CLAY PIT SVRA NOISE MONITORING

MARCH 14, 2021

SHORT-TERM MONITORING RESULTS

PREPARED FOR: State of California
Department of Parks and Recreation

May 11, 2021

CSDA | DESIGN GROUP

Table of Contents

List of Figures

List of Tables

1.0 Executive Summary

This report summarizes the measurement and observation of noise sources from and around the Clay Pit State Vehicular Recreation Area (SVRA) in Oroville, California. Noise measurements were conducted during the morning of Sunday, March 14, 2021 during normal park operating hours. Noise levels were monitored at the park border and nearby residential receivers to identify sources related to park activity and differentiate these from the typical ambient environment.

- Fully attended, four-hour noise measurements were conducted at two locations to quantify and characterize noise from SVRA operations (which include Off Highway Vehicle (OHV) use). One short term (ST) measurement was taken at the SVRA's southern boundary and one was taken along Rabe Road. The measurements began at 8:30 AM and concluded around 12:30 PM.

- The noise environment at the SVRA southern boundary was characterized by OHV activity, aircraft flyovers, high wind noise, and gunshots from the nearby Oroville Shooting Range. The noise environment along Rabe Road was characterized by OHV Activity, aircraft flyovers, gunshots from nearby Oroville Shooting Range, and road traffic along Larkin Road.

- There were no noise exceedances measured at either the SVRA southern boundary or the Rabe Road locations attributed to OHV Activity.

The definitions of relevant acoustical terminology and a discussion of the fundamentals of environmental sound propagation are included in Appendices A and B, respectively.

2.0 Introduction and Project Description

CSDA Design Group was contracted by the State of California to conduct continuous long-term (permanent) and short-term (attended) ambient sound monitoring at various SVRAs. Continuous ambient sound monitoring is required to support PRC 50900.02 (b). "The legislature hereby declares that effectively managed areas and adequate facilities for the use of off-highway vehicles and conservation and enforcement are essential for ecologically balanced recreation." Short-term monitoring for seasonal changes in park use and "Special Events" supplement the continuous, unattended noise level monitoring to provide accurate prescriptions of environmental versus SVRA operational noise sources.

This report details the four-hour fully attended noise measurements conducted at Clay Pit SVRA on March 14, 2021. This short-term monitoring session did not occur during a "Special Event" and serves as the baseline seasonal ambient.

3.0 Acoustical Criteria

3.1 *City of Oroville General Plan*

The City of Oroville 2030 General Plan Noise Element, Section D, stipulates the following goals and policies applicable to the Clay Pit SVRA.

- **Goal NOI-1:** Minimize community exposure to excessive noise by ensuring compatible land uses relative to noise sources.

- **Policy P1.3:** Require preparation of noise analysis/acoustical study, which is to include recommendations for mitigation, for all proposed projects which may result in potentially significant noise impacts to nearby noise sensitive land uses, such as residences or that is predicted to be exposed to noise levels greater than the exterior or interior noise levels shown in Table NOI-6 and NOI-7.

- **Policy P1.4:** Require an acoustical analysis and include appropriate mitigation measures in the project design where the land uses listed in Table NOI-6 are proposed in areas exposed to existing or projected exterior transportation noise levels exceeding the levels specified in Table NOI-6 [shown in Figure 1].

TABLE NOI-6 MAXIMUM ALLOWABLE NOISE EXPOSURE TO TRANSPORTATION NOISE SOURCES

	Exterior Noise Level Standard for Outdoor Activity Areas[a]	Interior Noise Level Standard	
Land Use	**L_{dn}/CNEL, dB**	**L_{dn}/CNEL, dB**	**L_{eq}, dB[b]**
Residential	60[c]	45	--
Transient lodging	60[c]	45	--
Hospitals, nursing homes	60[c]	45	--
Theaters, auditoriums, music halls	--	--	35
Churches, meeting halls	60[c]	--	40
Office buildings	--	--	45
Schools, libraries, museums	--	--	45
Playgrounds, neighborhood parks	70	--	--

Note: -- = not applicable.
[a] Where the location of outdoor activity areas is unknown, the exterior noise-level standard shall be applied to the property line of the receiving land use.
[b] As determined for a typical worst-case hour during periods of use.
[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed, provided that available exterior noise-level reduction measures have been implemented and interior noise levels are in compliance with this table.

Figure 1: City of Oroville General Plan Noise Element - Reprinted Table NOI-6

3.2 *Oroville Municipal Code*

The City of Oroville Municipal Code Noise Section, Chapter 9.20, stipulates the following noise limits applicable to the Clay Pit SVRA.

- **Section 9.20.030 Residential Property Noise Limits:** No person shall produce, suffer, or allow to be produced by any machine, animal or device, or any combination of same, on residential property, a noise level more than 5 dBA above the local ambient at any point outside of the property plane.

3.3 *Summary of Acoustical Criteria*

The acoustical criteria discussed in the Oroville Municipal Code above was applied to the measurement locations at the SVRA South Border and Rabe Road in addition to the DNL (the average day-night noise level) criteria discussed in the Oroville General Plan:

- **Adjacent Residential:** Adjacent land uses at the southern park border and along Rabe Road include Jaspers Gold RV Park and residential housing. As stated in the Oroville General Plan and Municipal Code, noise levels outside of the SVRA property plane shall not be more than 5 dBA above the ambient at the residential property line or exceed DNL 60 dBA. Although the criterion discussed in the Oroville Municipal Code typically excludes vehicular traffic from nearby roads, we have applied it to the SVRA as Off-Highway Vehicles (OHVs) may not be treated as typical vehicular traffic and are thus included under Section 9.20.030.

4.0 Data Analysis Methodology

The following step-by-step procedure explains the data analysis methodology:

1. During the attended short term field measurements, field staff log the type/source of any noisy events (e.g., aircraft flyovers, OHV noise).

2. The four-hour meter data is imported into our analysis software, NoiseWorks, and a visual inspection of the time history graphs, presented in Section 9.0, is conducted to determine the major noise sources any significant exceedances of the noise criterion established in Section 3.0.

3. The ambient noise level (i.e., the level without OHV noise) is established at the measurement location by masking (excluding) the events denoted during the measurement time period as OHV Noise., If a noise source comes from the SVRA, it is excluded from the ambient calculation. Once all SVRA related events are masked, the ambient level is established.

4. The average hourly noise level including SVRA noise is then calculated and compared to the ambient levels to determine whether noise from the SVRA is above the ambient.

