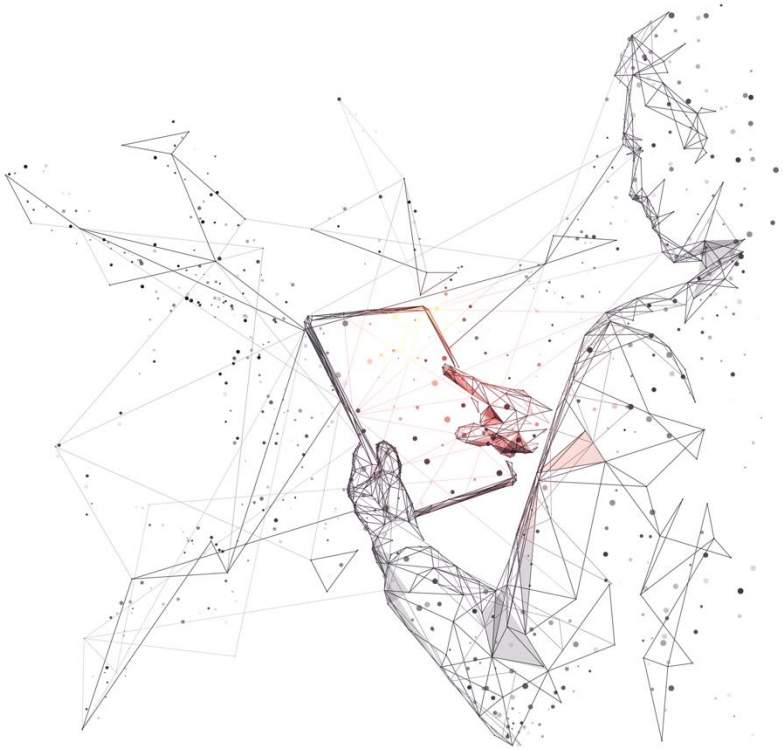
AUGUST 16, 2021



Noise Impact Assessment for at Over Cassocks Farm Rifle Range, Dumfries & Galloway

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Document Information

Project Name	:	**NIA for proposed Rifle range expansion**
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1. Introduction

1.1 This report has been commissioned to determine the current noise impact of the existing rifle range located on the Over Cassocks Farm grounds on the surrounding inhabited dwellings and identified receptors.

1.2 The rifle range itself has been in existence for some time. This report seeks to assess the range itself based on 'Clay target Shooting: Guidance on the Control of Noise (Jan 2003)' as it is considered to be the most closely associated standard.
The applicant proposes to upgrade the existing firing point with a permanent structure, and at the same time formalise the partial use of this agricultural land as a rifle range. The vast majority of the site will continue to be used primarily for agricultural use. The rifle range is primarily a diversification of uses on the farm and will operate alongside it at intermittent times.

1.3 This report will consider the noise impact in accordance with BS8233 and the WHO guidelines. Considerations will be made based on both the noise impact on the dwellings internally as well as guideline levels in garden/patio areas.

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2.0 Site Details

2.0.1 The site is contained within the Glendarg Burn Valley to the North of Eskdalemuir, Dumfries & Galloway.

2.0.2 The main range 'hut' is located at the summit of the hill with the targets located in the valley below. Targets range from 200m to 2 Miles away – with the majority of users on the range firing less than 1 mile.

2.0.3 A small low-noise diesel generator is used on the site to power the basic amenities but has not been deemed to be a noise source due to the difference between general levels produced and the background noise levels measured at the hut location.

2.0.5 Locations for measurements have been chosen based on what have been determined as the 'Noise Sensitive Receptors' (NSR). These NSRs have been selected based on a variety of dwellings and premises in the locality that could be impacted by Noise levels at the range.

2.1 Locations of monitors and settings used

2.1.3 Monitoring positions were located around the vicinity of the range as follows:

2.1.4 (Location1) Glendarg Farm [*Figure1*]

2.1.5 (Location 2) Fingland Guest House and Farm [*Figure 2*]

2.1.6 (Location 3) Davington Schoolhouse [*Figure 3*]

2.1.7 (Location 4) Ex Servicemen's Hall, located between the Samye Ling monestry and the seclusion area known as the 'retreat' *[Figure 4]*

2.1.8 (Location 5) Etterick – measured at the closest boundary to the rifle range with the least attenuation from surrounding hills to the village *[Figure 5]*.

Figure 1

Figure 2

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Figure 3

Figure 4

Figure 5

2.1.4 Measurements were made in 30 minute periods, on 100ms averaging in accordance with the guidelines given in the 'Clay target Shooting: Guidance on the Control of Noise (Jan 2003)'. The sound level meters were set to measure L_{AMax} and L_{Aeq} over the 30min periods to also allow comparison to the BS8233, TAN and WHO guidelines for noise disturbances within the NSR locations.

2.1.5 Shots were fired continuously throughout the 30min measurement period with a minimum of 1 every minute. There was a mixture of 50 calibre and 7.62 calibre rounds fired to help replicate variations in shooting days.

