Noise & Vibration Consultants Ltd.

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Date: 08.08.2018

FAO: Daniel Stykuc

NVC Ref. No: R18.0806/DRK

Re: Proposed ERF – Buttington Quarry
Baseline Study Results

Further to our recent correspondence regarding the above reference, we have now completed the baseline survey and the initial statistical analysis of the data set is provided below and graphs attached for your review.

Survey Period: Friday 20th (0900-1145) to Thursday 26th (1215-1315)

Monitoring Positions:
The baseline survey was carried out at 5 positions which provide a good representation of the background levels in the area being in proximity to the nearest sensitive receptors to the plant. The monitoring positions included:

- Location 1 – Rear of Cefn Cottage north of the site
- Location 2 – Sale Farm to the west of the site;
- Location 3 – Whitehouse Farm - southeast
- Location 4 – Brookside adjacent to the site entrance

- Additional of Location 5 – Adjacent to York House on site embankment as additional information.

See Figure 1 and photographs attached showing positions.

Measurements:
Sequential 15-minute monitoring periods using Type 1 microphones mounted on tripod and fitted with wind shield. Calibrated prior to and after measurements with calibrator.
Weather station positioned at Location 2 on high ground on west side of farmhouse unoccupied building. Measurements of LAeq, LA90, LA10 and LAmax levels.

Weather:
Weather conditions monitored every 5 minutes recording wind speed, temperature, humidity, wind direction and rainfall events. This data is still to be analysed relative to the data set to remove and data with wind speeds greater than 5m/s or rainfall periods.

All noise meters and calibrator within calibration requirements of BS4142: 2014. Measurements undertaken in accordance with BS4142: 2014 methodology.

Statistical analysis of full data set in terms of LA90 dB:

	Cefn Cottage	Cefn Cottage	Sale Farm	Sale Farm	Brookside	Brookside	Whitehouse	Whitehouse	York House	York House
Column1	**1 day**	**1 night**	**2 day**	**2 night**	**3 day**	**3 night**	**4 day**	**4 night**	**5 day**	**5 night**
Total number of values	390	192	393	192	397	192	390	192	391	192
Number of excluded value	0	0	0	0	0	0	0	0	0	0
Number of binned values	390	192	393	192	397	192	390	192	391	192
Minimum	26	22	21	19	30	29	23	22	27	22
25% Percentile	39.0	25.0	30.0	20.0	39.0	31.0	30.8	23.0	38.0	25.3
Median	**42.0**	**27.0**	**32.0**	**22.0**	**43.0**	**32.0**	**34.0**	**24.0**	**42.0**	**29.0**
75% Percentile	45.0	32.8	34.0	27.0	46.0	36.0	36.0	34.0	46.0	35.8
Maximum	57	41	48	38	60	45	45	38	57	46
Most common place	**42**	**24/25**	**32**	**20**	**45**	**31**	**36**	**23**	**46**	**27**
Mean	**41.6**	**28.5**	**32.0**	**24.1**	**42.3**	**33.7**	**33.0**	**27.2**	**42.1**	**30.6**
Std. Deviation	5.2	5.0	3.4	5.1	5.0	4.2	4.1	5.5	5.4	6.6
Std. Error of Mean	0.3	0.4	0.2	0.4	0.3	0.3	0.2	0.4	0.3	0.5
Lower 95% CI of mean	41.1	27.8	31.7	23.4	41.8	33.1	32.5	26.4	41.6	29.7
Upper 95% CI of mean	42.1	29.2	32.4	24.8	42.7	34.3	33.4	28.0	42.6	31.6

The above results show relative consistency with those properties closer to the main road to the southwest to northern sides of the development affected by daytime traffic noise (i.e. Cefn Cottage, Brookside and York House) and night-time levels dropping to low levels. At other positions to east and southern sides of development to be lower during the daytime (as expected) and low levels at night and not too dissimilar to the other locations.

BS4142: 2014 provides an example of statistical analysis relating to the `most common place' value as an indicator of representative background. We would normally refer to `median' or `most common place' as a means of establishing the value. The Standard does however make clear that the context of the site and noise climate is important and that the impact will depend on the context.

