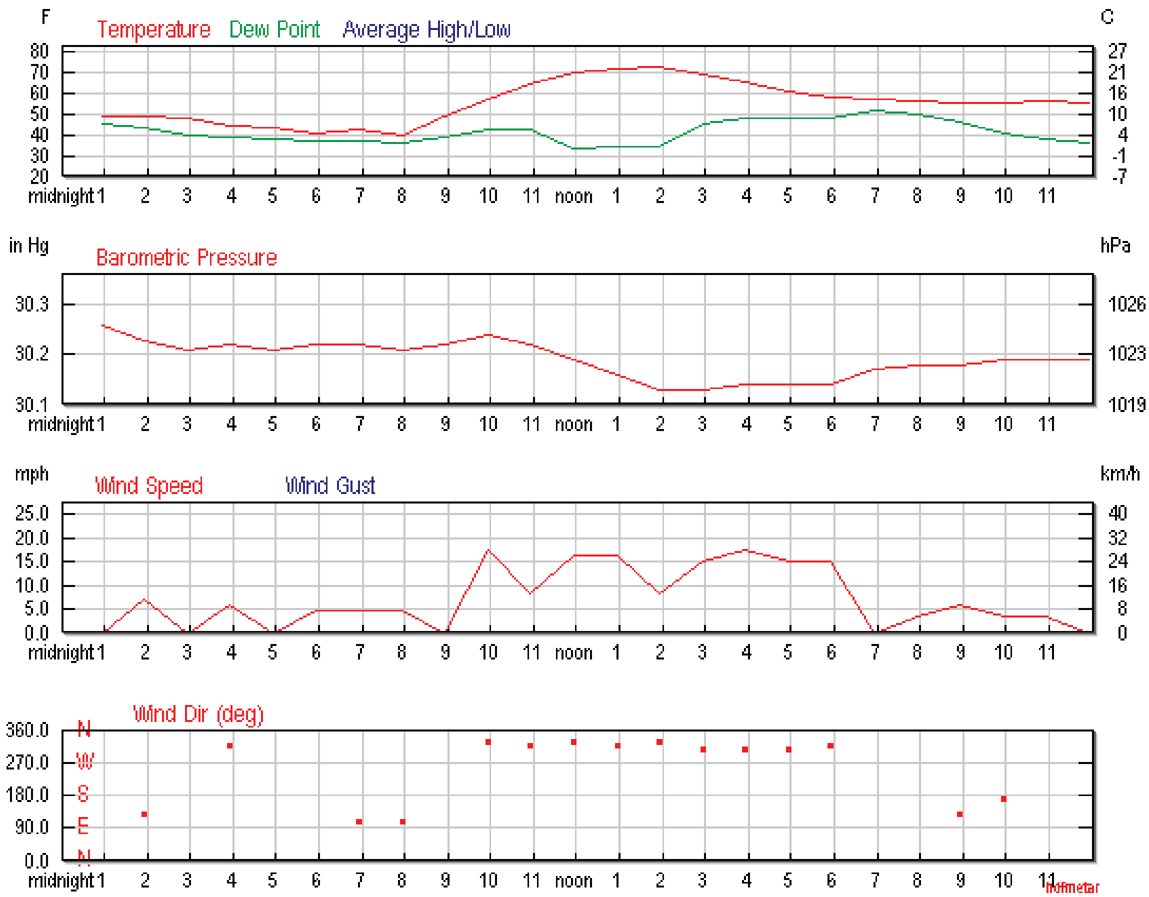
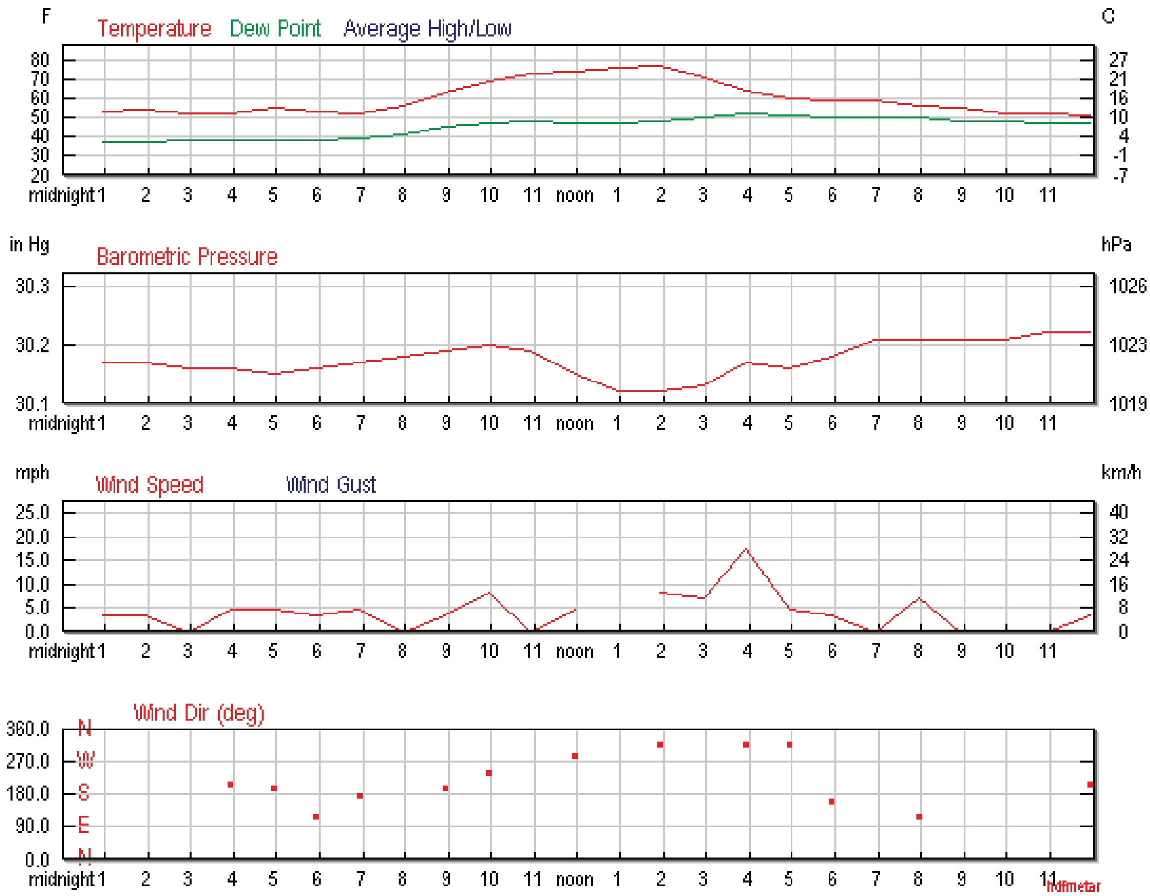


