

**RWE Renewables UK Dogger Bank
South (West) Limited**

**RWE Renewables UK Dogger Bank
South (East) Limited**

Dogger Bank South Offshore Wind Farms

Environmental Statement

Volume 7

Appendix 25-2 Baseline Noise Monitoring

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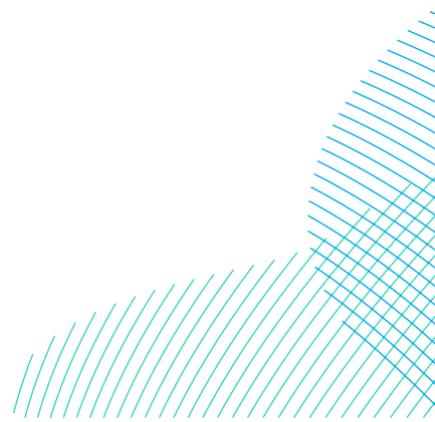
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Contents

25.2	Baseline Noise Monitoring	6
25.2.1	Introduction.....	6
25.2.2	Noise Monitoring Procedure	6
25.2.3	Baseline Noise Monitoring Results and Analysis	10
25.2.4	Background Sound Level Analysis.....	16

Tables

Table 25-2-1	Noise Monitoring Equipment.....	9
Table 25-2-2	Noise Monitoring Times and Dates	9
Table 25-2-3	Location A - Daytime (07:00 - 23:00) Baseline Monitoring Results	11
Table 25-2-4	Location A - Night-time Baseline Monitoring Results.....	12
Table 25-2-5	Location B - Daytime Baseline Monitoring Results.....	13
Table 25-2-6	Location B - Night-time Baseline Monitoring Results.....	14
Table 25-2-7	Location D - Daytime Baseline Monitoring Results	15
Table 25-2-8	Location D - Night-time Baseline Monitoring Results	15

Plates

Plate 25-2-1	Location A Photos (left: north, facing NSR; right: south, facing away from NSR)	7
Plate 25-2-2	Location B Photos (left: northeast, facing NSR; right: southwest, facing away from NSR).....	7
Plate 25-2-3	Location D Photos (left: south, facing receptor; right: southwest, facing away from receptor).....	8

Figures

Figure 25-2-1	- Noise Monitoring Locations
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Glossary

Term	Definition
Ambient / residual sound level, $L_{Aeq,T}$	The ambient sound level is the equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
A weighting	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the human ear.
Background sound level, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels
Decibel	The range of the audible sound pressure is approximately 2×10^{-5} Pa to 200Pa. Using decibel notation presents this range in a more manageable form, 0dB to 140dB. A decibel is 10 times the logarithmic ratio of a sound level to a standard reference level.
$L_{Aeq,T}$ – equivalent continuous A-weighted sound pressure level	The $L_{Aeq,T}$ is the value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time.
Maximum sound level, L_{AFmax}	The maximum fast-time-weighted (125ms), A-weighted sound level over a given time interval T
Onshore Converter Stations	A compound containing electrical equipment required to transform and stabilise electricity generated by the Projects so that it can be connected to the electricity transmission network. There will be one Onshore Converter Station for each Project.
Residual sound level, $L_{Aeq,T}$	The residual sound level is the ambient sound remaining at the assessment location when the specific sound source (sound source being assessed) is suppressed to such a degree that it does not contribute to the ambient sound.

Acronyms

Term	Definition
BS	British Standard
BSI	British Standards Institution
dB	Decibel
NSR	Noise Sensitive Receptor
UK	United Kingdom



25.2 Baseline Noise Monitoring

25.2.1 Introduction

1. This appendix provides additional technical information to accompany **Volume 7, Chapter 25 Noise (application ref: 7.25)**. It includes more detailed information regarding the baseline noise monitoring procedure, results and analysis.
2. The purpose of the baseline noise monitoring was to establish existing background and residual sound levels at noise sensitive receptors (NSRs) that could be affected by the Onshore Converter Stations. The background sound levels are used in the assessment of operational noise impacts associated with the Onshore Converter Stations. The background sound levels have been analysed in detail in section 25.1.4 of this appendix.
3. Monitoring locations, representative of individual or groups of NSRs, were identified and agreed with East Riding of Yorkshire Council. Eleven measurement locations representative of operational Onshore Converter Stations receptors were surveyed between during October/November 2022 and January 2023, eight of which have been scoped out of the operational assessment as they are no longer within the study area.