5. The difference in average hourly noise levels between the ambient and SVRA included data sets are compared to the prescribed criteria in Section 3.0 to determine if any exceedances occurred.

5.0 Existing Conditions and Observations

5.1 *Noise Measurement Locations*

Figure 2 indicates where the fully attended noise monitoring measurements were taken with respect to the SVRA and nearby ambient noise level contributors; Table 1 shows the GPS coordinates of the monitoring locations.

Table 1: GPS Coordinates of Monitoring Locations

Location	GPS Coordinates
SVRA South Border (Loc-1)	39° 28' 38.03" N 121° 37'06.05" W
Rabe Road (Loc-2)	39° 28"22.35" N 121° 37'30.47" W

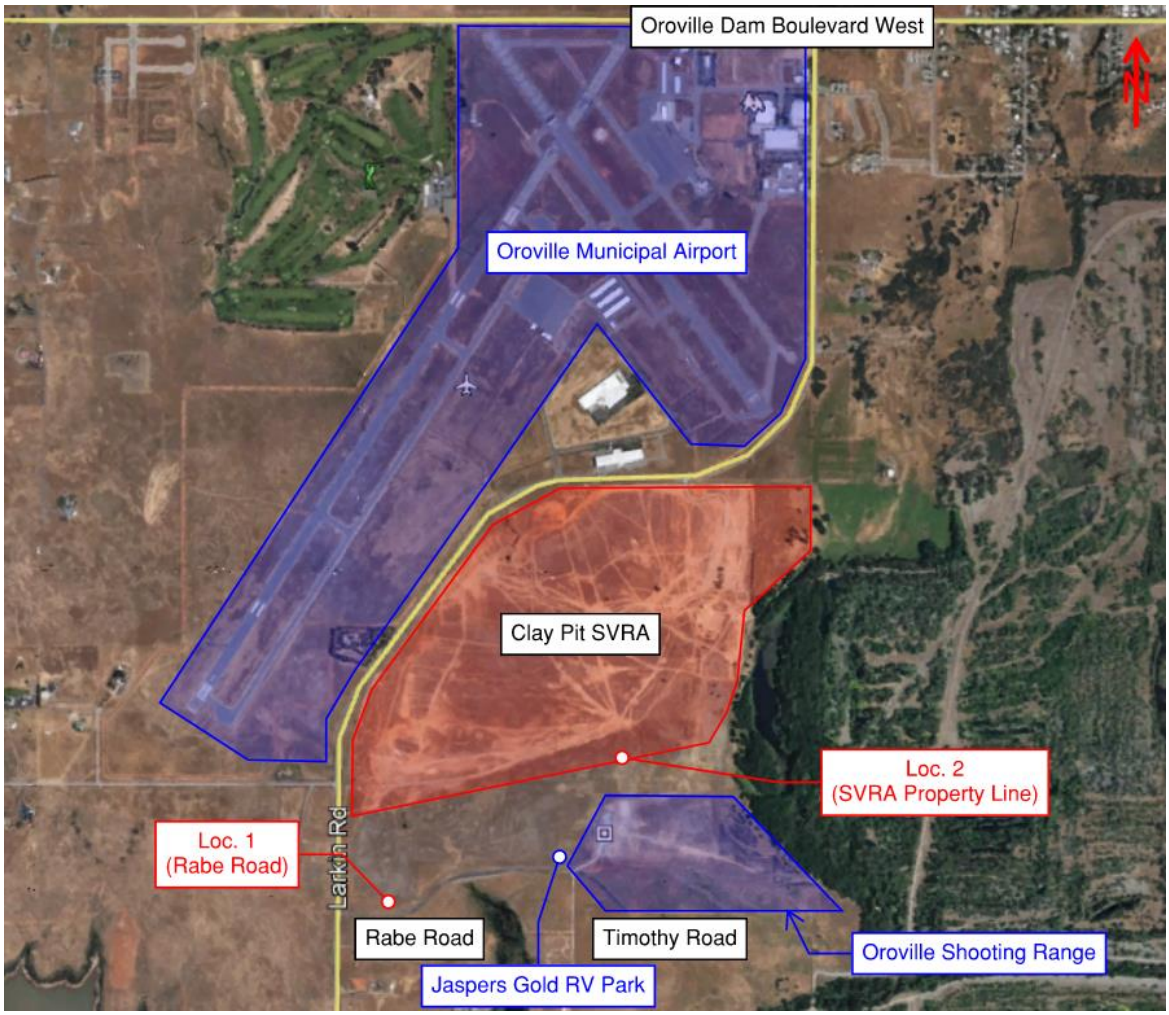


Figure 2: Clay Pit Noise Monitoring Locations

5.1 *Short Term Location – Rabe Road*

5.1.1 Measurement Notes

The measurement was taken on a tripod five feet above the ground and more than 10 feet from any reflecting surface. Figure 3 shows an image of the monitoring location and setup.

Figure 3: Microphone on Tripod – Rabe Road Measurement Location

The measurement commenced at about 8:30 AM and ended at about 12:30 PM on March 14, 2021.

The equipment was calibrated immediately before and after the measurement with no significant drift in response.

5.1 *Short Term Location – SVRA Property Line*

5.1.1 Measurement Notes

The measurement was taken on a tripod five feet above the ground and more than 10 feet from any reflecting surface. Figure 4 shows an image of the monitoring location and setup.

Figure 4: Microphone on Tripod – SVRA South Property Line Measurement Location

The measurement commenced at about 8:30 AM and ended at about 12:30 PM on March 14, 2021.

The equipment was calibrated immediately before and after the measurement with no significant drift in response.

5.2 *Weather*

On March 14, 2021 during the measurement period, the average wind speed ranged from 3 miles per hour (mph) to 8 mph, with wind gusts up to 16 mph; wind noise was audible during the measurement time period but did not significantly affect the measurements. The temperature ranged from a low of 44°F to a high of 57°F, while the average was 50°F. The humidity ranged from a low of 55% to a high of 83% and averaged 66%, with no precipitation during the measurement time period. Detailed meteorological data is included in Table 2 below.