Figure 16. Weather Data, January 17, 2015

Atmospheric conditions that may affect sound level measurements are shown. Wind speed above 10 mph on the afternoon of January 16, 2015 from 3 pm to 4:30 pm may have caused a small increase in sound levels below 45 dBA, measured during that time. There would be no effect on sound levels measured above 50 dBA.



5.0 REFERENCES

1. American National Standards Institute, Inc. 2004. *ANSI 1994 American National Standard Acoustical Terminology*. ANSI S.1.-1994, (R2004) , New York, NY.

2. American Society for Testing and Materials. 2004. *ASTM E 1014 - 84 (Reapproved 2000) Standard Guide for Measurement of Outdoor A-Weighted Sound Levels.*

3. Berglund, Birgitta, World Health Organization. 1999. *Guidelines for Community Noise* chapter 4, Guideline Values.

4. Bolt, Beranek and Newman. 1973. *Fundamentals and Abatement of Highway Traffic Noise*, Report No. PB-222-703. Prepared for Federal Highway Administration.

5. California Department of Transportation (Caltrans). 1982. *Caltrans Transportation Laboratory Manual.*

6. ______. 1998. *Caltrans Traffic Noise Analysis Protocol For New Highway Construction and Highway Reconstruction Projects*.

7. ______. 2006. *California Transportation Plan 2025*, chapter 6.

8. California Resources Agency. 2007. *Title 14. California Code of Regulations* Chapter 3. Guidelines for Implementation of the California Environmental Quality Act Article 5. Preliminary Review of Projects and Conduct of Initial Study Sections, 15060 to 15065.

9. City of San Luis Obispo. *City of San Luis Obispo General Plan, Noise Element*.

10. Federal Highway Administration. 2006. *FHWA Roadway Construction Noise Model User's Guide Final Report.* FHWA-HEP-05-054 DOT-VNTSC-FHWA-05-01.