25.2.2 Noise Monitoring Procedure

4. Unattended noise monitoring was undertaken at locations A, B and D, shown on **Figure 25-2-1**. Weather conditions were monitored using a weather station at location J.
5. Photographs of the sound level meters temporarily installed at noise monitoring locations A, B and D can be seen on **Plate 25-2-1 to Plate 25-2-3**. At each location the microphone was mounted on a pole 1.5 metres above ground in a free-field location, at least 3.5 metres from any reflecting surfaces.



Plate 25-2-1 Location A Photos (left: north, facing NSR; right: south, facing away from NSR)



Plate 25-2-2 Location B Photos (left: northeast, facing NSR; right: southwest, facing away from NSR)





Plate 25-2-3 Location D Photos (left: south, facing receptor; right: southwest, facing away from receptor)

6. Details of the sound level meters used for the noise monitoring are detailed in **Table 25-2-1**.
7. All sound level meters were checked for sensitivity with a field calibrator both before and after the measurements, no variations greater than 0.1 dB were noted. All instruments used were compliant with the requirements of the Class 1 standard for accuracy as defined with British Standards 60942:2018 and 61672:2013. Laboratory calibration of the survey equipment was conducted no more than one (calibrators) or two (sound level meters) years before the period of the survey.
8. The sound level meters (SLMs) were set up to log the octave band and A-weighted broadband sound pressure level (SPL) in continuous 100 ms periods for the duration of the survey. Levels were then post-processed into $L_{Aeq,15min}$ and $L_{A90,15min}$, in addition to range of other relevant parameters.
9. Weather conditions were measured using a Davis Vantage View weather station at location J (X: 503289, Y: 435949; scoped out of noise analysis), which measured wind speed, wind direction, temperature and precipitation continuously for the duration of the survey.

Table 25-2-1 Noise Monitoring Equipment

Monitoring Location	X coordinate	Y coordinate	Equipment details	Survey Meter	Field Calibrator
A	502017	436970	Manufacturer	Rion	Rion
			Type	NL-52	NC-74
			Serial No.	0610193	01020506
B	502534	436614	Manufacturer	Rion	Rion
			Type	NL-52	NC-74
			Serial No.	0864983	01020506
D	502031	436026	Manufacturer	Rion	Rion
			Type	NL-52	NC-75
			Serial No.	0976221	35081041

10. Details of the monitoring periods are provided below in **Table 25-2-2**. It should be noted that locations A and B the measurement included October half term (24 to 28 October 2022). Monitoring during this time period was agreed with East Riding of Yorkshire Council Environmental Health Department.

Table 25-2-2 Noise Monitoring Times and Dates

Monitoring Location	Start Time - Date	End Time - Date	Duration
A	14:00hrs - 13/10/2022	11:15hrs - 02/11/2022	~20 days
B	15:30hrs - 13/10/2022	02:15hrs - 01/11/2022	~19 days
D	14:30hrs - 19/01/2023	14:15hrs - 26/01/2023	~7 days