2.1.5 The monitoring was conducted using 1 x Type 1 NTI XL2 sound level meter, Tripod, outdoor case with batteries and outdoor microphone protection.

2.2.6 The measurements were taken by a fully qualified engineer with AMIOA status with the institute of Acoustics.

2.2.7 All measurements were taken after a field calibration was undertaken to ensure accuracy and repeatability of measurements. Calibration checks were also made at the end of each measurement to make sure there was not a drift of more than 0.5dB (rendering the measurement null and void under the Clay target Shooting: Guidance on the Control of Noise).

2.2.8 The assessment was conducted during an overcast day with low wind speeds. No measurements were taken where the windspeed was in excess of 5m/s.

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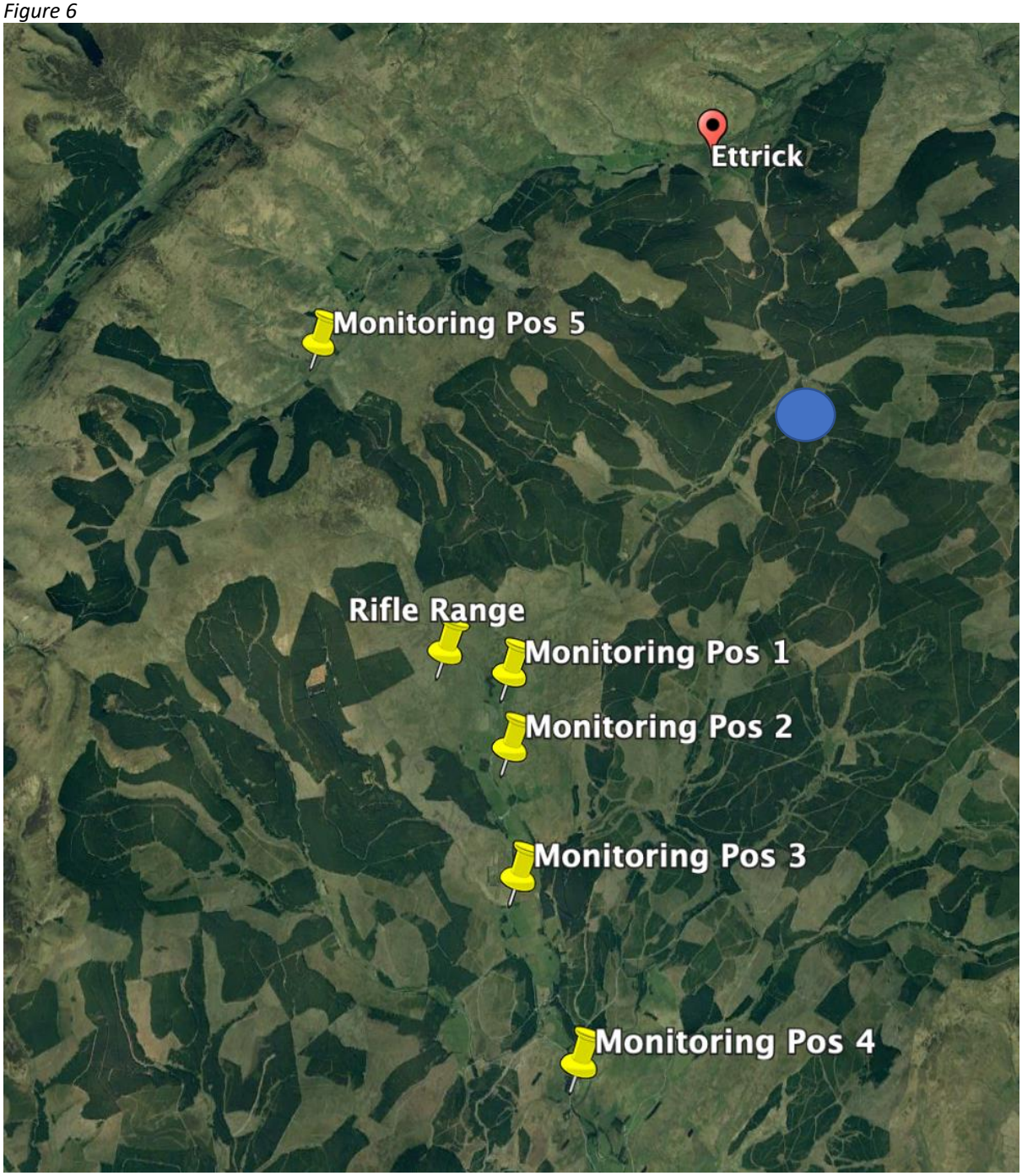
2.2 Plan Views of Site with Designated Work Areas

Figure 6



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3.0 Legislation - Standards and Guidelines (Noise)

3.1.1 The Assessment of Noise, Technical Advice Note (TAN) provides guidelines in Scotland for Noise Assessments for planning applications. "It aims to assist in assessing the significance of impact. Advice on the role of the statutory planning system in helping to prevent and limit the adverse effects of noise is set out in Planning Advice Note (PAN) 1/2011 *Planning and Noise*."