In terms of residual LAeq levels on average these were shown to be as follows:

	Cefn Cottage	Cefn Cottage	Sale Farm	Sale Farm	Brookside	Brookside	Whitehouse	Whitehouse	York House	York House
Column1	**1 day**	**1 night**	**2 day**	**2 night**	**3 day**	**3 night**	**4 day**	**4 night**	**5 day**	**5 night**
Total number of values	390	192	393	192	397	192	390	192	391	192
Number of excluded value	0	0	0	0	0	0	0	0	0	0
Number of binned values	390	192	393	192	397	192	390	192	391	192
Logarithmic mean	**55.4**	**48.8**	**41.9**	**39.8**	**64.7**	**58.5**	**45.5**	**40.1**	**56.1**	**49.6**

Clearly the above shows that in context with the LA90 levels the LAeq measurements are well above background sound levels.

Assuming that the measurement periods to be removed for high wind or rain does not alter the analysis (which is not expected), the assessment of **daytime** representative levels would be assessed as the following:

Daytime (0700-2300 hours)

	Representative LA90	LAeq
Properties to north of Site (i.e. Cefn Cottage, Lower Cefn and Cefn Farm:	42	55
Sale Farm to East:	32	42
Properties adjacent to A458 (e.g. Brookside)	43	65
Properties south of entrance (York House)	42	56
Properties west of site (Whitehouse Farm, Green Farm)	34	46

In view of typical LAeq levels determined at NSRs, in terms of a rating level for the Site, we would normally aim to ensure the site noise does not exceed the representative background level +4dB to ensure there is no adverse impacts. i.e.

	Representative LA90	Daytime Design Rating Level Limit $LAeq_{1hr}$
Properties to north of Site (i.e. Cefn Cottage, Lower Cefn and Cefn Farm:	42	46
Sale Farm to East:	32	36
Properties adjacent to A458 (e.g. Brookside)	43	47
Properties south of entrance (York House)	42	46
Properties west of site (Whitehouse Farm, Green Farm)	34	38

PCC Request for Clarification: Do you agree with the design rating level limit, if not what rating level do you advise and for what reason?

Night-time Period (2300-0700 hours):

	Representative LA90	LAeq
Properties to north of Site (i.e. Cefn Cottage, Lower Cefn and Cefn Farm:	25	49
Sale Farm to East:	20	40
Properties adjacent to A458 (e.g. Brookside)	31	59
Properties south of entrance (York House)	27	50
Properties west of site (Whitehouse Farm, Green Farm)	23	40

Noise impacts during night-time can be assessed relative to background but in the circumstance where background sound levels are low and rating levels low then absolute levels to protect residents from sleep disturbance become more relevant (due to context of the noise climate). We refer to BS4142: 2014 at Section 11 (Assessment of Impacts) Note 2:

"NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

Absolute Noise Criteria for Night-time

In terms of sleep disturbance criteria, WHO guidance (World Health Organisation (2009) – Night noise guidelines for Europe) for night-time noise refers to a noise aim of 40dB LAeq external to properties and an LAmax limit of 57dB (free field).

BS8233: 2014 `Guidance on sound insulation and noise reduction for buildings' guidelines indicate an internal level of 30dB $LAeq_{8hrs}$ for bedrooms to protect residents from sleep disturbance. This would equate to an external level of circa 42dB $LAeq_{8hrs}$ external to the bedroom window assuming an open window (i.e. 15dB drop for open window [ref. BS8233 Annex G G.1] and 3dB for façade reflection).

Existing LAeq levels are typically between 40dB to 59dB at night-time.

To provide suitable protection of amenity when residents are in their bedrooms with the window open we would suggest that in order to comply with absolute limits and the principles of BS4142, that under the condition of background sound levels being low and rating levels being low when absolute levels are more appropriate, then a lower limit of 30dB $LAeq_{15mins}$ would be reasonable or background +4dB, whichever is the higher. This would also mean that the design limit would be at least 10dB below residual sound levels, thereby not increasing the levels and the design limits would be well below sleep disturbance criteria.