25.2.3 Baseline Noise Monitoring Results and Analysis

11. The unattended noise monitoring results are presented by day in **Table 25-2-3** to **Table 25-2-8**.
12. Noise data has been excluded from all analysis when adverse weather (>5 m/s maximum wind speed or periods of rain) has been recorded at the weather station. Data either side of these exclusions has been reviewed and removed if noise levels appear to be affected by weather conditions.
13. The daytime and night-time ambient sound level ($L_{Aeq,T}$) values per day have been ascertained by calculating the logarithmic average of $L_{Aeq,15min}$ values over daytime (07:00-23:00, $T = 16$ hours) and night-time (23:00-07:00, $T = 8$ hours) periods. The 'summary' $L_{Aeq,T}$ values have been calculated by the mean of the daytime or night-time values.
14. The daytime and night-time background sound level (L_{A90}) values per day (i.e. those shown in the tables below) have been identified by calculating the modal average of the rounded whole-number $L_{A90,15min}$ values over daytime (07:00-23:00) and night-time (23:00-07:00) periods.
15. There is no single method of defining the representative background sound level (L_{A90}) that is appropriate for all datasets and noise climates. Therefore, to select representative background sound levels for use in the assessment (presented in the 'summary' value in the following tables) a review of the following information has been undertaken and presented in section 25.2.4, which follows guidance from BS 4142 and ANC BS4142 Technical Note:
 - Measured $L_{A90,15min}$ time history graph;
 - Measured $L_{A90,15min}$ data displayed as a histogram and in terms of percentiles;
 - The range, mean, modal and median of measured $L_{A90,15min}$ values over the total measurement.
16. The daytime and night-time maximum sound level (L_{AFmax}) values per day have been ascertained by calculating the top 10th percentile of $L_{AFmax,15min}$ values over daytime (07:00-23:00) and night-time (23:00-07:00) periods. The summary is the range of these daily values.

Table 25-2-3 Location A - Daytime (07:00 - 23:00) Baseline Monitoring Results

Date	L _{Aeq,16h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 13/10/2022	49	44	68
Friday 14/10/2022	48	43	75
Saturday 15/10/2022	49	44	78
Sunday 16/10/2022	47	44	68
Monday 17/10/2022	45	43	72
Tuesday 18/10/2022	53	47	72
Wednesday 19/10/2022	49	53	69
Thursday 20/10/2022	48	46	69
Friday 21/10/2022	52	49	67
Saturday 22/10/2022	48	44	75
Sunday 23/10/2022	50	46	71
Monday 24/10/2022	48	43	74
Tuesday 25/10/2022	51	46	76
Wednesday 26/10/2022	55	45	74
Thursday 27/10/2022	53	47	77
Friday 28/10/2022	48	46	71
Saturday 29/10/2022	53	49	73
Sunday 30/10/2022	49	46	70
Monday 31/10/2022	52	50	69
Tuesday 01/11/2022	48	46	71
Summary	50	45	67 - 78
Noise environment	Road Traffic, occasional dog barks, birdsong		



Table 25-2-4 Location A – Night-time Baseline Monitoring Results

Date	L _{Aeq,8h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 13/10/2022	43	34	55
Friday 14/10/2022	39	34	60
Saturday 15/10/2022	41	40	56
Sunday 16/10/2022	41	39	60
Monday 17/10/2022	43	32	59
Tuesday 18/10/2022	47	36	59
Wednesday 19/10/2022	45	37	59
Thursday 20/10/2022	41	31	55
Friday 21/10/2022	39	35	53
Saturday 22/10/2022	42	33	56
Sunday 23/10/2022	39	28	54
Monday 24/10/2022	40	33	53
Tuesday 25/10/2022	44	37	58
Wednesday 26/10/2022	45	35	57
Thursday 27/10/2022	47	36	60
Friday 28/10/2022	44	35	56
Saturday 29/10/2022	40	32	57
Sunday 30/10/2022	42	35	55
Monday 31/10/2022	42	38	59
Tuesday 01/11/2022	40	36	53
Summary	42	31	53 - 60
Noise environment	Road Traffic		



Table 25-2-5 Location B - Daytime Baseline Monitoring Results

Date	L _{Aeq,16h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 13/10/2022	57	53	70
Friday 14/10/2022	57	53	74
Saturday 15/10/2022	56	52	75
Sunday 16/10/2022	56	52	73
Monday 17/10/2022	56	53	72
Tuesday 18/10/2022	57	51	73
Wednesday 19/10/2022	52	56	71
Thursday 20/10/2022	55	52	71
Friday 21/10/2022	58	55	74
Saturday 22/10/2022	59	54	76
Sunday 23/10/2022	56	50	72
Monday 24/10/2022	57	54	75
Tuesday 25/10/2022	59	55	74
Wednesday 26/10/2022	58	53	76
Thursday 27/10/2022	57	54	73
Friday 28/10/2022	57	54	72
Saturday 29/10/2022	58	54	73
Sunday 30/10/2022	58	53	72
Monday 31/10/2022	59	56	74
Summary	57	53	70 - 76
Noise environment	Road Traffic		