3.1.2 "Before undertaking a noise impact assessment, it is important that the person undertaking the assessment has a thorough understanding of the project and its context. This would involve:

- understanding the nature of the development;
- understanding the nature and character of the prevailing noise environment;
- identifying all the potential new noise sources that will arise from the proposal, during the construction, operation and, where relevant, decommissioning phases;
- understanding the nature of the new noise sources that will arise from the proposal, including such features as tonal characteristics, intermittency, duration and timing (diurnally and seasonally)
- Identifying potential noise sensitive receptors.

3.1.3 For a quantitative assessment of the noise impacts, the noise level change needs to be related to the sensitivity of the receptor so that the significance of the noise level change can be determined. Hence, the significance of the noise impact at a particular receptor can be determined from the magnitude of the noise change and the sensitivity of that receptor to the change in noise. The magnitude of the noise level change can be assessed relative to an absolute threshold level or relative to the pre-existing ambient noise level."

3.1.4 The guideline makes specific reference to the Magnitude of Impact on a proposed new development from existing noise sources:

3.1.5 The assessment procedure referred to in the TAN is split into several stages:

3.1.5.1 **Stage 1 – Initial Process**. This requires an assessment to identify the sensitivity of the receptors; defined as High, Medium or Low. Further guidance on this is given in Table 2.1 of the document as detailed below:

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Table 2.1: Level of Sensitivity Associated with Various Examples of NSRs

Sensitivity	Description	Examples of NSR
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios Schools during the daytime Hospitals/residential care homes Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive. Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event Night Clubs

3.1.5.2 **Stage 2 – Quantitative Assessment.** Reference is made to Noise Generating Developments (NGD) and Noise Sensitive Developments (NSD). In each case the assessment involves comparing an appropriate noise target level with the absolute noise level. Recommendations are based on BS8233/WHO guidelines for noise impact. This refers back to the magnitude of impact table seen below from table 2.4 in the guidance.

Table 2.4: Example of Associating Exceedance Noise Levels with Magnitudes of Impacts for a New Residential Area.

(Existing - Target [1]) Noise Level, x $L_{Aeq,16h(07:00-23:00)}$ dB	**Magnitude of Impact**
x = 10	Major adverse
5 = x < 10	Moderate adverse
3 = x < 5	Minor adverse
0= x < 3	Negligible adverse
x < 0	No change

3.1.5.3 **Stage 3 – Qualitative Assessment.** Where the magnitude of impact may not be adequate due to it being based on the change in noise levels alone, other factors may need to be considered. These factors which should be taken into account at this stage include nature of the noise source, in particular, the spectral content of the noise source and its absolute level. Stage 3 of the assessment therefore looks at the impact on behaviour, especially in residential areas, and the resulting quality of life. Table 2.5 in the guidance details the qualitative impact on the subjects.

Table 2.5: Example of Assigning Descriptors for Qualitative Impacts from Noise on Residential Properties.

Perception	Criteria of Descriptor for residential dwellings	Descriptor for qualitative impact
Noticeable (Very disruptive)	Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm.	Major
Noticeable (Disruptive)	Causes an important change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Moderate

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Noticeable (Mildly intrusive)	Noise can be heard and may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Minor
Just Noticeable (Non intrusive)	Noise can be heard, but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Negligible
Not noticeable	None	No Impact

3.1.5.4 **Stage 4 – Level of Significance.** The significance of the noise impact on Noise Sensitive Receptors (NSRs) is then determined in Table 3.2 below:

Table 3.2: Significance of Effects

Magnitude of Impact	**Sensitivity of Receptor**		
	Low	**Medium**	**High**
Major	Slight/Moderate	Moderate/Large	Large/Very Large
Moderate	Slight	Moderate	Moderate/Large
Minor	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight
No change	Neutral	Neutral	Neutral

3.0.5.5 **Stage 5 - The Decision Process**. Depending on the outcome of the assessment, the decision-making process would take into account the level of significance of the noise impact on the property according to:

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- Very Large: These effects represent key factors in the decision-making process. They are generally, but not exclusively associated with impacts where mitigation is not practical or would be ineffective;

- Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a moderate or slight significance;

- Moderate: These effects, if adverse, while important, are not likely to be key decision-making issues;

- Slight: These effects may be raised but are unlikely to be of importance in the decision-making process;

- Neutral: No effect, not significant, noise need not be considered as a determining factor in the decision-making process.

3.1.6. It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

- The effect may be determined by reference to guideline noise values. British Standard (BS) 8233:2014 and World Health Organisation (WHO) "Guidelines for Community Noise" contain such guidelines.
- Another method is to compare the resultant noise level against the background noise level (L_{A90}) of the area. This is the method employed by BS 4142:2014 to determine the likelihood of complaint from noise of an industrial nature. It is best suited to the assessment of steady or pseudo-steady noise.

3.1.7 British Standard 8233:2014 is principally intended to assist in the design of new dwellings; however, the Standard does state that it may be used in the assessment of noise from new sources being brought to existing dwellings.