Table 2: Detailed 3/14/2021 Meteorological Data

Time	Temp. (°F)	Humidity	Cloud Cover	Precipitation	Wind Direction	Wind Speed
7:00 AM	45°F	71%	Fair	0.0 in	NW	15 mph
8:00 AM	45°F	71%	Mostly Cloudy	0.0 in	NW	14 mph
9:00 AM	48°F	66%	Cloudy	0.0 in	NNW	12 mph
10:00 AM	50°F	63%	Cloudy	0.0 in	NNW	16 mph
11:00 AM	52°F	61%	Cloudy	0.0 in	NNW	14 mph
12:00 PM	53°F	59%	Cloudy	0.0 in	N	18 mph
1:00 PM	54°F	57%	Cloudy	0.0 in	NNW	15 mph

5.3 *General Noise Conditions*

OHV noise, birds chirping, high wind noise, nearby road traffic, and aircraft flyovers were the dominant contributors to the noise environment at the monitoring locations. The specific nature of these noises, as well as an analysis of those levels above the prescribed criteria, are discussed below.

6.0 Measurement Results

There were no exceedances of the prescribed thresholds at either location attributed to the SVRA. Results for both locations are discussed below:

6.1 *Rabe Road – Measurement Observations*

Typical noises included OHV activity, high wind noise, gunshots from the nearby Oroville Shooting Range, noise from nearby road traffic, and aircraft flyovers (Oroville Municipal Airport). Although OHV activity was audible at the measurement location, traffic noise from Larkin Road and Rabe Road, aircraft flyovers, and gunshot noise from Oroville Shooting Range were the highest contributors to the noise environment. There were no exceedances of the prescribed thresholds.

Hourly graphs of the measured noise levels, with typical noise source indications, can be found in Appendix C. A summary of the typical noise sources at this measurement location is shown below in Figure 5; as road traffic along Rabe Road and Larkin Road was constant throughout the measurement time period, Road Traffic is considered indistinguishable from the ambient environment. Note that this is a representative graph of the noise environment; as many events occurred simultaneously, percentages presented are approximate.

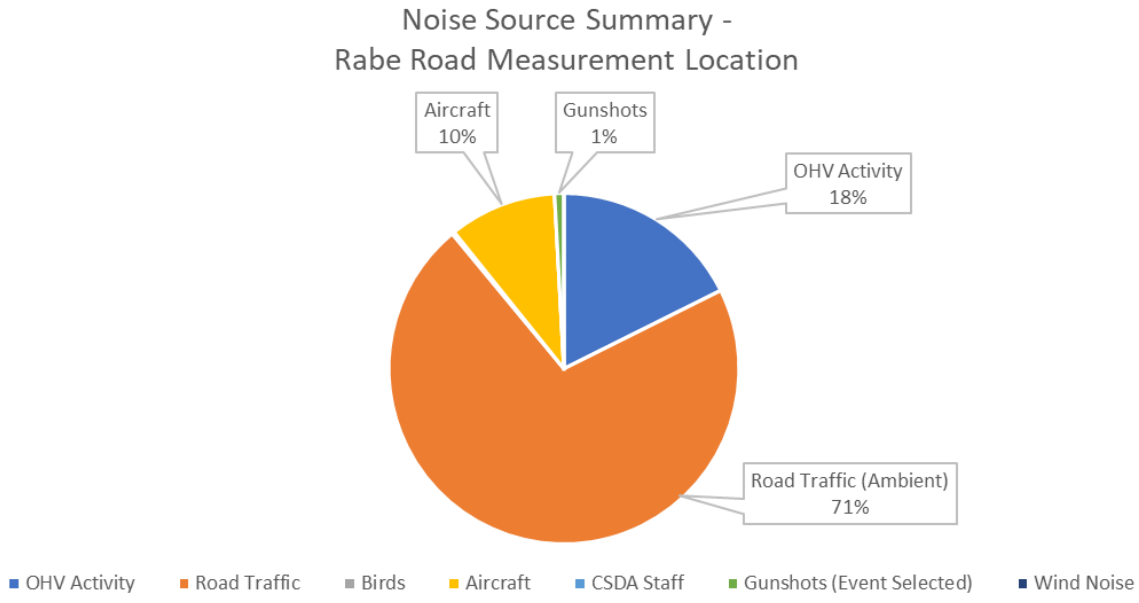


Figure 5: Rabe Road Measurement Location – Noise Source Distribution

6.2 *Rabe Road - Measured Levels*

Table 3 provides a summary of the measurement results.

Table 3: Rabe Road – Measured Levels

Start Time (Hourly Intervals)	L_{eq} Avg. Ambient + SVRA [dBA]	L_{eq} Avg. Ambient (No SVRA) [dBA]	Criteria [Amb. + 5, dBA]/ Meets Criteria?	DNL Ambient + SVRA [dBA]	DNL Ambient (No SVRA) [dBA]	Criteria [dBA]/ Meets Criteria?
8:26 AM	51	51	56/Y	47	47	60/Y
9:00 AM	50	50	55/Y	47	47	60/Y
10:00 AM	49	48	54/Y	46	45	60/Y
11:00 AM	50	50	55/Y	46	47	60/Y
12:00 PM	50	50	55/Y	47	47	60/Y

6.3 *SVRA South Border - Measurement Observations*

Typical noises included OHV activity, high wind noise, gunshots from the nearby Oroville Shooting Range, and aircraft flyovers (Oroville Municipal Airport). Although OHV activity was audible at the measurement location, nearby gunshots from Oroville Shooting Range and aircraft flyovers were the largest contributors to the measured noise levels. There were no exceedances of the prescribed thresholds.

Hourly graphs of the measured noise levels, with typical noise source indications, can be found in Appendix C. A summary of the typical noise sources at this measurement location, as compared to the total ambient environment, is shown below in Figure 6. Note that this is a representative graph of the noise environment; as many events occurred simultaneously, percentages presented are approximate.