Table 25-2-6 Location B – Night-time Baseline Monitoring Results

Date	L _{Aeq,8h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 13/10/2022	53	37	68
Friday 14/10/2022	49	37	67
Saturday 15/10/2022	50	42	68
Sunday 16/10/2022	53	42	68
Monday 17/10/2022	53	35	67
Tuesday 18/10/2022	52	36	67
Wednesday 19/10/2022	51	38	67
Thursday 20/10/2022	52	33	66
Friday 21/10/2022	51	38	68
Saturday 22/10/2022	50	35	66
Sunday 23/10/2022	48	30	66
Monday 24/10/2022	53	36	68
Tuesday 25/10/2022	53	39	68
Wednesday 26/10/2022	53	37	68
Thursday 27/10/2022	54	38	68
Friday 28/10/2022	52	38	68
Saturday 29/10/2022	51	34	68
Sunday 30/10/2022	52	37	69
Monday 31/10/2022	46	41	68
Summary	52	30	53 - 60
Noise environment	Road Traffic		

Table 25-2-7 Location D - Daytime Baseline Monitoring Results

Date	L _{Aeq,16h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 19/01/2023	44	40	66
Friday 20/01/2023	49	46	65
Saturday 21/01/2023	48	44	63
Sunday 22/01/2023	47	43	69
Monday 23/01/2023	48	44	65
Tuesday 24/01/2023	57	45	68
Wednesday 25/01/2023	47	44	65
Thursday 26/01/2023	49	48	66
Summary	49	44	63 - 69
Noise environment	Road Traffic		

Table 25-2-8 Location D - Night-time Baseline Monitoring Results

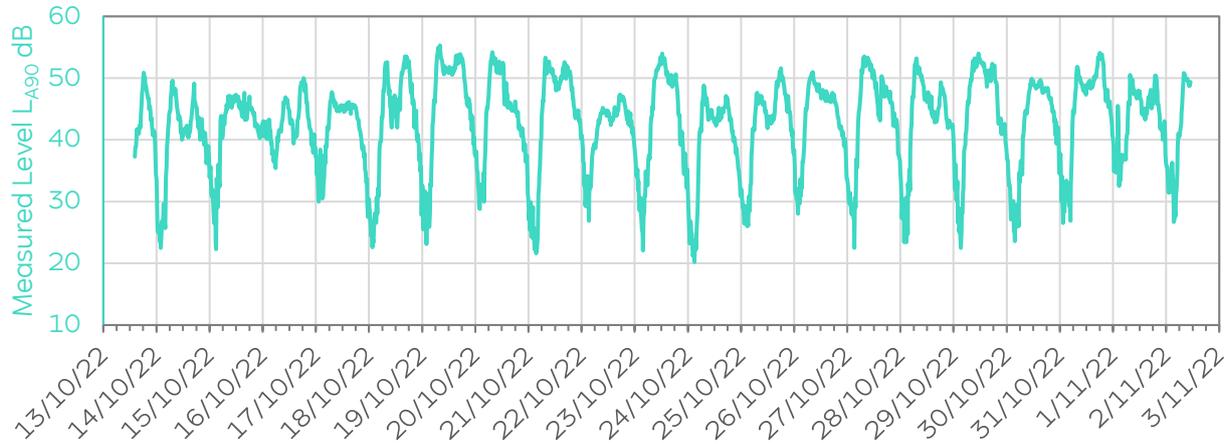
Date	L _{Aeq,8h} (dB)	L _{A90} (dB)	L _{AFmax} (dB)
Thursday 19/01/2023	42	35	53
Friday 20/01/2023	46	33	58
Saturday 21/01/2023	41	30	55
Sunday 22/01/2023	41	29	54
Monday 23/01/2023	43	33	58
Tuesday 24/01/2023	38	29	51
Wednesday 25/01/2023	44	36	55
Summary	42	26	51 - 58
Noise environment	Road Traffic		