Night-time Period (2300-0700 hours):

	Representative LA90	**Night-time Design Rating Level Limit $LAeq_{15mins}$**
Properties to north of Site (i.e. Cefn Cottage, Lower Cefn and Cefn Farm:	25	30
Sale Farm to East:	20	30
Properties adjacent to A458 (e.g. Brookside)	31	35
Properties south of entrance (York House)	27	31
Properties west of site (Whitehouse Farm, Green Farm)	23	30

PCC Request for Clarification: Do you agree with the design rating level limit and logic, if not what rating level do you advise and for what reason?

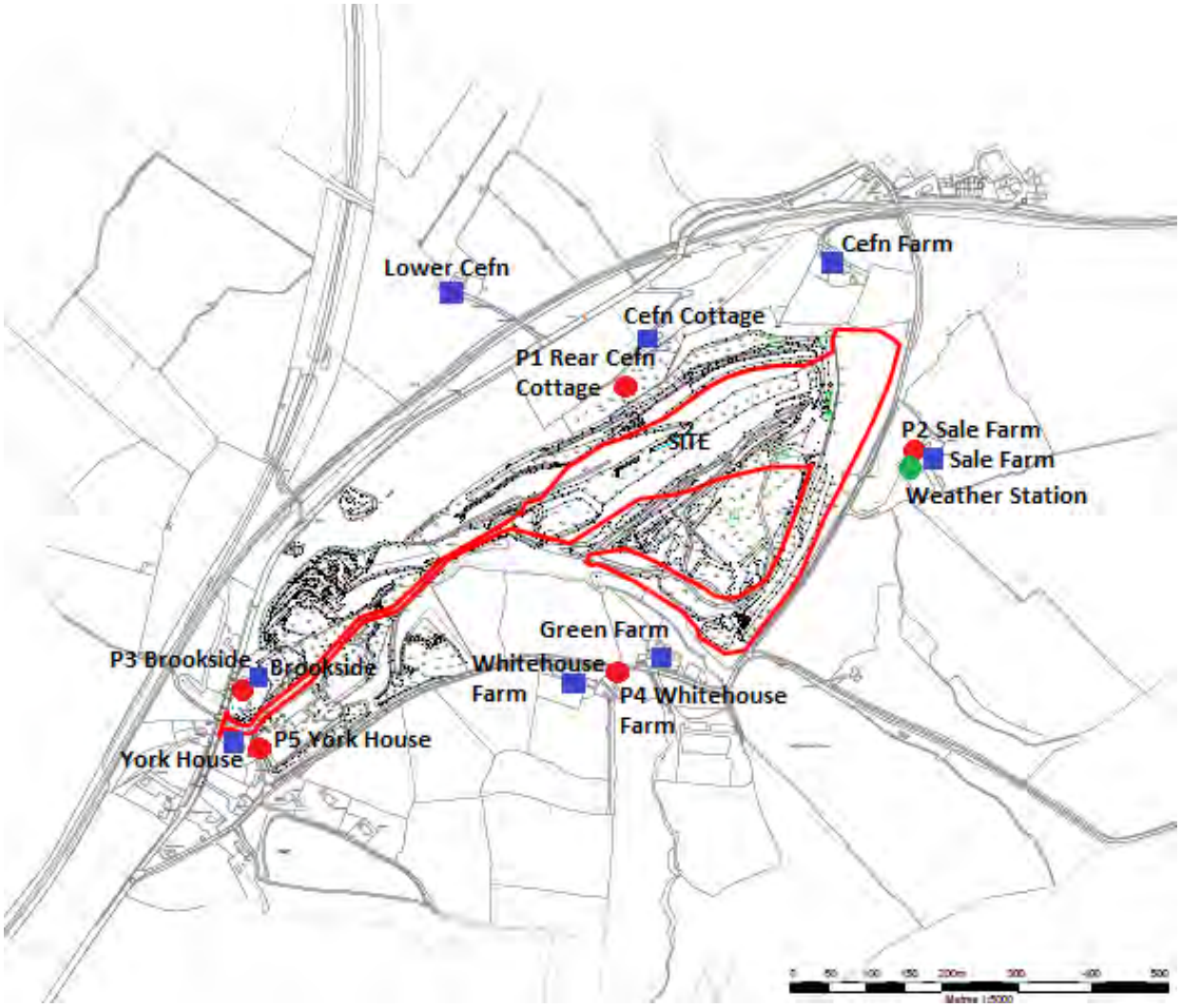
We would appreciate your views and feedback on the above information and proposals for design at your earliest convenience.