3.1.8 The WHO guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological or physiological effect.

The WHO/BS 8233 guideline noise values are summarised in the following table:

Table 1

Guidance Document	L_{AeqT}	L_{AMax}	Outcome
World Health Organisation "Community Noise 2000"	55dB		Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	50dB		Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	35dB		Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	30dB		Sleep disturbance, night-time (indoors)
		60dB	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
		45dB	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)
BS 8233:2014 "Sound Insulation and noise reduction for buildings"	55dB		Upper limit for external steady noise. (gardens and patios).
	50dB		Desirable limit for external steady noise. (gardens and patios).
	L_{Aeq} 16 hours = 35 dB		Resting, living room day. (Internal – steady noise)
	L_{Aeq} 16 hours = 40 dB		Dining, dining room day. (Internal – steady noise)
	L_{Aeq} 16 hour = 35 dB		Sleeping, bedroom day (Internal – steady noise)
	L_{Aeq} 8 hours = 30 dB		Sleeping, bedroom day (Internal – steady noise)

3.1.9 For $L_{Aeq,t}$ criteria the time base (T) given in the documents is 16 hours for daytime limits and 8 hours for night time limits. All surveys are conducted based

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on 1 second readings on a Type 1 sound level meter. The readings are taken every 5 mins for noise.

3.1.10 Audio recordings are taken throughout the measurements to allow for further assessments on high levels and to determined their source.

3.2 BS8233:2014

3.2.1 It was seen as important to assess the current impact of the noise levels on the premises marked as the Noise Sensitive Receptors (NSR) along with the levels from the rifle range. Audio recordings were taken at each location so that any peaks/L_{Amax} levels could be attributed to the gunshots from the rifle range.

3.2.2 British Standard 8233:2014 is principally intended to assist in the design of new dwellings; however, the Standard does state that it may be used in the assessment of noise from new sources being brought to existing dwellings.

3.2.3 The WHO guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological or physiological effect.

3.2.4 BS8233:2014 suggests a typical façade will offer a maximum of 15dB attenuation in the sound entering the building when windows are open. Therefore, the maximum external noise level from the source under consideration should be 50dBA to allow a maximum 35dBA within the dwelling during the day, and 45dBA at night to allow a maximum of 30dBA within the dwelling. These values are matched in WHO Guidelines for Community Noise displayed in Table 1.

3.2.5 The report notes that the measurements taken at each location are also to determine the existing ambient noise levels. In some cases these may be above the levels suggested in both BS8233 and WHO guidelines prior to the introduction of any noise levels from the range.

3.3 Clay target Shooting: Guidance on the Control of Noise (Jan 2003)

3.3.1 The guideline provides clear reasoning and methodology for the measurement of Clay Target shooting. Although it states that it is not relevant for standard rifle ranges, the absence of any specific standard for noise measurements at rifle ranges has meant that this is still the closest measurement guideline for gun-related noise impact assessments. The guidelines state *"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)"*

3.3.2 *"The basic aim of measurement is to obtain a series of shot level readings, each corresponding to successive shots. As far as possible these readings should be unaffected by any other noises occurring during the measurement period. Each shot level (see definitions)*

should correspond to the maximum A-weighted sound pressure level caused by the shot using time weighting F; or, alternatively, the maximum value caused by the shot in a continuous series of short Leq ($L_{Aeq, 100ms}$ or $L_{Aeq, 125ms}$) measurements. These methods will generally produce very similar values for a given series of shots. From the shot level readings, the shooting noise level, SNL, (see definitions) can be calculated."

3.3.3 The measurement criteria is also defined in the guidelines:

"The *SNL* is defined as the logarithmic average of the 25 highest shot levels, from the shoot in question, over the 30 minute measurement period. The shot levels will have been obtained from recorded levels corrected where necessary for residual noise.

The shot level L_{shot} can be obtained from the recorded level L'_{shot} by logarithmically subtracting the contemporaneous residual noise level $L_{A,r}$, according to the equation below.

$$L_{shot} = 10*\lg((10^{\wedge}(L'_{shot}/10))-(10^{\wedge}(L_{A,r}/10)))$$

3.3.4 The logarithmic average of the 25 highest shot levels from the shoot in question, over the 30 minute measurement period, calculated according to the equation below. The shot levels will have been obtained from recorded levels corrected where necessary for residual noise.

$$SNL = 10* \lg(((10^{\wedge}(L_{shot,1}/10)) + (10^{\wedge}(L_{shot,2}/10)) + ...(10^{\wedge}(L_{shot,25}/10)))/25)$$

where $L_{shot,1}$ to $L_{shot,25}$ are the 25 highest shot levels.
Note: It should be clearly understood that the *SNL* is not equivalent to an $L_{Aeq, 30minute}$

Note 1: Planning permission should not normally be granted for a major shoot if the mean *SNL* exceeds 55dB where the background level is less than 45dB.

Note 2: Individual tuitions that last for no more than a couple of hours in total are generally acceptable up to a maximum *SNL* of 65dB during weekdays between the hours of 10am to 5pm.