25.2.4 Background Sound Level Analysis

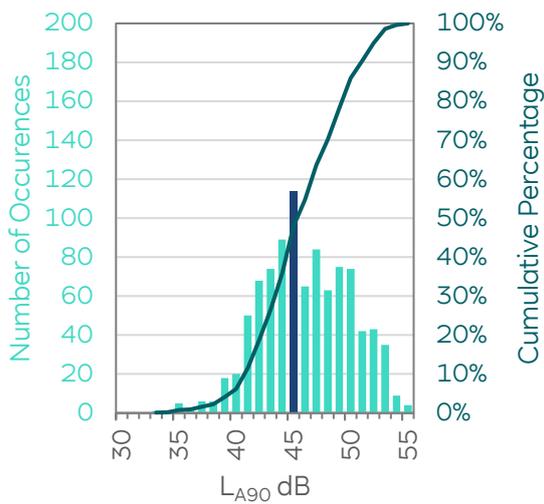
17. The following three pages present the background sound level analysis for the three noise monitoring locations A, B and D. The representative background sound level has been used to assess the impact of the predicted operational noise from the Onshore Converter Stations using guidance from BS4142. In the BS4142 assessment the 'rating level' of the operational noise is compared to the background sound level, with the higher the excess over background the higher the likelihood of an adverse impact. Therefore, when selecting representative values, consideration has been given to providing a reasonable worst-case L_{A90} e.g. if multiple values appear representative, the lowest of these is often most appropriate.
18. For position A, a representative daytime background sound level of 45 dB L_{A90} has been chosen. This has been selected as it is the modal value, which is also close to, and slightly below, the mean and median values and therefore represents a reasonable worst-case scenario. A representative night-time background level of 31 dB L_{A90} has been chosen as this is also the modal value, 3 to 4dB below the mean and median values.
19. For position B daytime the modal value of 56 dB L_{A90} hasn't been chosen in this case because approximately two thirds of measured L_{A90} levels are below this level. Instead, the mean value of 53 dB has been chosen. A representative night-time background level of 30 dB L_{A90} has been chosen because it is the modal value, which is also below to the mean and median values.
20. For position D daytime the mean value of 44 dB L_{A90} has been chosen as a representative daytime background sound level, where two thirds of values are above this. A representative night-time background level of 26 dB L_{A90} has been chosen. This value is below the mode, mean and median values and has been chosen following a review of the distribution, as it represents the lowest third of measured values i.e. a reasonable worst-case.