If you require any further information or clarification, please do not hesitate to contact the undersigned.

Yours sincerely

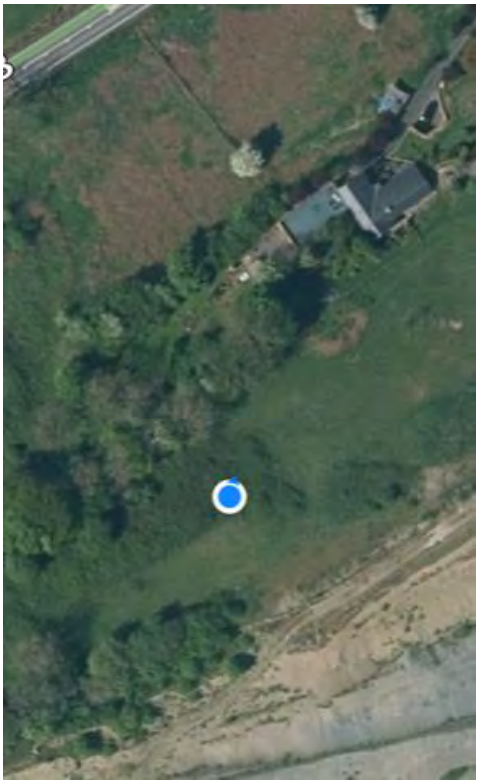
D R Kettlewell MSc MIOA MAE I.Eng
Managing Director
Principal Acoustic Consultant