Note 3: *SNL* values of around 65dB are likely to evoke a strong adverse community response. The shoot should take active steps to achieve a very significant reduction in mean *SNL* and/or to make a commensurate reduction in the number of hours that they shoot per week."

3.3.5 Annoyance is a key part of this investigation. "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)."

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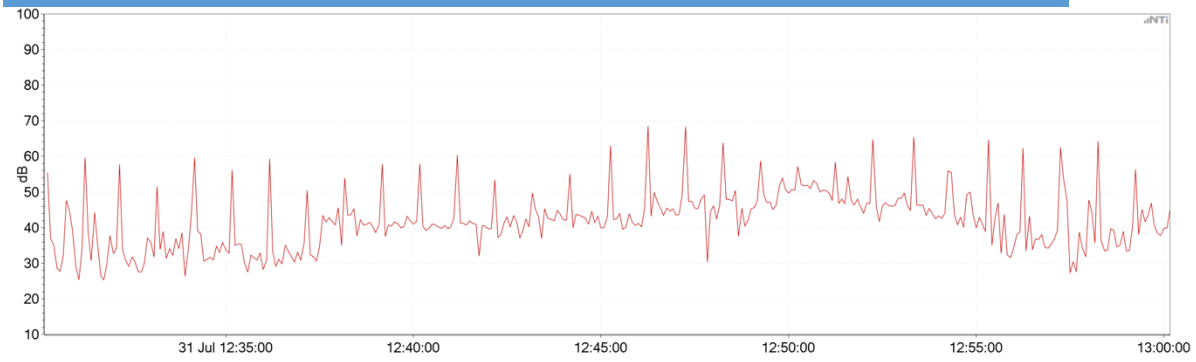
3.4 Chosen Assessment Methods

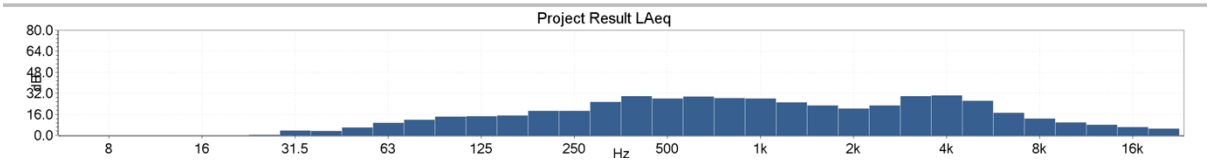
3.4.1 It is considered important to consider both the Clay target Shooting: Guidance on the Control of Noise (Jan 2003), and the BS8233:2014/WHO guidelines for Community Noise 1999 as the most appropriate methods of assessing the current impact on the properties both internally, and in the garden areas. TAN guidelines can then be used in future planning applications if any expansion of the range is being considered.

4.0 Results

4.1 – Location 1

Location	Start Date/Time	$L_{Aeq30mins}$	$L_{A90,30mins}$	SNL
Glendarg Farm	**30/07/21 12.30pm**	**39dB**	**24.1dB**	**74.5dB**





Event	Time	Measured L_{Amax} (Rounded to nearest dB)
Gunshot	12:59:13	56.3
Gunshot	12:58:13	64.3
Gunshot	12:57:14	62.5
Gunshot	12:56:13	62.3
Gunshot	12:55:17	64.4
Gunshot	12:54:15	55.9
Gunshot	12:53:15	65.4
Gunshot	12:52:13	58.4
Gunshot	12:51:13	58.4

Gunshot	12:50:13	57.1
Gunshot	12:49:12	58.7
Gunshot	12:48:14	63.8
Gunshot	12:47:13	59.1
Gunshot	12:46:13	59.7
Gunshot	12:45:14	63
Gunshot	12:44:09	55
Gunshot	12:41:08	60.3
Gunshot	12:40:08	57.9
Gunshot	12:39:09	57.8
Gunshot	12:36:09	59.3
Gunshot	12:35:07	56.2
Gunshot	12:34:08	59.6
Gunshot	12:32:08	57.7
Gunshot	12:31:11	59.6
Gunshot	12:30:14	55.4

Comments

- The gunshots were clearly distinguishable at this location.
- Some sheep noise and birds on the wire near to the microphone.
- The gunshots were higher than all other noises to produce the top 25 L_{Amax} measurements.
- The ambient noise level and also the L90/background noise level for the location were extremely low.
- This was the one location where there is line-of-sight to the top of the range hut.
- No noticeable disturbances to local wildlife including swifts nesting nearby, and sheep, cows and horses in the fields between the range and the measurement location

4.2 – Location 2

Location	Start Date/Time	$L_{Aeq30mins}$	$L_{A90,30mins}$	SNL
Fingland Guest House	**13.12pm – 13.42pm**	**35.4dB**	**27.8dB**	**63.5dB**