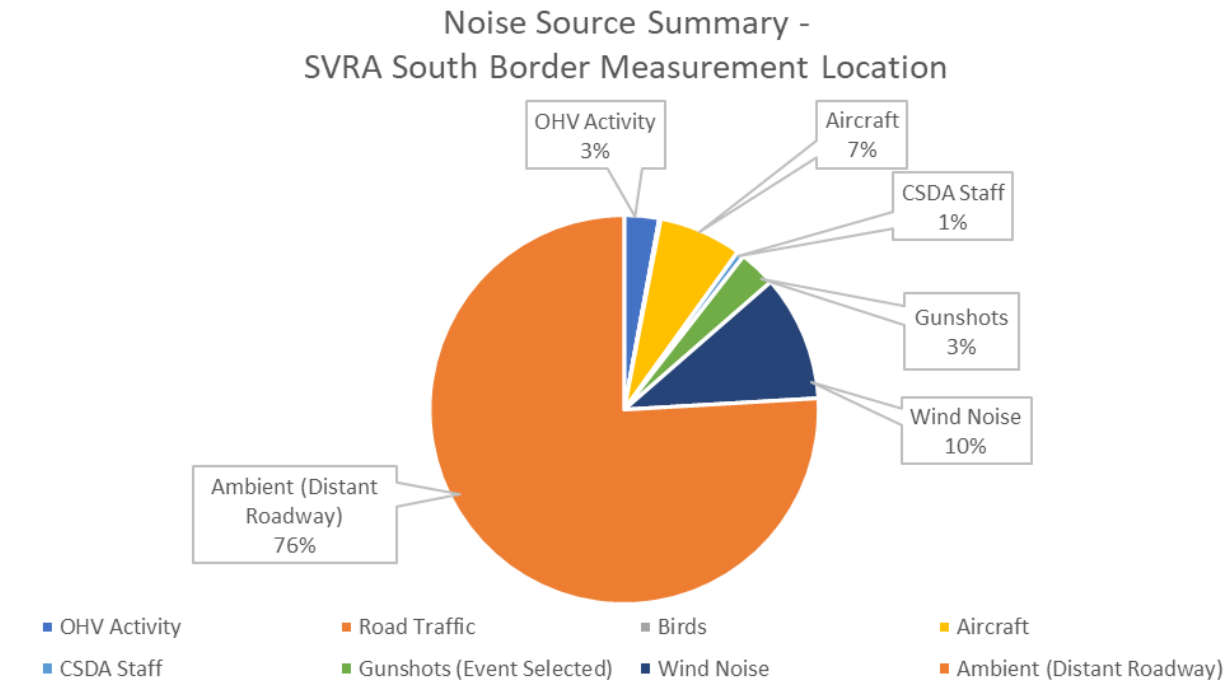


Figure 6: SVRA South Border Measurement Location – Noise Source Distribution

6.4 *SVRA South Border – Measured Levels*

Table 4 provides a summary of the measurement results.

Table 4: SVRA South Border – Measured Levels

Start Time (Hourly Intervals)	L_{eq} Avg. Ambient + SVRA [dBA]	L_{eq} Avg. Ambient (No SVRA) [dBA]	Criteria [Amb. + 5, dBA]/ Meets Criteria?	DNL Ambient + SVRA [dBA]	DNL Ambient (No SVRA) [dBA]	Criteria [dBA]/ Meets Criteria?
8:26 AM	56	56	61/Y	50	50	60/Y
9:00 AM	53	53	58/Y	50	50	60/Y
10:00 AM	52	52	57/Y	49	49	60/Y
11:00 AM	57	57	62/Y	54	54	60/Y
12:00 PM	63	63	68/Y	60	60	60/Y

This concludes our noise monitoring report for the measurements conducted at Clay Pit SVRA on March 14, 2021. Please do not hesitate to reach out with any questions or concerns.

7.0 Appendix A: Definition of Terms and References

A-Weighted Sound Level: A term for the A-Weighted sound pressure level. The sound level is obtained by use of a standard sound level meter and is expressed in decibels. Sometimes the unit of sound level is written as dB(A).

Day/Night Average Sound Level (L_{dn} or DNL): A descriptor established by the U.S. Environmental Protection Agency to describe the average day-night level with a 10 dB penalty applied to noise occurring during the nighttime hours (10 pm to 7 am) to account for the increased sensitivity of people during sleeping hours. A 10 dB increase in sound level is perceived by people to be twice as loud.

L_{eq}: The equivalent continuous sound level which would contain the same sound energy as the time varying sound level.

City of Oroville General Pan – Noise Element:
https://www.cityoforoville.org/home/showdocument?id=12189

City of Oroville Municipal Code – Noise Section:
https://qcode.us/codes/oroville/

8.0 Appendix B: Fundamentals of Sound

Noise is typically defined as unwanted sound and has the potential of negatively affecting human health. Noise in the community has often been cited as a health problem since it affects general well-being and contributes to undue stress and annoyance. At especially high noise levels, hearing loss can occur. Details about the fundamentals of sound and common noise descriptors, as well as further discussion regarding human response to noise and common noise sensitive receivers, are provided below.

Sound is the energy (disturbance or vibration), that is transmitted in the form of waves through a medium, such as air or water. Sound waves are typically described in terms of in terms of intensity and frequency. Sound intensity refers to the amount of energy in a sound wave and is quantified on a logarithmic "decibel" scale. Levels of sound intensity correspond to different degrees of loudness, where 0 dBA generally corresponds with the threshold of human hearing and sound levels of 120 dBA to 140 dBA, or higher correspond to thresholds of pain. The frequency of sound is defined as the number of cycles per second and is measured in Hertz (Hz). Humans are typically sensitive to sound levels between 20 Hz to 20,000 Hz, where the frequency of a sound wave corresponds to the perceived pitch.

