

London office

1B(c) Yukon Road
London
SW12 9PZ
Tel: 0203 475 2280

Manchester office

105 Manchester Road
Bury
BL9 0TD
Tel: 0161 850 2280

LODGE FARM, COMMON WOOD, HOLT

NOISE IMPACT ASSESSMENT

Report **14301-NIA-01 RevA**

Prepared on 16 January 2019

Issued For:

**Field & Falcon
Lodge Farm
Commonwood
Holt
Wrexham
LL13 9TE**



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List of Attachments

14301-SP1	Indicative Site Plan
14301-TH1A-B	Environmental Noise Time Histories for Receiver 1
14301-TH2A-B	Environmental Noise Time Histories for Receiver 2
14301-TH3	Environmental Noise Time History for Baffle Investigation
Appendix A	Glossary of Acoustic Terminology

1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Field & Falcon to undertake an assessment of shooting noise emissions from the shooting facility at Lodge Farm, Common Wood, Holt.

Measured noise levels will be used to determine the suitability of the site for use, including proposals for permitted shooting hours.

This report presents the results of measurements undertaken followed by an assessment of the likelihood of operations causing annoyance to the closest residential and noise sensitive receivers.

2.0 SITE DESCRIPTION

A shooting tutorial facility at Lodge Farm, Holt comprises rifle ranges and clay pigeon shooting ranges.

Proposed hours of operation for the facility as a whole are as follows:

- Monday to Sunday: 09:00 - 17:00.

An assessment has been carried out in order to assess whether the site is suitable for activities and whether the proposed operating hours are appropriate.

An assessment has been undertaken according to '*Clay Target Shooting: Guidance on the Control of Noise*', issued by the Chartered Institute of Environmental Health.

The affected noise sensitive receptors have been identified as follows:

- Receiver 1: Residential dwelling located a minimum of 400 m to the south of the facility,
- Receiver 2: Residential dwelling located a minimum of 900 m to the north of the facility.

It should be noted that the facility is used for shooting tutoring sessions only, with no 'pay and shoot' service offered. This means that during a typical shooting session, there are fewer shots than are typical, due to the guidance and tutoring between shots. This also means that use of larger bore rifles and larger gauge shotguns are less frequency used, due to the inexperience of shooters.

3.0 NOISE CRITERIA

The guidance of 'Clay Target Shooting: Guidance on the Control of Noise' is to establish a Mean Shooting Noise Level [mean SNL] using measurement methodology design by Building Research Establishment Ltd [BRE] and compare this to a range to determine the likelihood of noise levels causing annoyance to noise sensitive receptors.

The range to which the mean SNL is compared is described as follows:

"The BRE research suggests that there is no fixed shooting noise level at which annoyance starts to occur. Annoyance is less likely to occur at a mean shooting noise level (mean SNL) below 55 dB(A), and highly likely to occur at a mean shooting noise level (mean SNL) above 65dB(A). The likelihood of annoyance at levels within this range will depend upon local circumstances and some of the factors that may need to be considered are given in Appendix 5."

Measurement and assessment has been undertaken to calculate the mean SNL, for comparison with the above range.

It should be noted that in all considerations, Lodge Farm is considered a 'major shoot', based on the potential to have multiple shoots during a single week.

4.0 ASSESSMENT MEASUREMENTS

4.1 Procedure – Rifle Range

On the rifle range, the following rifles are commonly used:

- .22 Bore Rifle,
- .223 Bore Rifle,
- .308 Bore Rifle.

Shots are fired at metallic targets, which also generate noise when struck.

In order to take suitable noise measurements for the two identified receivers, the following visits were undertaken in order to measure Shoot Noise Levels [SNL]:

A visit was undertaken on Monday 10 December 2018. Weather was dry, with a light breeze. This was considered a suitable wind vector for the assessed receiver.

A shoot was undertaken deemed to be representative, ensuring that all ranges and bore sizes were used during the shoot.

Measurements were taken of the LAFp, (the fast time weighted, a-weighted sound pressure level) in line with the requirements of the guidance document.