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Event (25 highest Max)	Time	Measured L_{Amax} (Rounded to nearest dB)
Gunshot	13:12:50	50.6
Crow near mic	13:12:53	51.7
Sheep	13:12:54	48.7
Sheep	13:12:56	51.2
Gunshot	13:13:04	50.4
Gunshot	13:25:41	48.7
Phone dropped on floor	13:26:26	48.8
Gunshot	13:26:27	51.5
Sheep	13:26:34	49.8
Sheep	13:27:15	48.9
Gunshot	13:27:16	49.4
Sheep	13:28:14	57
Gunshot	13:28:21	59.2
Bird landing near mic	13:28:25	54.9
Gunshot	13:28:40	52.2
Gunshot	13:29:44	50
Gunshot	13:30:53	49.9
Gunshot	13:32:35	48.7
Gunshot	13:38:55	48.9
Eagle/Buzzard Overhead	13:41:41	49.6
Gunshot	13:41:46	49.7
Sheep	13:42:15	48.8
Gunshot	13:42:19	52.6
Eagle/Buzzard overhead	13:42:35	54
Gunshot	13:42:39	49.7

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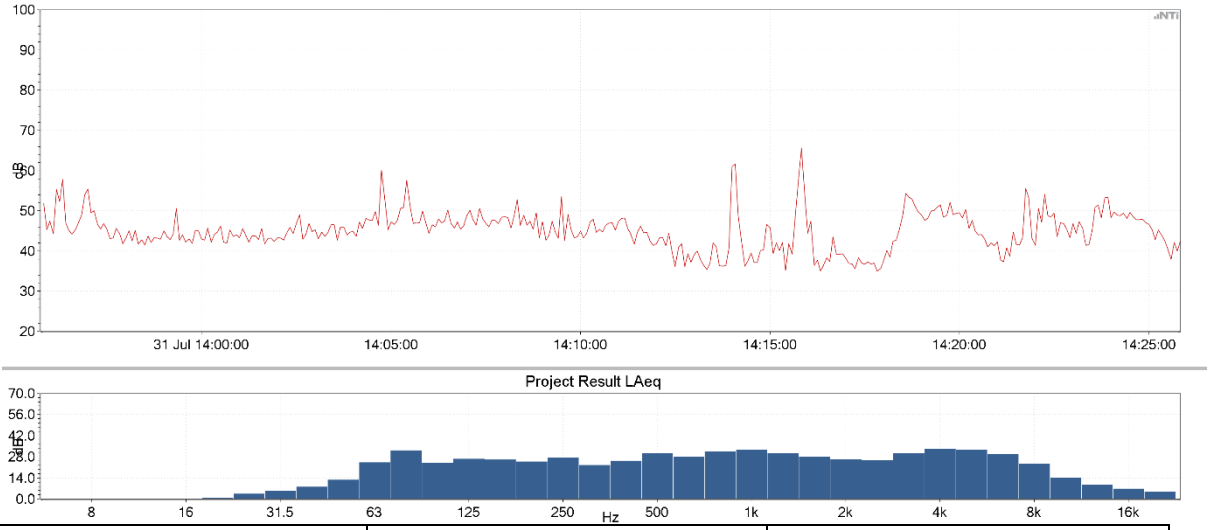
Comments

- Gunshots were distinguishable but at a noticeably lower level than Location 1.
- Not all gunshots were heard based on the pattern of firing.
- Some of the highest maxes were caused by local wildlife as indicated above. This has been verified by the audio recordings made at the time of the measurements.

4.3 Location 3

Location	Start Date/Time	$L_{Aeq30mins}$	$L_{A90,30mins}$	SNL
Davington Schoolhouse	**13.55pm – 14.25pm**	**42.8dB**	**30.5dB**	**-**



Event	Time	Measured L_{Amax} (Rounded to nearest dB)
Car	13:56:56	55.4
Car	14:04:43	60.1
Car	14:05:22	57.6
Car	14:13:59	60
Car	14:15:48	65.6
Car	14:18:38	53.4
Car	14:21:44	55.6
Car	14:23:50	53.2

Comments

- The majority of high levels measured at the site, and that can be heard on the audio recordings, are from passing traffic.

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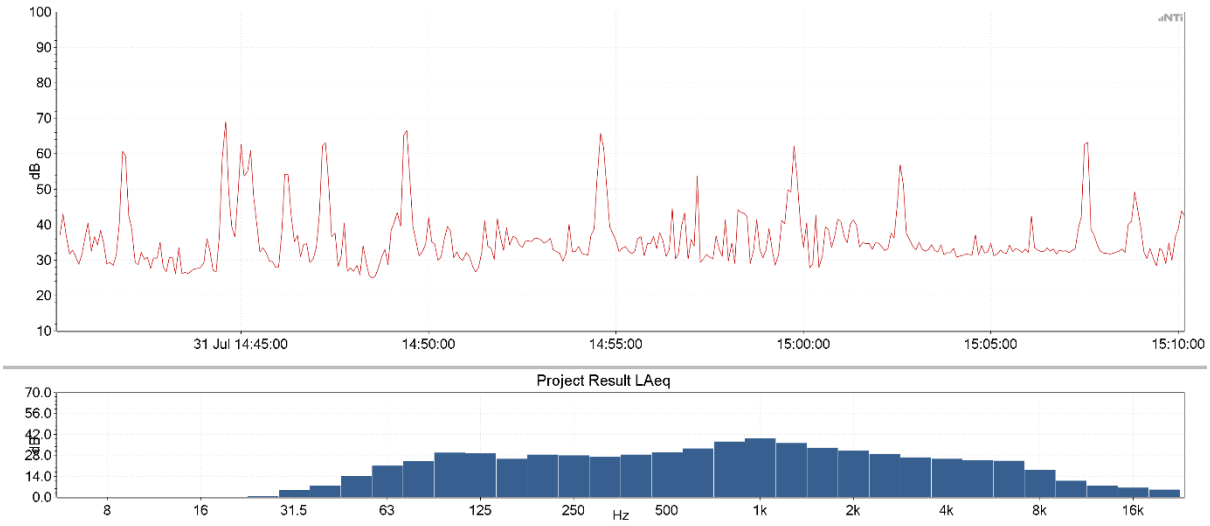
- Gun fire was not audible during the measurements and nothing was picked up on the audio recordings even when increasing the volume to listen carefully.
- A sample of the highest L_{AMax} readings are given above.