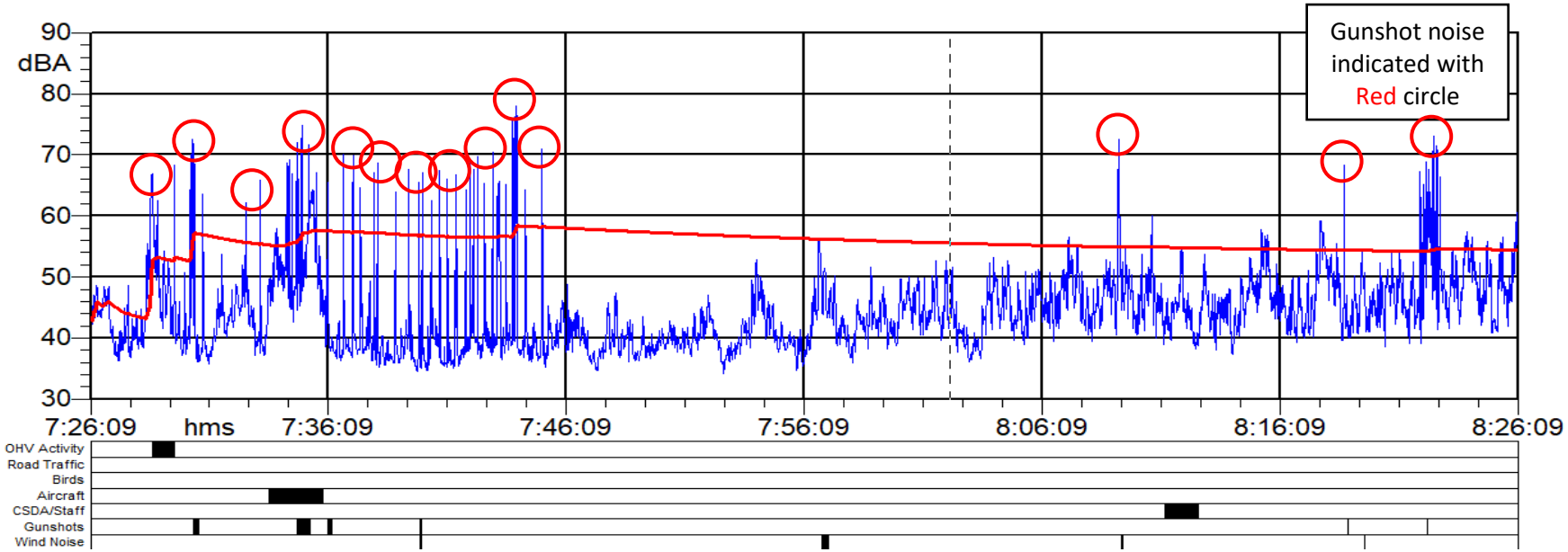
Since human ears are not equally sensitive to all frequencies, noise measurements are therefore weighted to account for the ear's frequency-dependent response to sound. The most common example of frequency-weighting is known as A-weighted decibel level ("dBA"; "dB(a)"), which is applied to most environmental noise measurements. Since sound levels are measured on a logarithmic scale, decibel addition is also based on a logarithmic scale. For example, a 65 dBA sound source when added to another 65 dBA source (a doubling of the sound pressure) does not result in 130 dBA, but rather in a total incremental increase of 3 dBA. In general, a change in sound level between 1 dBA to 3 dBA is barely noticeable to humans, where a change of 10 dBA is perceived as a doubling or halving of sound level.

Sound levels reduce with respect to distance at different rates, depending on the source type. In general, noise from sources such as stationary mechanical equipment and construction machinery (known as "point sources") reduce between 6 dBA to 7.5 dBA per doubling of distance from the source. Noise from sources such as a busy highway (known as "line sources") reduce between 3 dBA to 4.5 dBA per doubling of distance from the source. The presented ranges of attenuation depend on the type of ground surface between the noise source and the receiver. Highways and hard surfaces such as concrete or asphalt typically have an attenuation rate of 6 dBA for point sources and 3 dBA for line sources, whereas softer surfaces, shave such as vegetated terrain, have an attenuation rate of 7.5 dBA for point sources and 4.5 dBA for line sources. Atmospheric conditions as well as shielding affects (such as the existence of buildings or noise walls between source and receiver) could also affect noise levels from different positions.

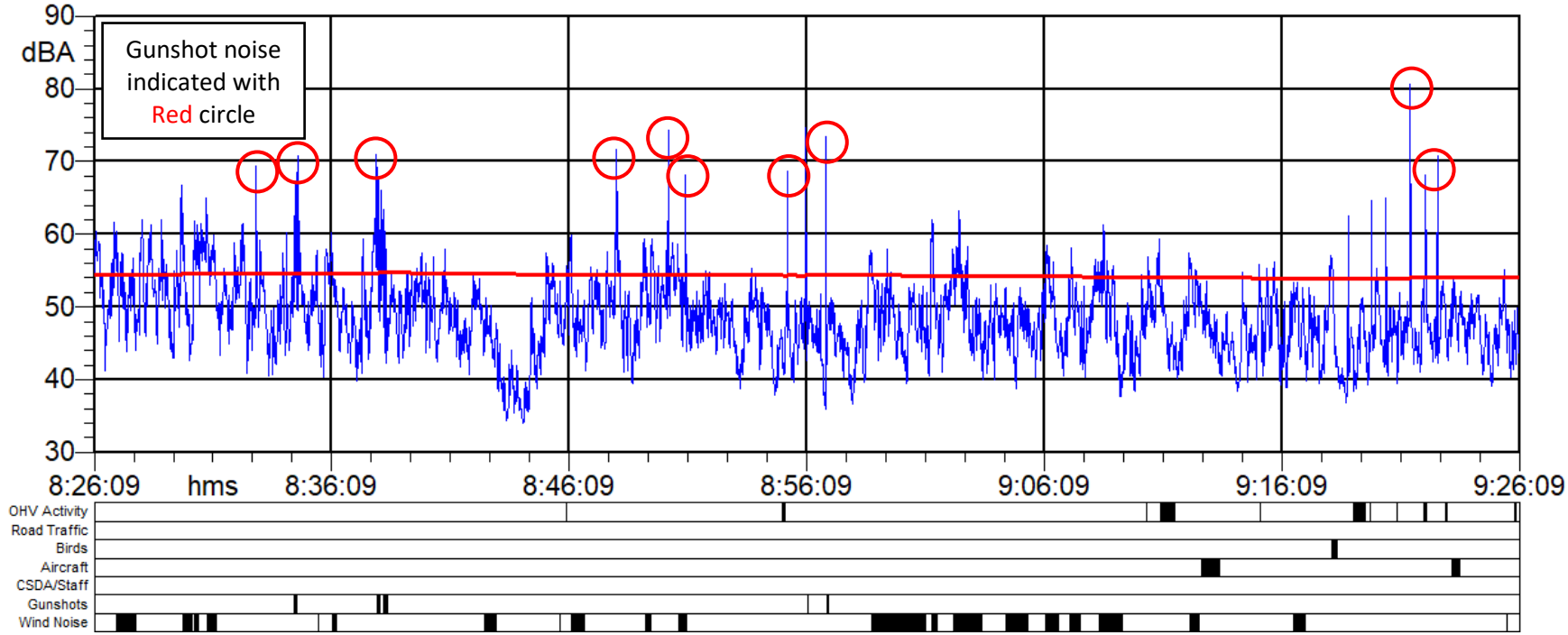
9.0 Appendix C: Hourly Time History Graphs of Measurements

It should be noted that as the measurements were performed on March 14, 2021 (Daylight Savings Time), measurements occurred 1-hour later than indicated on the time history plots below. Note that the Bold Red Line running through the graphs below indicates the average L_{eq} during the measurement time period.