Based on accessibility and suitability of monitoring positions, the following surveys were undertaken:

- Position 1 (Residential Boundary to the South): 25-minute measurement^[1], with a typical shoot in progress. Some background noise was caused by passing road traffic including tractors. Shoot levels were easily distinguishable from the ambient noise profile, particularly for larger bore rifles,
- Position 2 (Residential Boundary to the North): 17-minute measurement^[1], with a typical shoot in progress. Some background noise was caused by passing road traffic including tractors. Shoot noise levels with smaller bore rifles were masked by ambient noise levels, while shoot noise from larger bore rifles was distinguishable from the ambient noise profile.

[1] The number of shots measured during each period was deemed to be representative of the number of shots anticipated during a typical 30-minute tutorial session.

From the surveys the following analyses were undertaken in order to assess the effects of different bore rifles, and the effects of the shoot as a whole:

- The logarithmic average of the loudest 5 shots from each rifle size to provide an estimate of the SNL for each rifle [*indicative only*].
- **The logarithmic average of the loudest 25 shot noise levels during the entire shoot to calculate the SNL at each receiver.**

4.2 Procedure – Clay Shooting

On the clay shooting range, the following shotguns are commonly used:

- 12 Gauge Shotgun,
- 20 Gauge Shotgun,
- .401 Bore Shotgun.

In order to take suitable noise measurements for the two identified receivers, the following visits were undertaken in order to measure Shoot Noise Levels [SNL]:

A visit was undertaken on Monday 10 December 2018. Weather was dry, with a light breeze. This was considered a suitable wind vector for the assessed receiver.

A shoot was undertaken deemed to be representative, ensuring that all bays and shotgun types were used during the shoot.

Measurements were taken of the LAFp, (the fast time weighted, a-weighted sound pressure level) in line with the requirements of the guidance document.

Based on accessibility and suitability of monitoring positions, the following surveys were undertaken:

- Position 1 [Residential Boundary to the South]: 12-minute measurement^[1], with a typical shoot in progress. Some background noise was caused by passing road traffic including tractors. Shoot levels were easily distinguishable from the ambient noise profile,
- Position 2 (Residential Boundary to the North): 14-minute measurement^[1], with a typical shoot in progress. Some background noise was caused by passing road traffic including tractors. Shoot levels were easily distinguishable from the ambient noise profile.

[1] The number of shots measured during each period was deemed to be representative of the number of shots anticipated during a typical 30-minute tutorial session.

From the surveys the following analyses were undertaken in order to assess the effects of different size shotguns, and the effects of the shoot as a whole:

- The logarithmic average of the loudest 5 shots from each shotgun size to provide an estimate of the SNL for each shotgun *[indicative only]*.
- **The logarithmic average of the loudest 25 shot noise levels during the entire shoot to calculate the SNL at each receiver.**

4.3 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 01dB Black Solo Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

5.0 RESULTS

5.1 Receiver 1 Measurements

For Receiver 1 measurements, time histories showing the different shot noise levels measured are shown in time histories 14301-TH1A and 14301-TH1B for rifle range and clay shooting noise respectively. Shot noise levels are separated by weapon size as indicated on the charts.

The calculated SNL for each measurement position is shown in Table 5.1, along with an estimated SNL for each weapon size.

Noise Source	Comments	Calculated SNL
Rifle Range Shoot		
.22 Bore Rifle		47.8 dB(A)
.223 Bore Rifle	Estimated SNL is the logarithmic average of loudest 5 shots	57.8 dB(A)
.308 Bore Rifle		63.3 dB(A)
Entire Shoot	SNL is the logarithmic average of loudest 25 shots	58.1 dB(A)
Clay Shoot		
12 Gauge Shotgun		50.6 dB(A)
20 Gauge Shotgun	Estimated SNL is the logarithmic average of loudest 5 shots	53.9 dB(A)
.401 Bore Shotgun		55.4 dB(A)
Entire Shoot	SNL is the logarithmic average of loudest 25 shots	51.8 dB(A)

Table 5.1: Calculated SNL Towards Receiver 1

5.2 Receiver 2 Measurements

For Receiver 2 measurements, time histories showing the different shot noise levels measured are shown in time histories 14301-TH2A and 14301-TH2B for rifle range and clay shooting noise respectively. Shot noise levels are separated by weapon size as indicated on the charts.

The calculated SNL for each measurement position is shown in Table 5.2, along with an estimated SNL for each weapon size.