4.4 – Location 4

Location	Start Date/Time	$L_{Aeq30mins}$	$L_{A90,30mins}$	SNL
Ex Serviceman's Hall	**14.40pm – 15.10pm**	**45.1dB**	**25.7dB**	**-**



Event	Time	Measured L_{Amax} (Rounded to nearest dB)
van	14:44:30	65.1
car	14:44:31	68.7
car	14:45:11	60.9
car	14:46:10	54.2
car	14:47:09	62.2
car	14:49:18	60.6
car	14:49:20	65.1
sheep	14:54:27	46.1
sheep	14:54:29	51.8
car	14:54:30	61.1
car	14:54:37	61.5
car	14:59:43	62.2
car	15:02:32	56.6
car	15:07:28	60.1

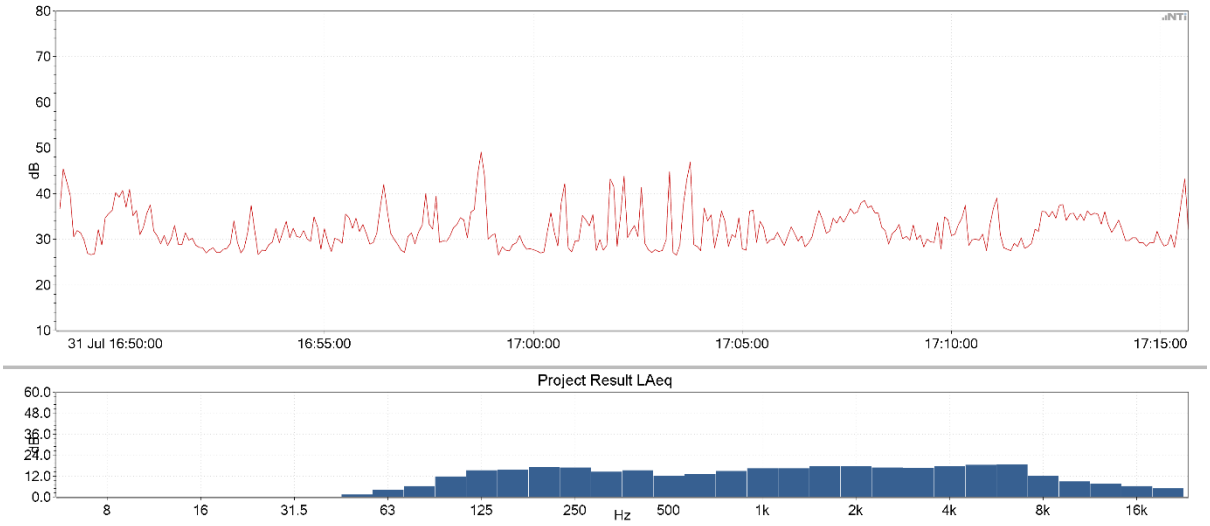
car	15:07:30	63.2
sheep	15:08:47	48.9

Comments

- The majority of high levels measured at the site, and that can be heard on the audio recordings, are from passing traffic.
- Gun fire was not audible during the measurements and nothing was picked up on the audio recordings even when increasing the volume to listen carefully.
- A sample of the highest L_{AMax} readings are given above.

4.5 – Location 5

Location	Start Date/Time	$L_{Aeq30mins}$	$L_{A90,30mins}$	SNL
Etterick closest boundary	**16.48pm – 17.18pm**	**25.7dB**	**27dB**	**-**



Event	Time	Measured L_{Amax} (Rounded to nearest dB)
Creaking building	16:48:44	45.4
Creaking building	16:56:22	42
Creaking building	16:58:40	49.1
Birds in the distance	17:01:45	43.2
Creaking building	17:02:05	43.8
Birds in the distance	17:03:40	46.9

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Comments

- The majority of high levels measured at the site, and that can be heard on the audio recordings, are from a creaking building.
- The background and ambient levels are extremely low in the area so such noises would not normally be audible. Gun fire was not audible during the measurements and nothing was picked up on the audio recordings even when increasing the volume to listen carefully.
- A sample of the highest L_{AMax} readings are given above.