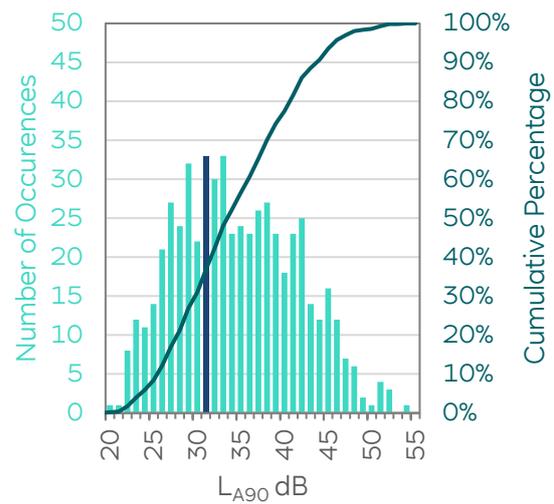
Position A - Time History



Position A - Daytime

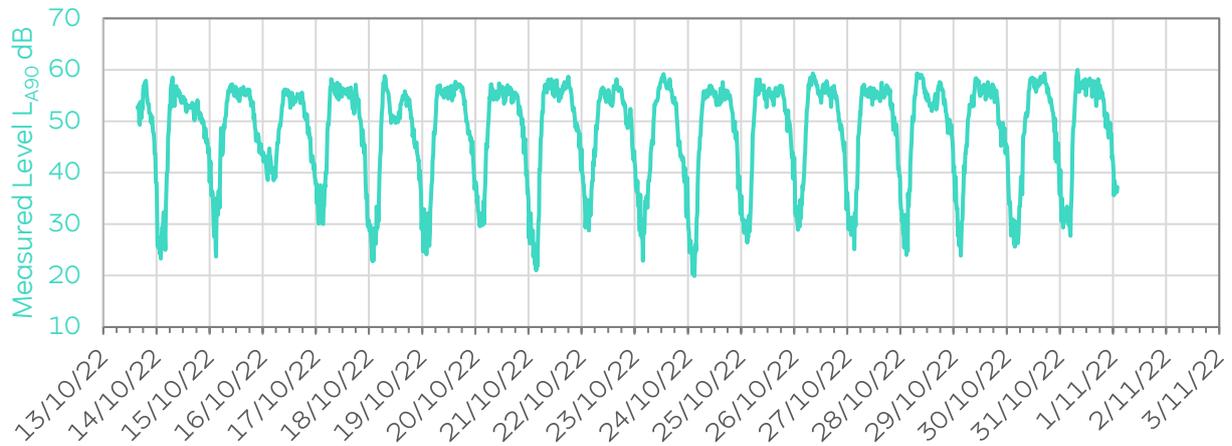


Position A - Night-time

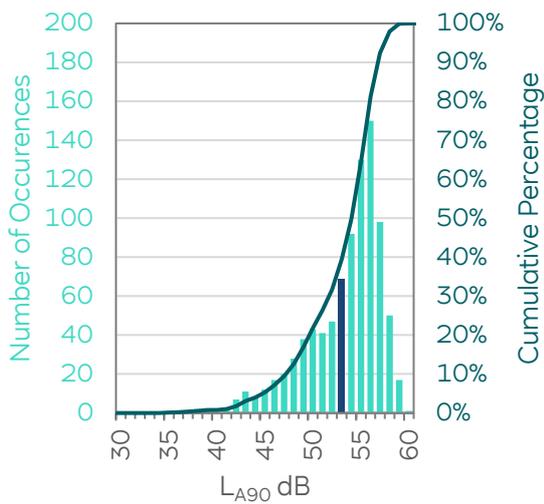


	Daytime	Night-time
Range	33 - 55	20 - 54
Mean	46	35
Mode	45	31
Median	46	34
Representative Value	45	31