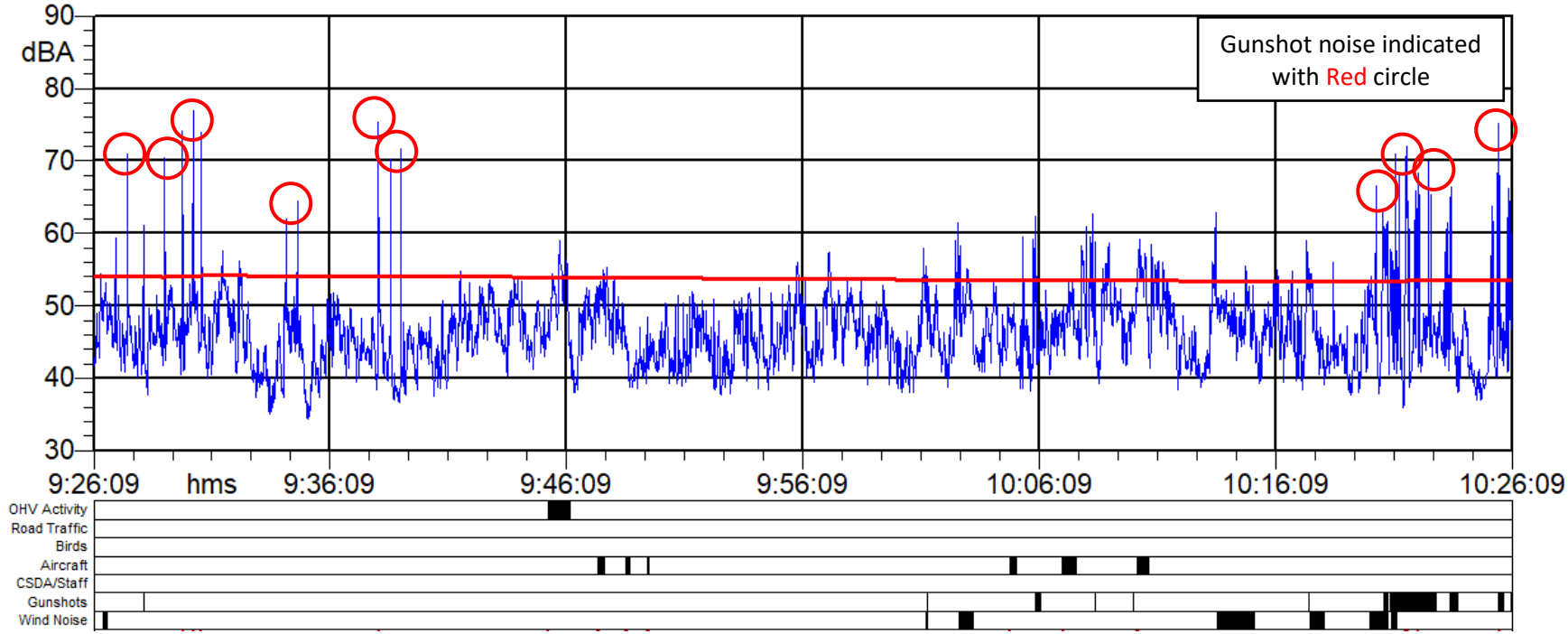
9.1 *SVRA South Border Hourly Time History*



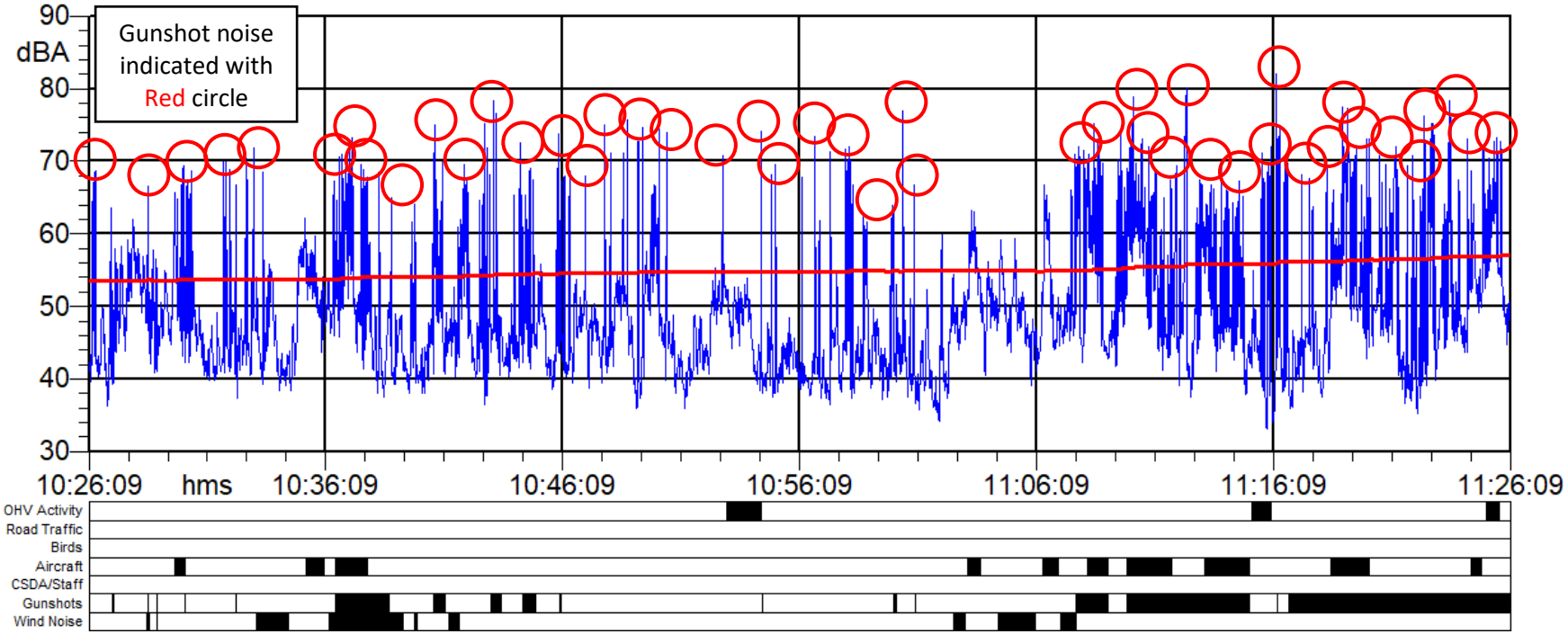
The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.



The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.