Noise Source	Comments	Calculated SNL
Rifle Range Shoot		
.22 Bore Rifle		<i>Indistinguishable</i>
.223 Bore Rifle	Estimated SNL is the logarithmic average of loudest 5 shots	45.8 dB(A)
.308 Bore Rifle		45.9 dB(A)
Entire Shoot	SNL is the logarithmic average of loudest 25 shots	< 44.4 dB(A) ^[1]
Clay Shoot		
12 Gauge Shotgun		41.2 dB(A)
20 Gauge Shotgun	Estimated SNL is the logarithmic average of loudest 5 shots	43.0 dB(A)
.401 Bore Shotgun		42.9 dB(A)
Entire Shoot	SNL is the logarithmic average of loudest 25 shots	41.3 dB(A)

Table 5.2: Calculated SNL Towards Receiver 2

[1] Fewer than 25 shots were distinguishable above ambient noise during the entire shoot.

6.0 DISCUSSION

As shown in Table 5.1 for Receiver 1, the calculated SNL due to the rifle range shoot is above the lower end of the defined range as shown in Section 3.0. The SNL due to the clay shooting noise is below the lower end of the range.

As shown in Table 5.2 for Receiver 2, the calculated SNL due to either shoot activity is below the lower end of the range.

It can therefore be concluded that at the closest residential premises, the level of noise generated would be classed as 'less likely' to cause annoyance, with the exception of rifle range noise at Receiver 1.

As shown in Table 5.1, noise due to the .308 bore rifle was significantly louder than noise due to the .22 and .23 bore rifles.

6.1 Investigation of Rifle Range Baffles

In order to reduce noise from the louder .308 bore rifles within the rifle range, an investigation has been undertaken using constructed baffle boxes. The boxes have been constructed using a perforated metal with absorptive mineral wool behind, with the box designed to sit around the body of the rifle.

Figure 6.1 shows the baffle boxes, with photographs taken from different angles.



Figure 6.1: Images of Constructed Baffles (2 No. Boxes)

In order to take suitable noise measurements for the worst affected receiver (Receiver 1), the following visits were undertaken in order to measure Shoot Noise Levels [SNL]:

A visit was undertaken on Tuesday 15 January 2019. Weather was dry, with a light breeze. This was considered a suitable wind vector for the assessed receiver.

A shoot was undertaken deemed to be representative, ensuring that different combinations of baffle (no baffle, 1 baffle box, 2 baffle boxes) and moderation on rifles was assessed.

Measurements were taken of the LAFp, (the fast time weighted, a-weighted sound pressure level) in line with the requirements of the guidance document.

Based on accessibility and suitability of monitoring positions, the following surveys were undertaken:

- Position 3 [Towards Residential Boundary to the South]: 12-minute measurement^[1], with a typical shoot in progress. Some background noise was caused by passing road traffic including tractors. Shoot levels were easily distinguishable from the ambient noise profile,

[1] The number of shots measured during each period was deemed to be representative of the number of shots anticipated during a typical 30-minute tutorial session.

From the surveys the following analyses were undertaken in order to assess the effects of different baffle treatments:

- The logarithmic average of the shots with each baffle and moderation combination,
- The reduction in apparent noise level, if any, calculated for each baffle combination.

A time history showing the different shot noise levels measured are shown in figure 14301-TH3. Shot noise levels are separated according to the baffle used as indicated on the charts.

For each baffle type, the first 3 shots show the unmoderated rifle, while the last 3 shots show the moderated rifle.

The estimated SNL for each mitigation combination is shown in Table 6.1. It should be noted that the SNL are only shown for comparison. They do not relate to levels at the Receiver, due to the monitoring location being closer to the rifle range.

Noise Source	Comments	Estimated SNL
Rifle Range Shoot		
.308 Bore Rifle [No Baffle]	Unmoderated Rifle	65.6 dB(A)
	Moderated Rifle	60.2 dB(A)
.308 Bore Rifle [1 Baffle Box]	Unmoderated Rifle	54.8 dB(A)
	Moderated Rifle	68.8 dB(A)
.308 Bore Rifle [2 Baffle Boxes]	Unmoderated Rifle	52.2 dB(A)
	Moderated Rifle	58.4 dB(A)

Table 6.1: Estimated SNL With Mitigation

As shown in Table 6.1, a meaningful reduction is achieved for both moderated and unmoderated rifles when 2 baffle boxes are used on each rifle. We would therefore recommend factoring this baffle combination into the proposed noise management plan.