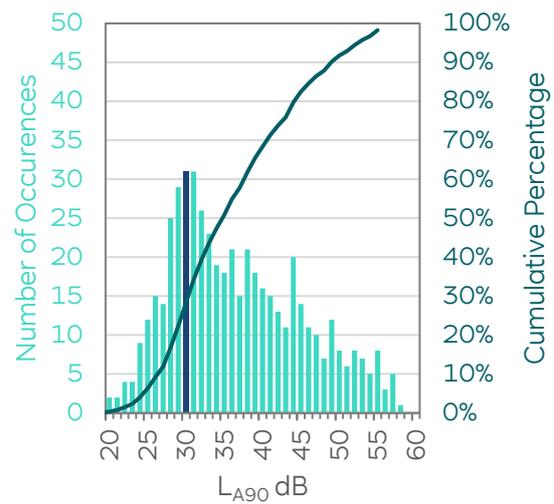
Position B - Time History



Position B - Daytime

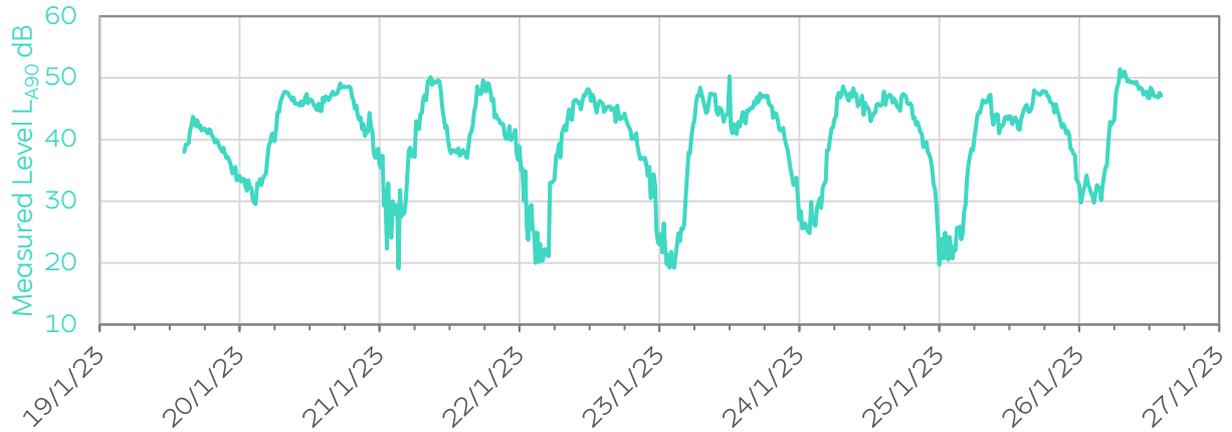


Position B - Night-time

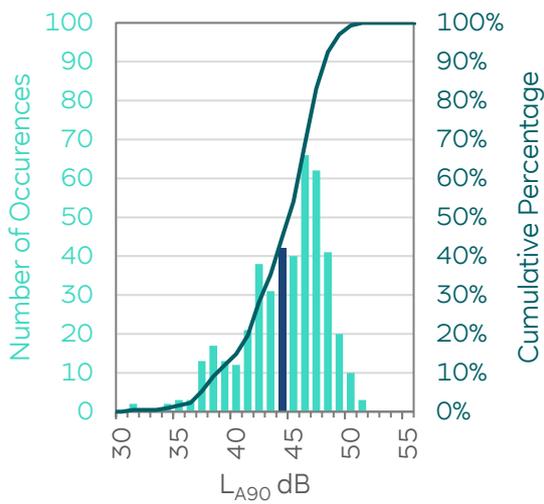


	Daytime	Night-time
Range	35 - 60	20 - 58
Mean	53	37
Mode	56	30
Median	55	35
Representative Value	53	30

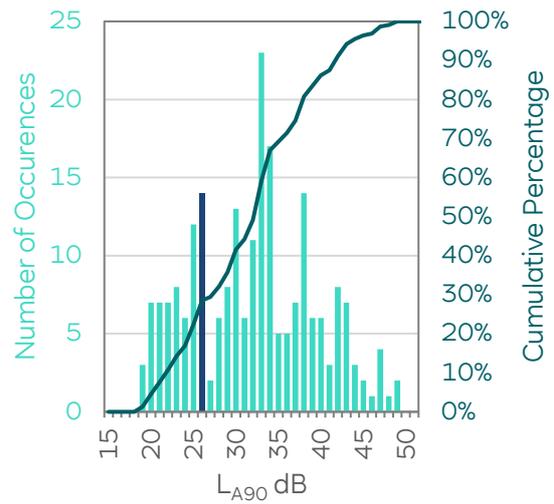
Position D - Time History



Position D - Daytime



Position D - Night-time



	Daytime	Night-time
Range	31 - 51	19 - 49
Mean	44	32
Mode	46	33
Median	45	33
Representative Value	44	26

References

Association of Noise Consultants (2020) BS 4142:2014+A1:2019 Technical Note

British Standard Institution (2013) BS EN 61672-1 – Electroacoustics. Sound level meters Specifications. BSI, London.