Figure 1: Noise Monitoring Positions



Photographs of Monitoring Positions

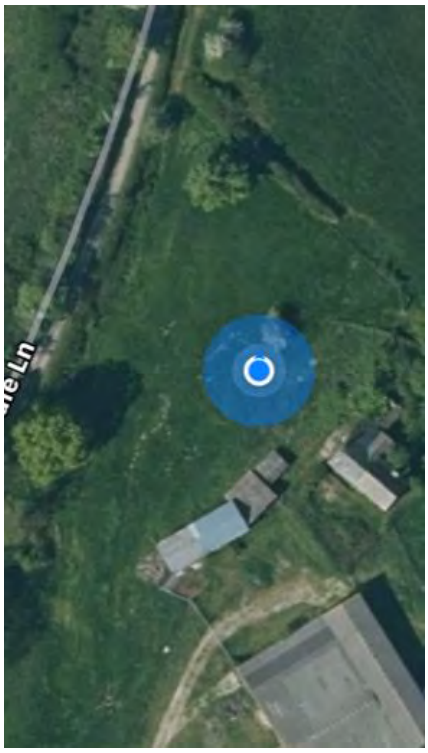
P1: Rear of Cefn Cottage on open land



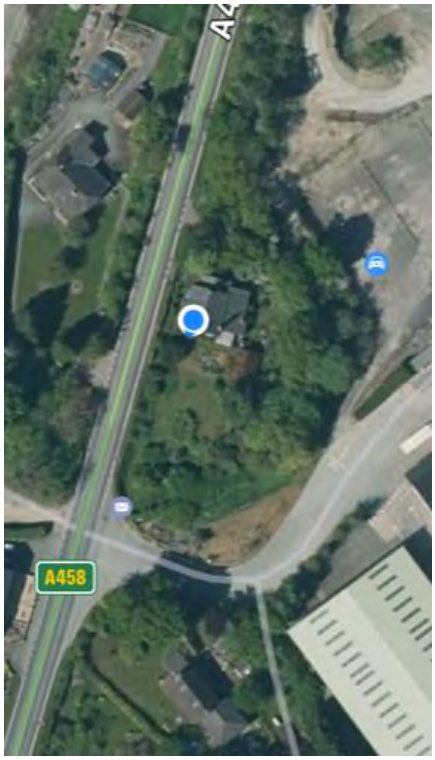