6.2 Proposed Noise Management

In order to protect the amenity of surrounding residential receivers, a noise management plan has been devised. The primary focus is to protect the amenity of receivers during particularly sensitive hours (eg evenings and weekends) and particularly to reduce the noise due to the rifle range during sensitive periods.

Based on the measured noise levels and the observed sensitivities around the site, the following noise management plan is proposed in order to reduce the negative impact on residential receivers, while allowing reasonable operation for the shooting facility:

- Monday – Friday:
 - No shooting outside the hours 09:00 to 17:00.
- Saturday:
 - No shooting outside the hours 09:00 to 14:00.
 - Rifles larger than .223 bore on rifle range must use 2 baffle boxes as mitigation.
- Sunday & Public Holidays:
 - No shooting activity.

7.0 CONCLUSION

An assessment of shooting noise levels has been undertaken at Lodge Farm, Common Wood, Holt. The results of the survey have enabled measured levels to be compared against a range defined in the relevant guidance document.

Calculations show that guidance from the relevant guidance document indicates that noise levels are defined as 'less likely' to cause annoyance for surrounding noise sensitive receptors for the majority of activities as assessed.

A noise management plan has been proposed in order to protect the amenity of residential receivers, and to reduce the noise due to observed exceedances.

Report by
Duncan Martin MIOA

Checked by
Florian Clement MIOA

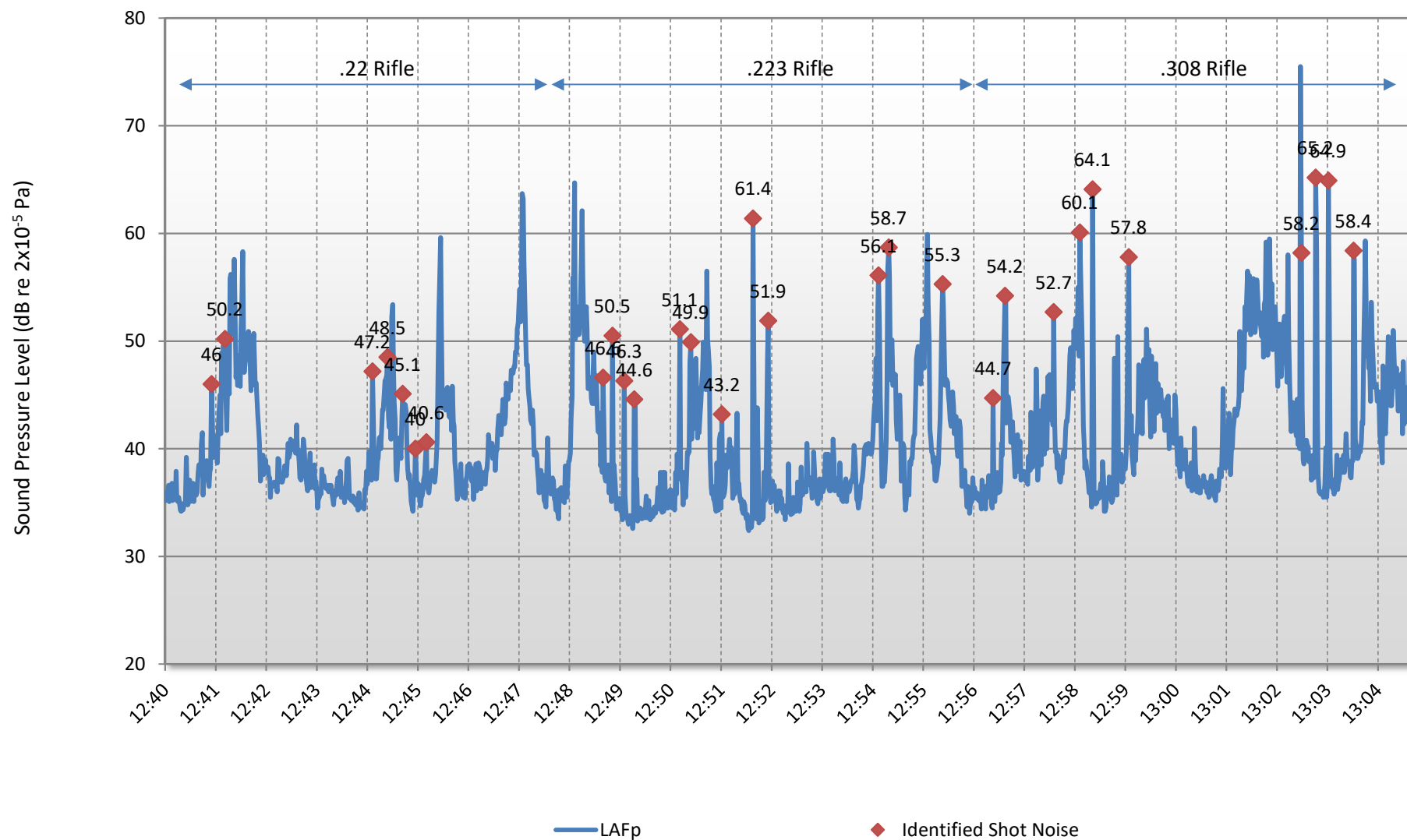


Lodge Farm, Common Wood, Holt - Receiver

1

Rifle Range Noise Time History

10 December 2018

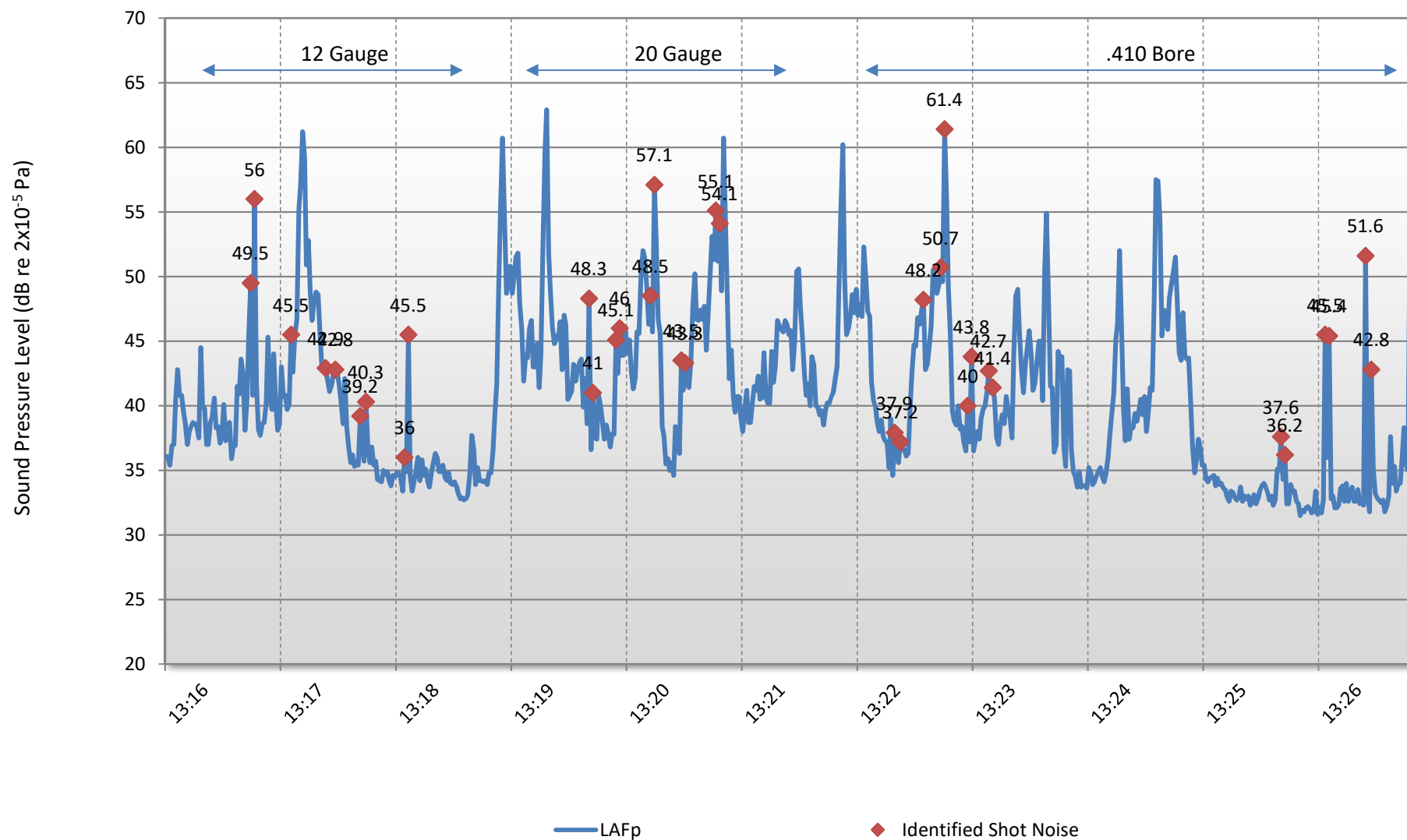


Lodge Farm, Common Wood, Holt - Receiver

1

Clay Shooting Noise Time History

10 December 2018

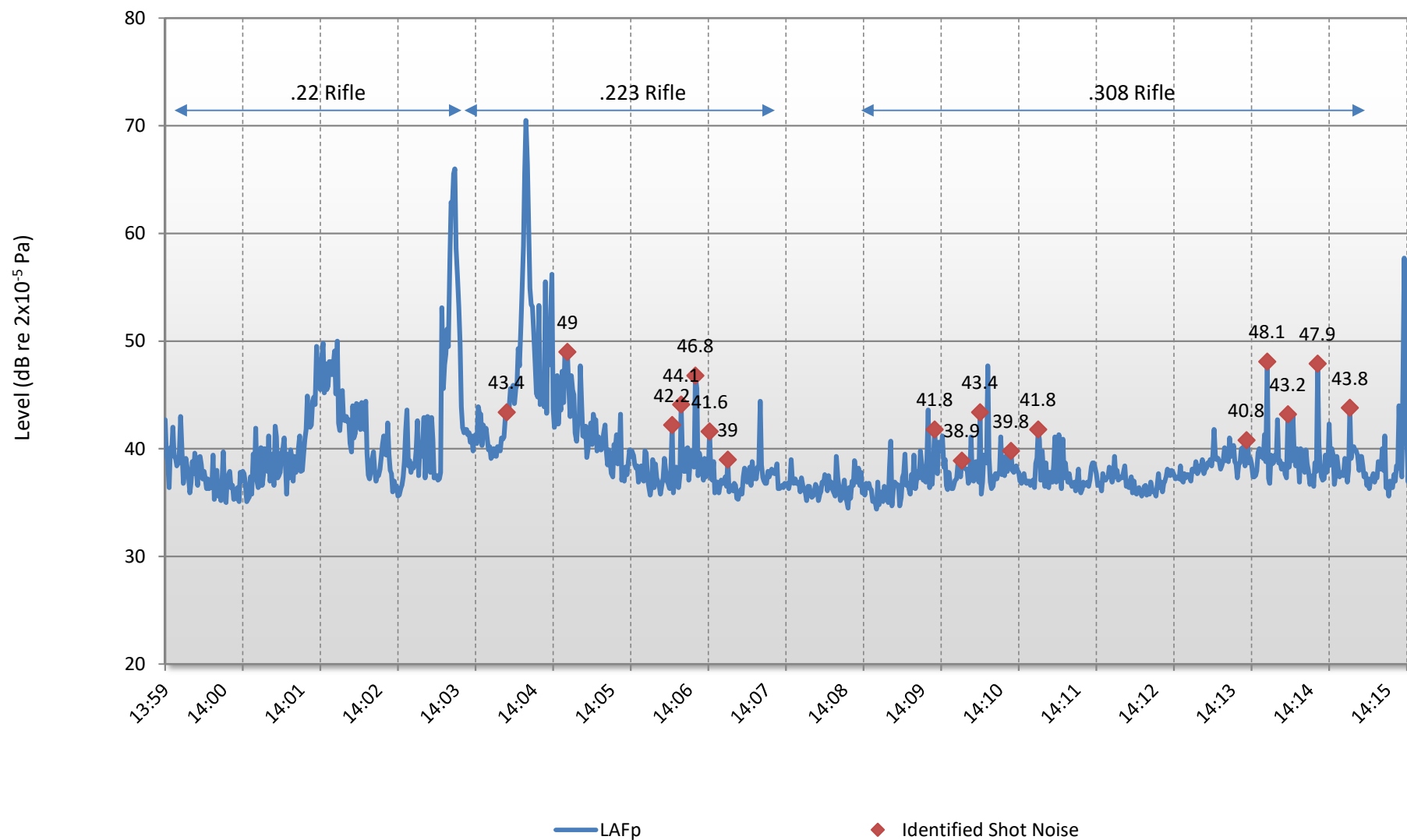