5.0 Conclusion and Further Comments

5.1 Discussion of Levels

5.1.1 Location 3 and 5 are both areas where comments have been received in the recent past. At each location the dominant noise source was the B709 road and then a building that was creaking as the sun warmed it up. There were no gunshots audible at each of these locations.

5.1.2 According to BS8233 and WHO guidelines for community noise the levels experienced at all 5 locations were below the 55dB needed to avoid any adverse comments from local residents.

5.1.3 Table below shows the Shooting Noise Levels in accordance with Clay target Shooting: Guidance on the Control of Noise (Jan 2003).

Table

Location	Shooting Noise Level (SNL)	Small Event Acceptable Value	Difference (dB)	Acceptable Day Event Level	Difference (dB)
1. Glendarg	74.5dBA	65dB	+9.5	55dB	+19.5
2. Fingland	63.5dBA	65dB	-1.5	55dB	+8.5
3. Davington	-	65dB	N/A	55dB	N/A
4. Ex Service Hall	-	65dB	N/A	55dB	N/A
5. Etterick	-	65dB	N/A	55dB	N/A

5.1.4 The Shooting Noise Level (SNL) at Glendarg is above the permitted levels for both small and large events and, in accordance with Clay target Shooting: Guidance on the Control of Noise (Jan 2003), "likely to evoke a strong adverse community response" under normal circumstances. The location contains supporters of the range but measures should be taken to reduce the levels experienced at the location as the background levels in the area are so low.

5.1.5 It was noted that despite the levels and the obvious values compared to the background noise level – there was no noticeable disturbances to any of the wildlife

in the area including 2 horses standing approximately 200m closer to the range than the measurement.

5.1.5 The SNL at Fingland was also above the recommended levels above which it is 'likely to evoke a strong adverse community response' for the longer events. Shorter events where the recommended levels are 65dB would be within permitted levels. If measures are taken to reduce the levels for location 1 then location 2 would then fall inside the recommended values for both types of events.

5.1.6 There were no SNL values to be recorded at locations 3,4 and 5 as the gunfire was not measurable nor audible.

5.2 Suggested Mitigations

5.2.1 There is currently no insulation in the rifle-range 'hut'. The unit consists of a wooden structure on a concrete floor. This will mean that any impulse noise, such as gunshots, will cause reverberations in the building and likely be amplified by the metal corrugated roof structure.

5.2.2 If further mitigations were to be made then providing insulation to the ceiling, walls and flooring would absorb some of the sound energy produced by the gunfire. This would reduce the noise breakout from the structure and any impact on the locality. There are various different material types with acoustic properties that can be used to both reduce the internal reverberant sound pressure levels, and also the break-out noise from the building itself as well as the open windows for firing.

5.2.3 Currently the rifles are fired through openings in the hut. This firing point will mean that a large portion of the noise produced by the gunfire is indeed projected from the rifle-range structure outwards into the valley ahead. The report would suggest that an acoustic barrier such as a 6-8 Foot Gabon or even deep haybale wall be erected on the East-facing side of the building. This would further reduce levels as the majority of the NSR are located in the South to South East direction. Firing of the range is in the North East direction so any reductions in that direction towards the village of Etterick would have to be based on the sound insulation applied to the building to reduce total breakout noise from the range itself.

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6.0 Credentials

Name	Title	Credentials
James Flitton BSc AMIOA	Technical Director	CSCS Professionally Qualified person
		Associate Member Institute of Acoustics
		Affiliate Member of IDE
		Affiliate Member of IOR

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Appendix A – Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

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Appendix B - Certificates of Calibration

NTi AUDIO

Manufacturer Calibration Certificate

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3. All tests are traceable in accordance with ISO/IEC 17025.

This model of sound level meter submitted for periodic testing successfully completed the applicable pattern-evaluation tests given in IEC 61672-2. The pattern approval certificate is available at www.nti-audio.com/XL2.

Sound Level Meter

Manufacturer	NTi Audio		
Type	XL2-TA	S/N	A2A-18475-E0
Firmware	V4.21		
Reference Level Range	mid		
Microphone Model	M2230		
Preamplifier	MA220	S/N	9378
Microphone Capsule	MC230A	S/N	A19093
Performance class	Class 1		
Customer Inventory Nr.			

Customer

Date 13 October 2020

Certificate UK-20-072

Results **PASSED**
(for detailed report see next pages)

Operator David Young

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NTi AUDIO

Manufacturer Calibration Certificate

The following instrument has been tested and calibrated to the manufacturer specifications.
The calibration is traceable in accordance with ISO/IEC 17025 covering all instrument functions.

- Device Type: **Class 1 Sound Calibrator CAL200**
- Serial Number: **17656**

- Date of Calibration: **13 October 2020**
- Certificate Number: **44117-17656-CAL200**
- Results: **PASSED**
  (for detailed report see next page)

Tested by: D.Young

Signature:

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