P2: Western side of Sale Farm

Noise meter

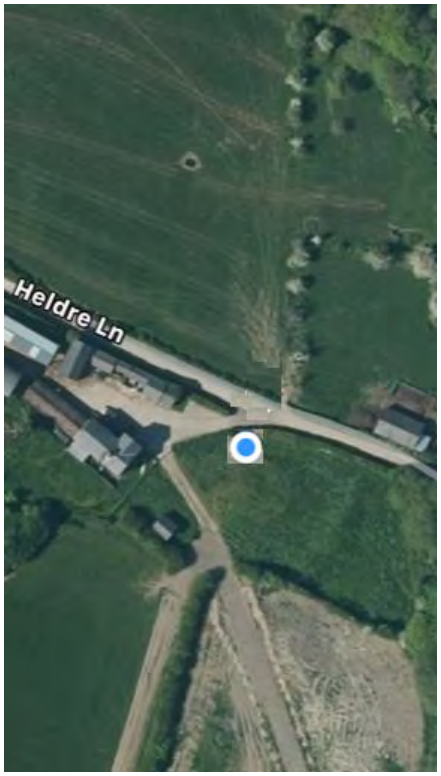
Weather Station



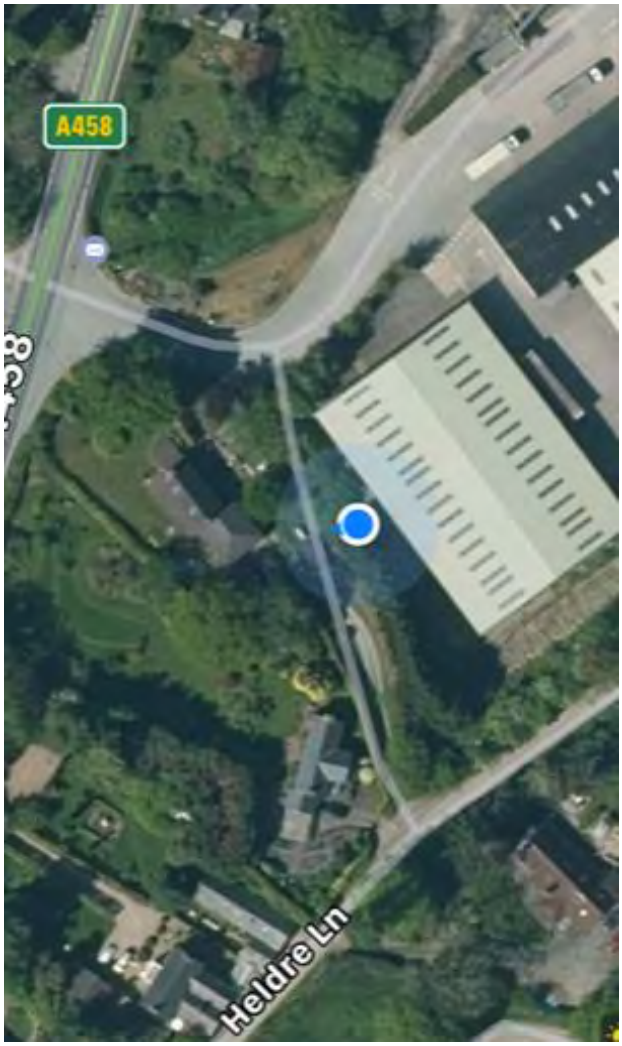
P3: Brookside Garden



P4: Whitehouse Farm Garden Area