Lodge Farm, Common Wood, Holt - Receiver

2

Rifle Range Noise Time History

10 December 2018

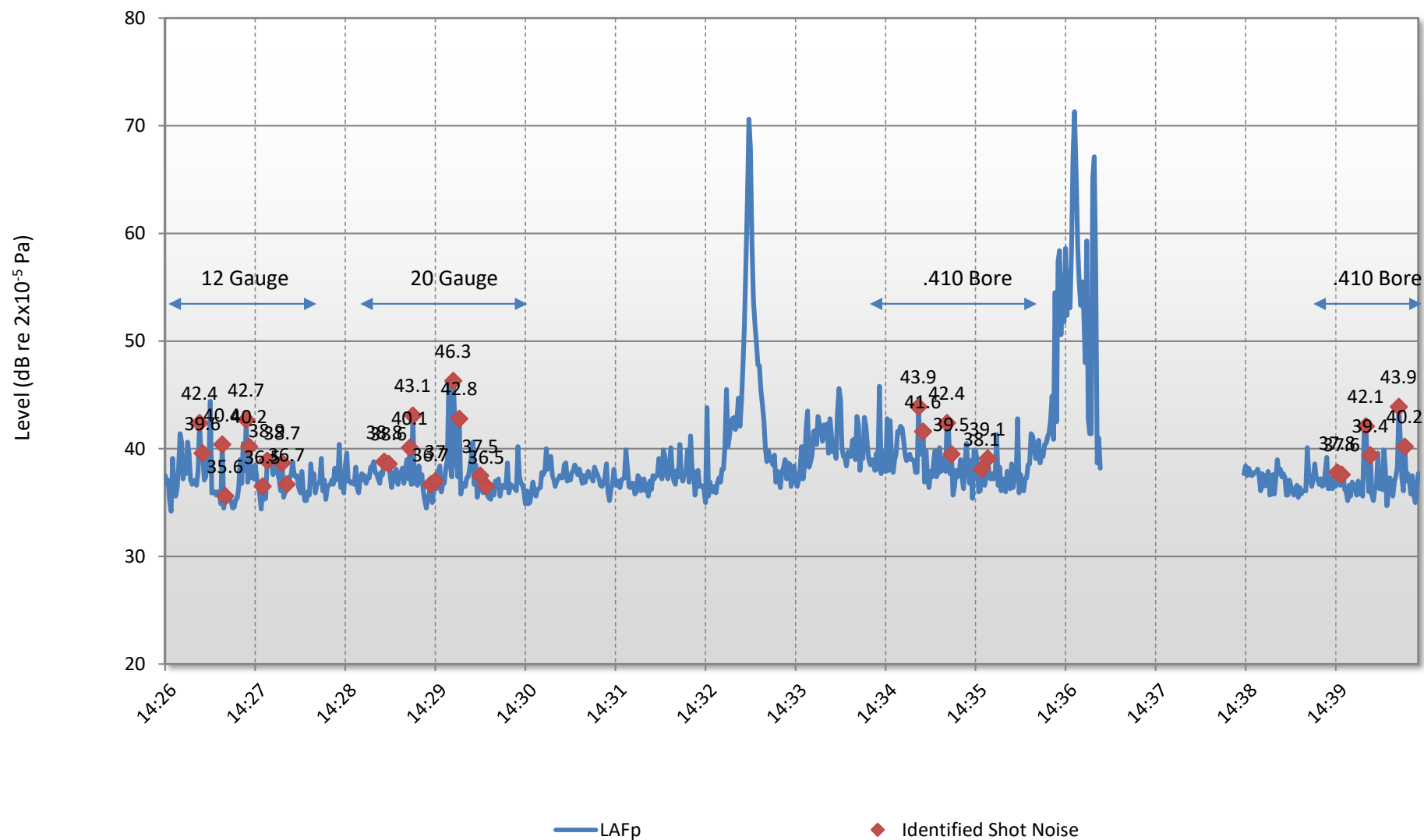


Lodge Farm, Common Wood, Holt - Receiver

2

Clay Shooting Noise Time History

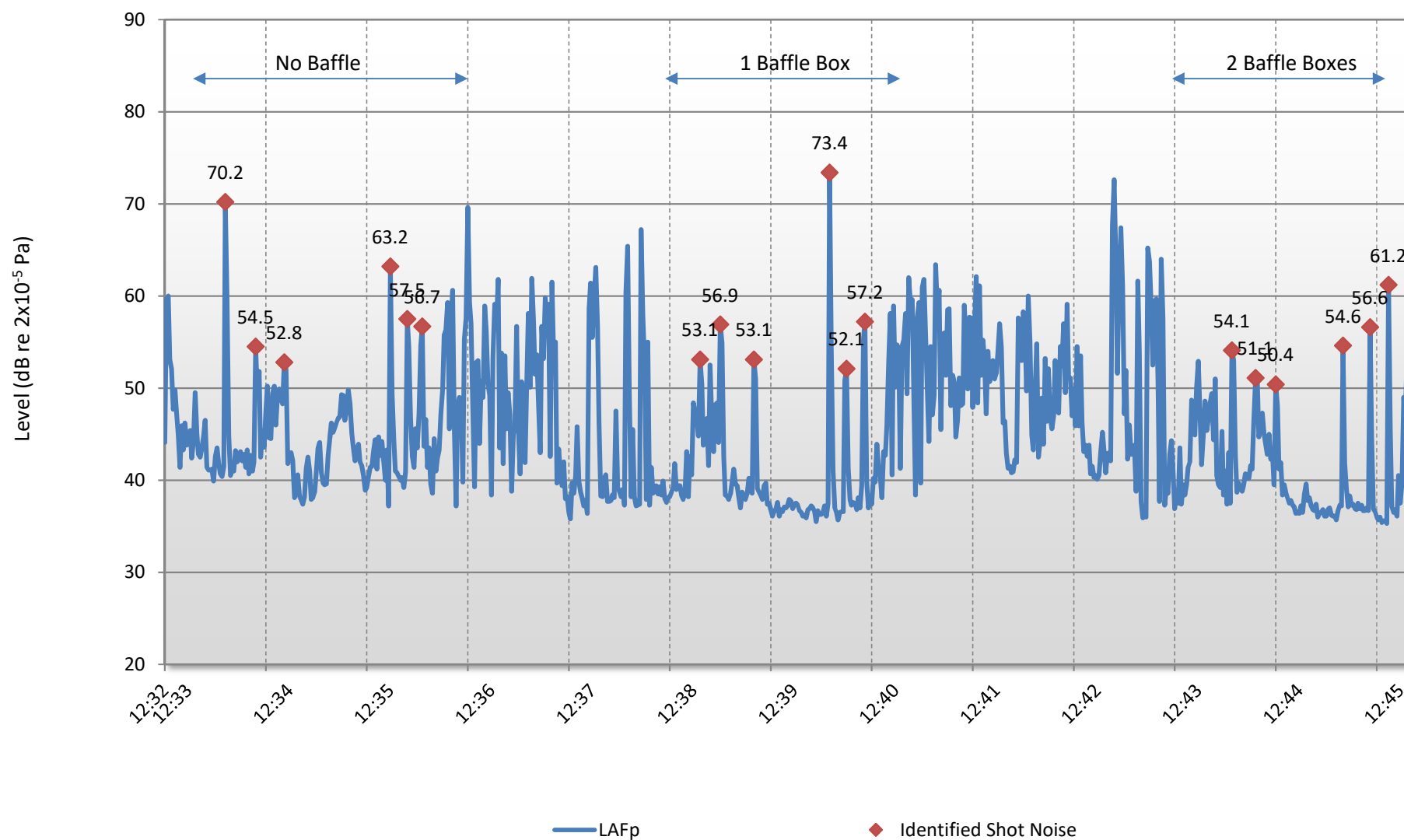
10 December 2018



Lodge Farm, Common Wood, Holt - Baffle Assessment

Rifle Range Noise Time History

15 January 2019



GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq} . The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.