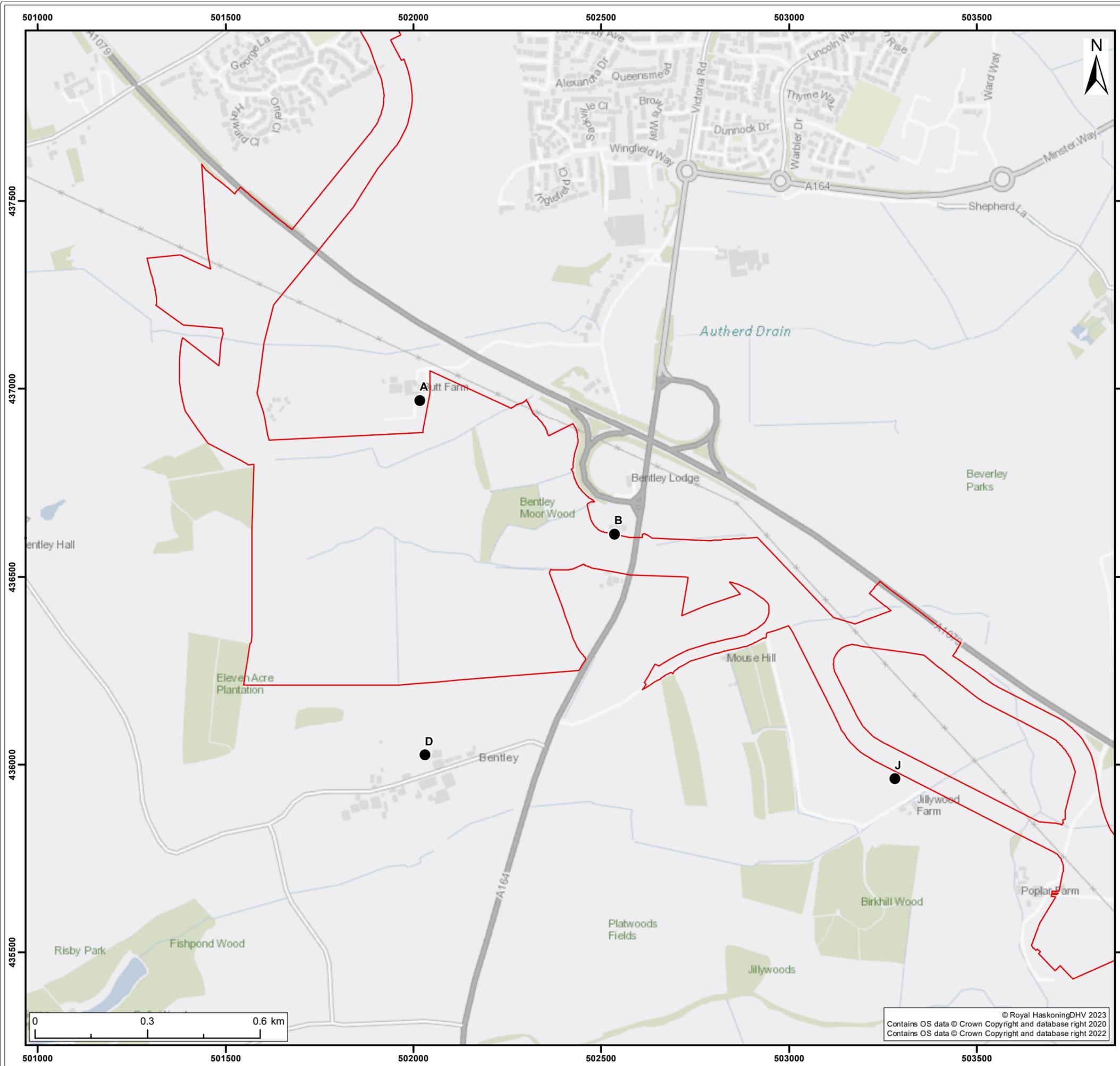
British Standard Institution (2014+A1:2019) BS4142 – Methods for rating and assessing industrial and commercial sound. BSI, London.

British Standard Institution (2018) BS EN 60942 – Electroacoustics. Sound calibrators. BSI, London.



Figure 25-2-1 Noise Monitoring Locations





Legend:
 Onshore Development Area
 Noise Monitoring Locations

S2	P01	18/12/2023	Suitable for Information	SB	ML
SUI	REV	DATE	DESCRIPTION	DRW	CHK

Title:
Noise Monitoring Locations

Figure: 25-2-1 Drawing No: PC2340-RHD-ON-ZZ-DR-Z-0687

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