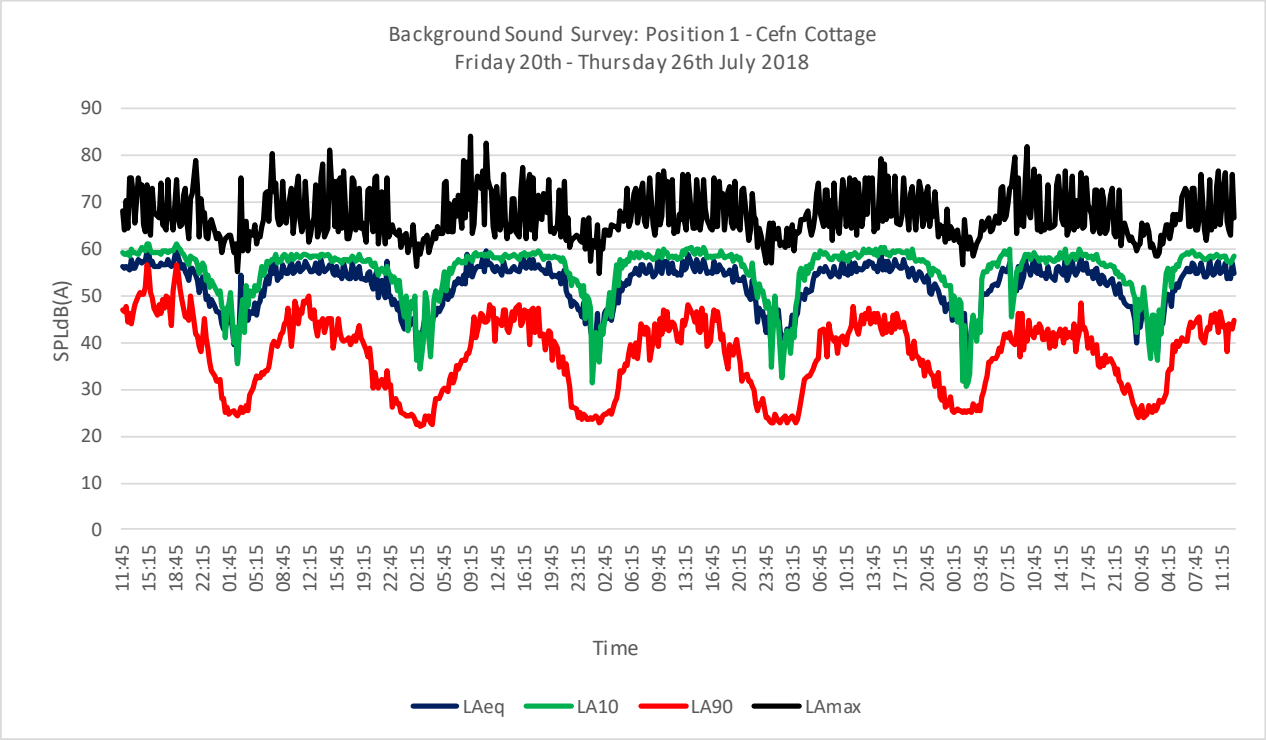


P5: Embankment to Side of York House

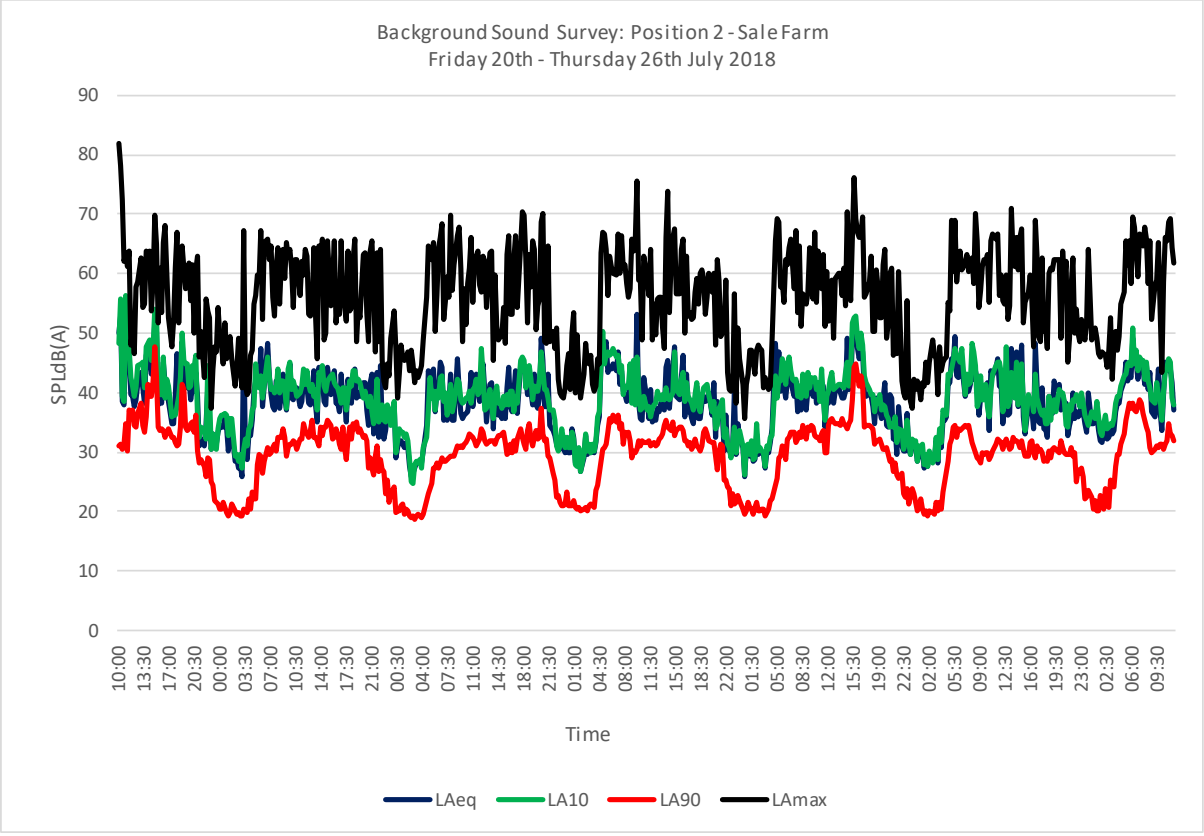


Time History Graphs

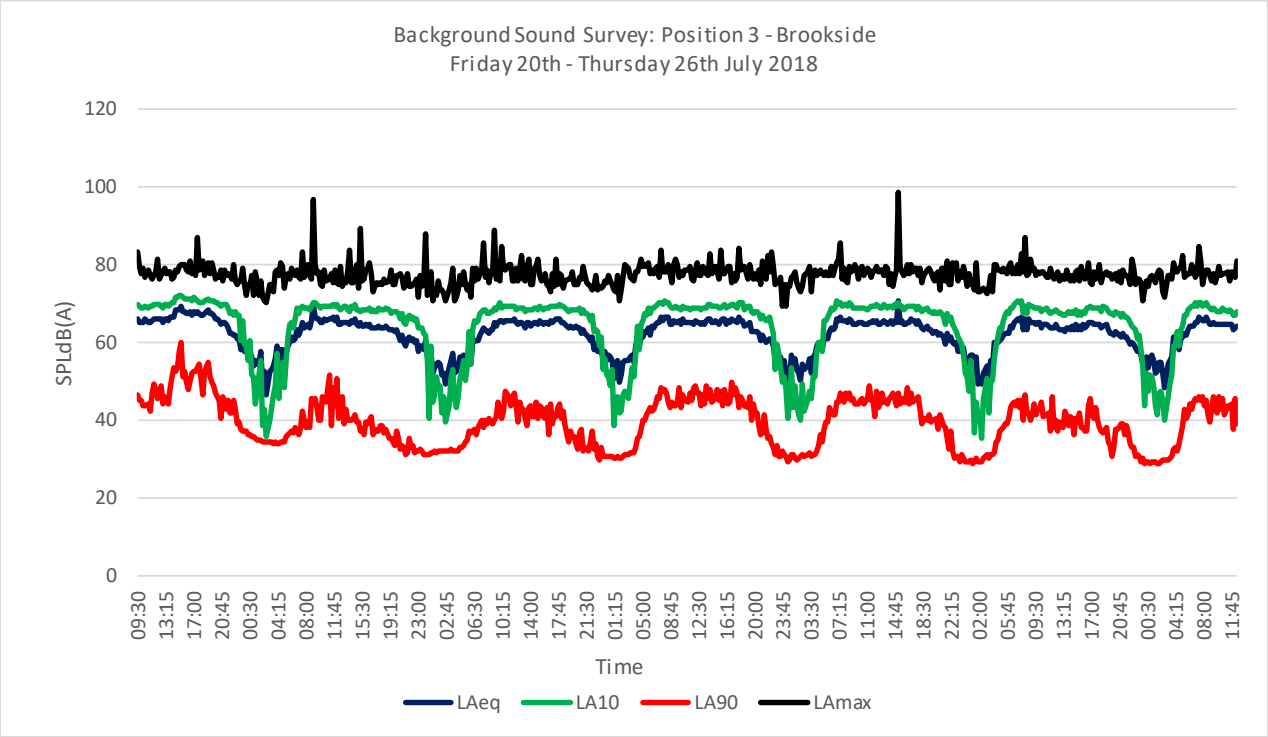
P1: Rear of Cefn Cottage