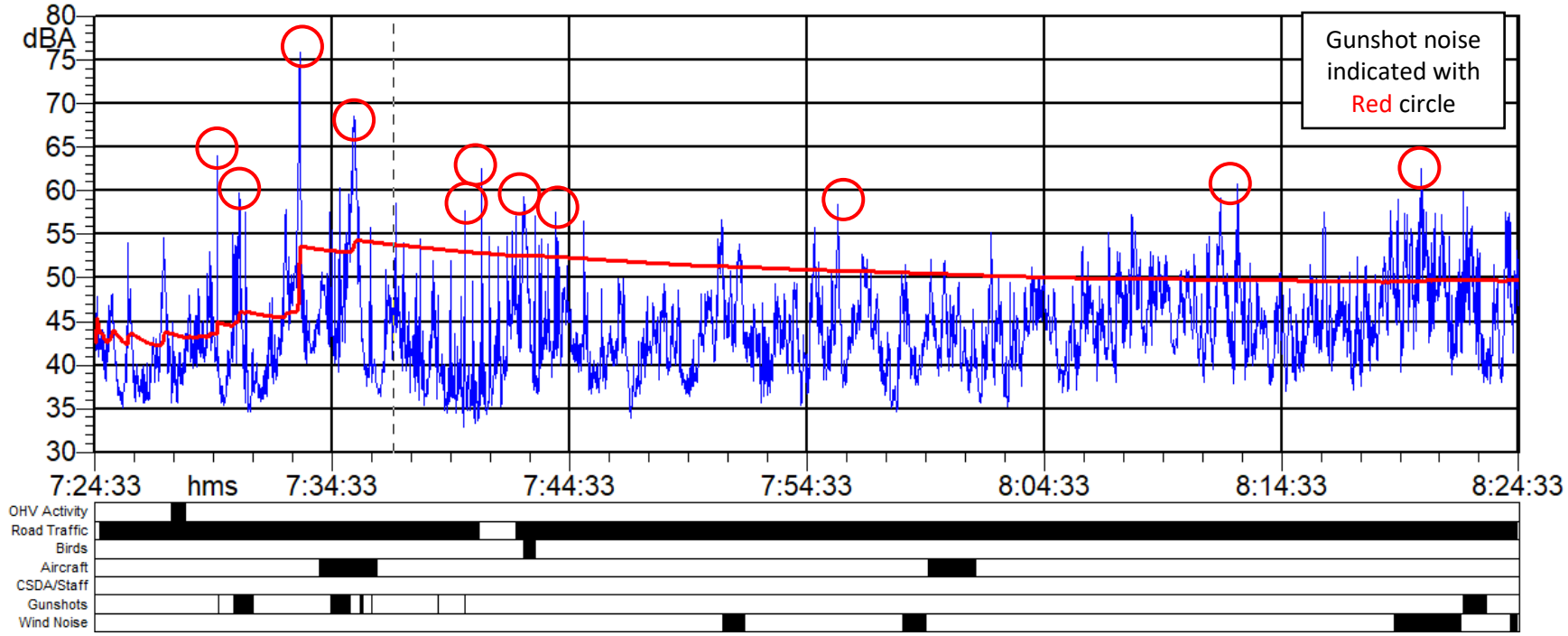


The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.

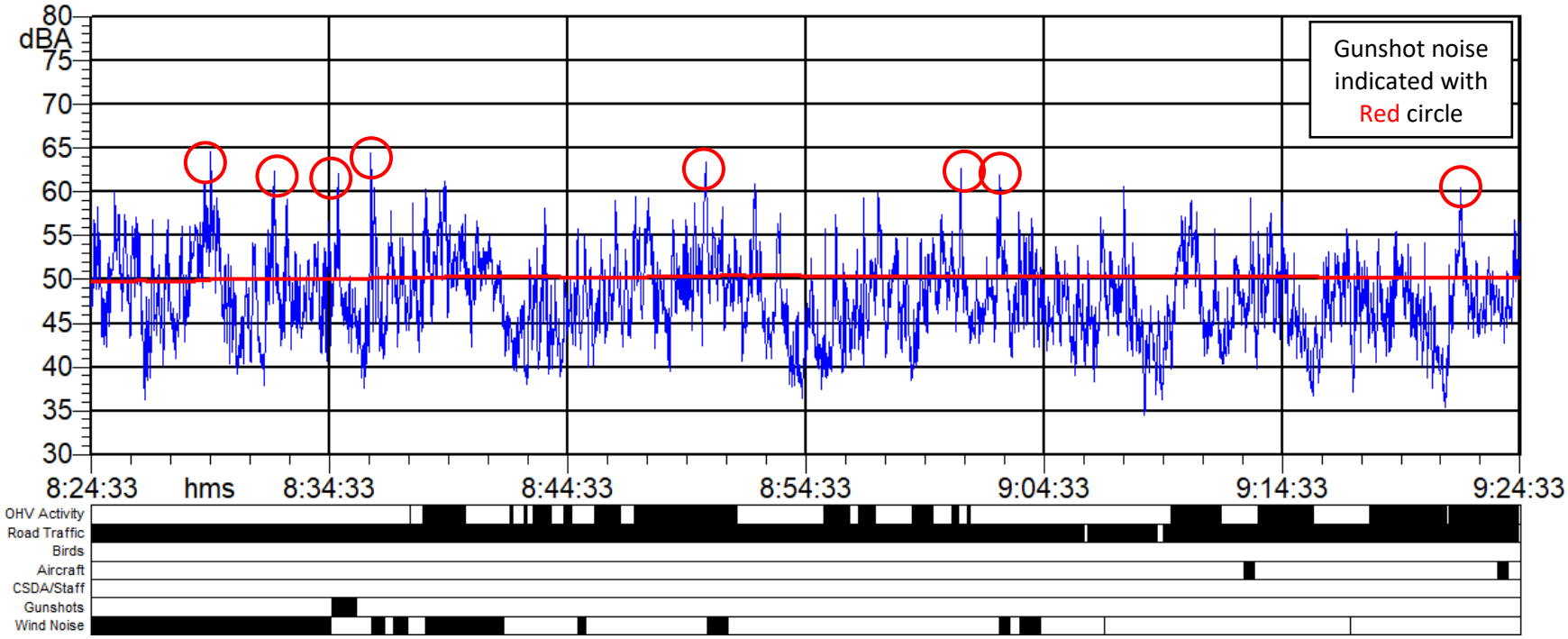


The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.