11. Harris, Cyril.M., editor. 1979 *Handbook of Noise Control*.

6.0 APPENDIX I: Notes, Definitions

TERM	DEFINITION
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level is typically defined by the LEQ level.
Background Noise Level	The underlying, ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up the background. The background level is generally defined by the L90 percentile noise level.
Sound Level, dB	Sound Level. Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals, SLOW time response, in accordance with ANSI S1.4-1971 (R1976) Unit: decibels(dB).
dBA or dB(A):	A-weighted sound level. The ear does not respond equally to all frequencies, but is less sensitive at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound level of a noise containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is said to be A-weighted, and the units are dBA. The A-weighted sound level is also called the noise level.
Equivalent Sound Level LEQ	Because sound levels can vary markedly in intensity over a short period of time, some method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, one describes ambient sounds in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called LEQ. In this report, an hourly period is used.
Percentile Sound Level (Ln)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (e.g., L90)
Subjective Loudness Changes.	In addition to precision measurement of sound level changes, there is a subjective characteristic which describes how most people respond to sound: •A change in sound level of 3 dBA is *barely perceptible* by most listeners. •A change in level of 6 dBA is *clearly perceptible*. •A change of 10 dBA is perceived by most people as being *twice* (or *half*) as loud.
Time weighting	Different, internationally recognized, meter damping characteristics are available on sound level measuring instruments: Slow (S), Fast (F) and Impulse (I). In this community sound level measurement, the Fast (F) response time is used.
Day/Night Level (Ldn)	Ldn is the A-weighted equivalent continuous sound level for a 24-hour period with a ten dB adjustment added to sound levels that occur during nighttime hours (10 pm to 7 am).
Community Noise Equivalent Level (CNEL)	Community Noise Equivalent Level, CNEL, is the A-weighted equivalent continuous sound (CNEL) level for a 24-hour period with a ten dB adjustment added to sound levels occurring during nighttime hours (10 pm to 7 am) and a five dB adjustment added to the sound levels occurring during the evening hours (7 pm to 10 pm).

7.0 Measurements, Calculations and Modeling

7.1 Wind Measurement

Sound level measurements become less reliable when average wind speed is greater than 11 m.p.h. at the measurement site. Therefore, wind speed and direction are measured periodically at the measurement site and the results are correlated with wind data from a nearby established weather station. A Larson Davis WS 001 windscreen is used as wind protection for all microphones and is left in place at all times.

Wind speed and direction were noted throughout the measurement period and compared with data from the nearby National Weather Service weather station at San Luis Obispo County Regional Airport. A Davis Turbo Wind meter was used to measure wind speed at the measurement site. The Turbo Wind meter is a high performance wind speed indicator with exceptional accuracy.

7.2 Precision of Sound Level Meters.

The American National Standards Institute (ANSI) specifi es several types of sound levelmeters according to their precision. Types 1,2, and 3 are referred to as “precision,” “generalpurpose,” and “survey” meters, respectively. Most measurements carefully taken with a type 1 sound level meter will have an error not exceeding 1 dB. The corresponding error for a type 2 sound level meter is about 2 dB.

The sound level meters used for measurements shown in this report are Larson-Davis Laboratories Model 820. These sound level meters meet all requirements of ANSI s1.4, IEC 651 for Type 1 accuracy and include the following features: 110 dB dynamic range for error free measurements. Measures FAST, SLOW, Unweighted PEAK, Weighted PEAK, Impulse, Leq, LDOD, LOSHA, Dose, Time Weighted Average, SEL, Lmax, Lmin, LDN. Time history sampling periods from 32 samples per second up to one sample every 255 seconds.

Field calibration of each sound level meter is accomplished before and after all field measurements with an external calibrator. Laboratory calibration of the all instruments is performed at least biannually and accuracy can be traced to the U.S. National Institute of Science and Technology standard.

7.3 Sound Level Measurement Method

The protocol for conducting sound level measurements is prescribed in detail by the American Society for Testing and Materials (ASTM) in their E 1014 publication and the CalTrans Traffic Noise Analysis Protocol. The procedures and standards in those documents are met or exceeded for sound level measurements shown in this report. The standards of ASTM E 1014 are exceeded by using Type 1 sound level meters for all measurements in this report instead of the less accurate Type 2 meters. Therefore, the precision of the measurements in this report is likely to be better than +/- 2 dB as stated in ASTM E1014. Particular and specific sound sources are identified by listening to synchronous audio recordings of peak sound level events.

Caltrans Noise Measurement Guidelines: Caltrans makes available general guidelines for taking into account environmental elements in noise measurements. The following is an excerpt from their guidelines. The Traffic Noise Analysis Protocol contains Caltrans noise policies, which fulfill the highway noise analysis and abatement/mitigation requirements stemming from the following State and Federal environmental statutes:

- California Environmental Quality Act (CEQA)
- National Environmental Policy Act (NEPA)
- Title 23 United States Code of Federal Regulations, Part 772 “Procedures for Abatement of Highway Traffi c Noise and Construction Noise” (23 CFR 772)
- Section 216 et seq. of the California Streets and Highways Code

Noise Contour Modeling

Noise contours incorporating the measured sound level values were generated using CADNA/A, an acoustical modeling program that incorporates the TNM 2.5 algorithms, and which was developed to predict hourly Leq values for free-flowing traffic conditions. This computer modeling tool, made by Datakustik GmbH, is an internationally accepted acoustical modeling software program, used by many acoustics and noise control professional offices in the U.S. and abroad. The software has been validated by comparison with actual values in many different settings. The program has a high level of reliability and follows methods specified by the International Standards Organization in their ISO 9613-2 standard, “Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation.” The standard states that, “this part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.”

The computer modeling software takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain variations. The CADNA/A software uses a grid of receivers covering the project site.