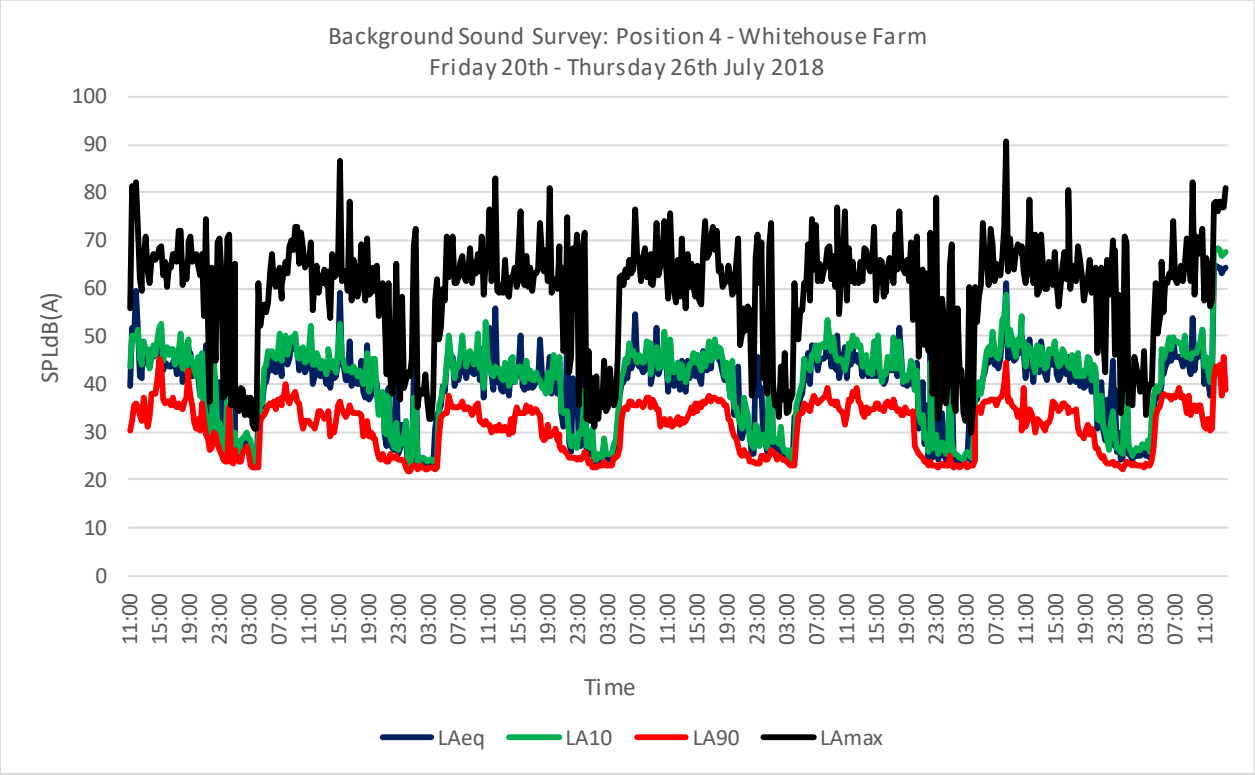
P2: Sale Farm (West side of Farmhouse – derelict)



P3: Brookside Garden Area



P4: Whitehouse Farm Garden Area



P5: Embankment to Side of York House