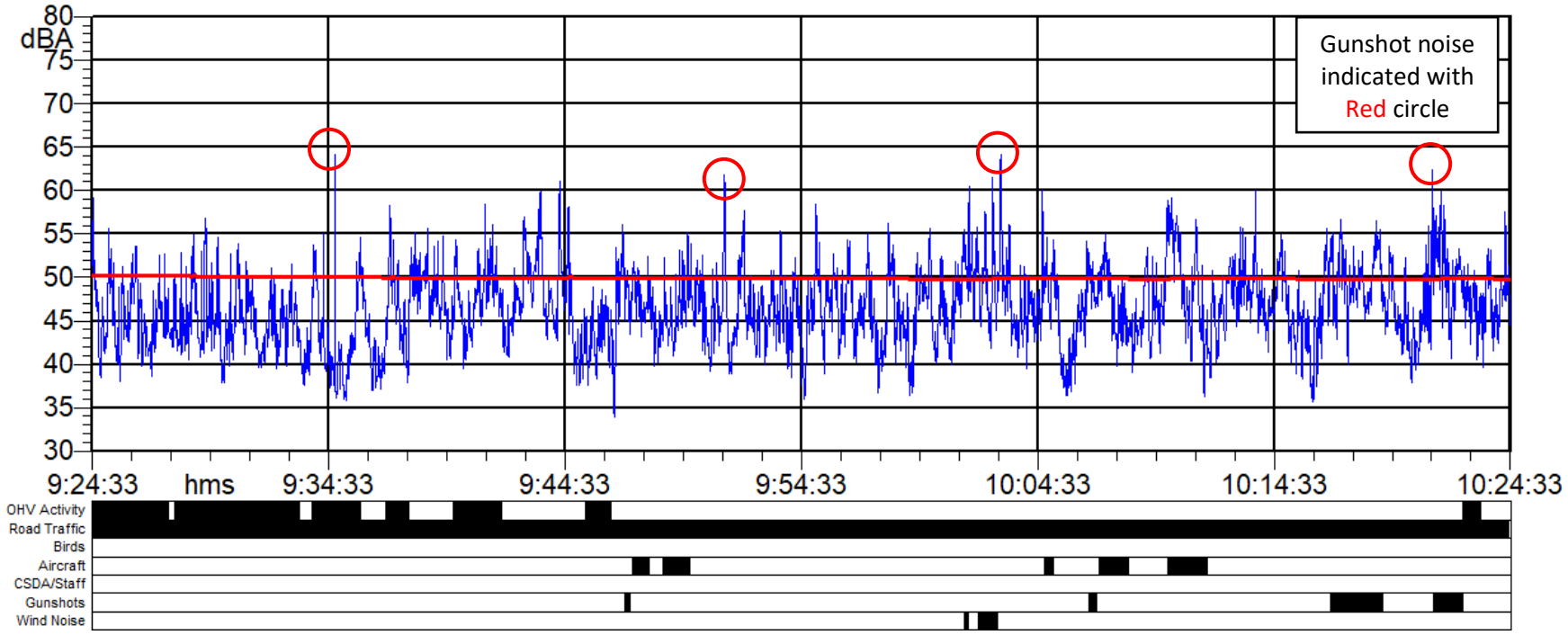
9.1 *Rabe Road Hourly Time History*



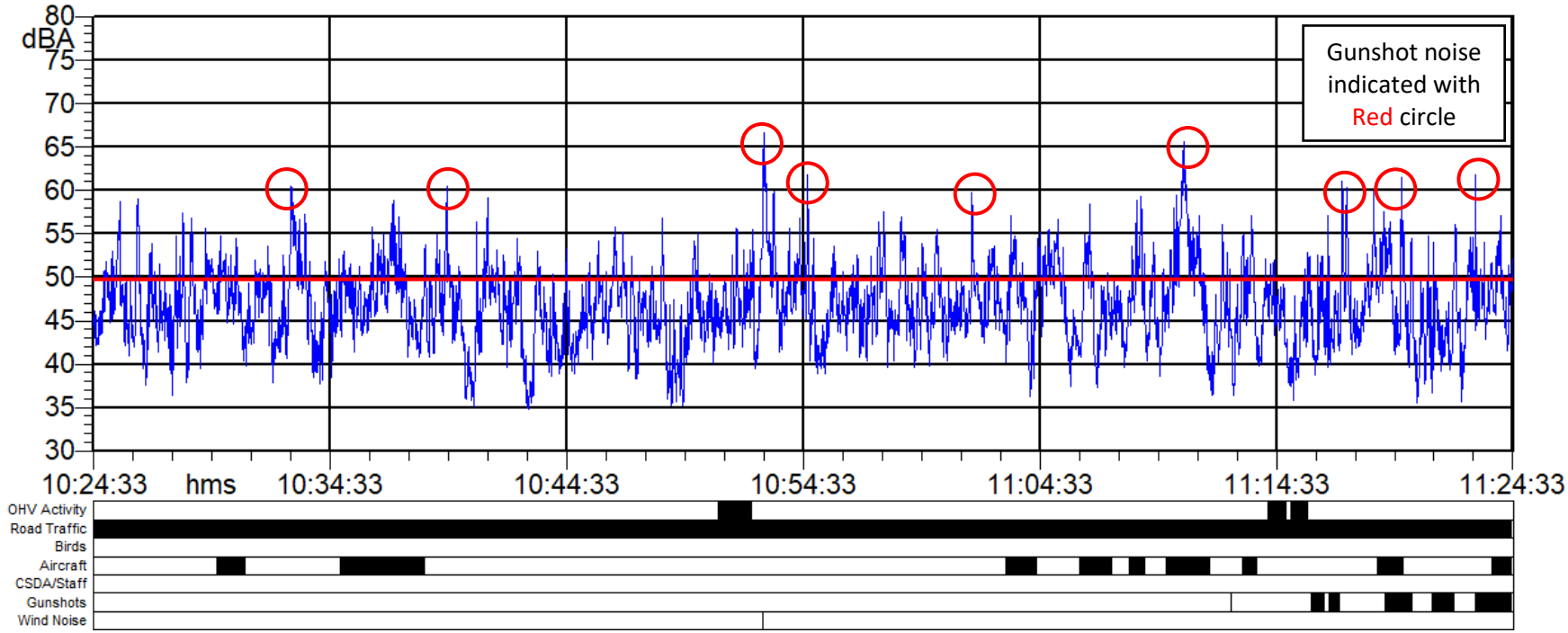
The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.



The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.



The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.



The noise source categories below the time history graphs mark what noise source was specifically heard (often times more than one) during the attended monitoring session and are included to better illustrate the noise environment and relative noise source levels; note that not every gunshot was marked in the field, which is why they have been circled in red for clarity.