NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Appendix 26.1 Baseline Noise Survey

Document Reference:	3.3.60
Volume:	3.3
APFP Regulation:	5(2)(a)
Date:	July 2024
Revision:	0

Project Reference: EN010119

NORTH FALLS
Offshore Wind Farm

Project	North Falls Offshore Wind Farm
Document Title	Environmental Statement Appendix 26.1 Baseline Noise Survey
Document Reference	3.3.60
APFP Regulation	5(2)(a)
Supplier	Royal HaskoningDHV
Supplier Document ID	PB9244-RHD-ZZ-ON-TN-ON-0122

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
0	July 2024	Submission	RHDHV	NFOW	NFOW

REPORT

North Falls Offshore Wind Farm: Baseline Noise Survey and Acoustic Terminology

Client: North Falls Offshore Wind Limited

Reference: PB9244-RHD-ZZ-ON-TN-ON-0122

Status: S0/P01.01

Date: 06 December 2022

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Document title:	North Falls Offshore Wind Farm: Baseline Noise Survey and Acoustic Terminology
Subtitle:	
Reference:	PB9244-RHD-ZZ-ON-TN-ON-0122
Status:	P01.01/S0
Date:	06 December 2022
Project name:	North Falls Offshore Wind Farm
Project number:	PB9244
Author(s):	BC
Drafted by:	BC
Checked by:	TB
Date:	06/12/22
Approved by:	GC
Date:	06/12/22

Classification
Project related

Royal HaskoningDHV

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Glossary of Acronyms

BS	British Standard
BSI	British Standards Institution
NVSR	Noise and Vibration Sensitive Receptor
PEIR	Preliminary Environmental Information Report

Glossary of Terms

The Project Or 'North Falls'	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.
Onshore project area	The boundary in which all onshore infrastructure required for the Project will be located (i.e. landfall; onshore cable route, accesses, construction compounds; onshore substation and national grid substation extension), as considered within the PEIR.
Horizontal directional drilling (HDD)	Trenchless technique to bring the offshore cables ashore at the landfall. The technique will also be used for installation of the onshore export cables at sensitive areas of the onshore cable route.
Landfall	The location where the offshore cables come ashore.
Landfall search area	Locations being considered for the landfall, comprising the Essex coast between Clacton-on-Sea and Frinton-on-Sea.
Landfall compound	Compound at landfall within which HDD or other trenchless technique would take place.
Onshore cable corridor(s)	Onshore corridor(s) considered within the PEIR within which the onshore export cables and associated infrastructure will be located. A final onshore cable route for which consent will be sought will be selected from within these corridor(s).
Onshore cable route	Onshore route within which the onshore export cables and associated infrastructure would be located.
Onshore export cables	The cables which take the electricity from landfall to the onshore substation and on to the national grid. These comprise High Voltage Alternative Current (HVAC) cables, buried underground.
Onshore substation	A compound containing electrical equipment required to transform and stabilise electricity generated by the Project so that it can be connected to the national grid.
Onshore substation zone	Area within which the onshore substation will be located.

1 BASELINE NOISE SURVEY

1.1 Introduction

1. This report details the baseline sound survey undertaken to characterise the existing soundscape within the proposed North Falls Offshore Wind Farm (herein 'the Project' or 'North Falls') noise and vibration study area.
2. The baseline sound survey comprised of unattended measurements at locations representative of identified noise and vibration sensitive receptors (NVSRs) around the landfall search area and onshore substation zone[1]. Measurements were conducted in accordance with current guidance including BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' and BS 7445-2:1991 'Description and measurement of environmental noise'.
3. The baseline sound data will be used within the construction and operational phase environmental impact assessments for the Project.
4. The survey procedures were agreed with Tendring District Council via the Project Evidence Plan Process which comprised two meetings of the Traffic and Transport, Air Quality, Climate Change and Noise and Vibration Expert Topic Group (ETG) in July 2021 and May 2022. The survey was undertaken between 8th July 2022 and 20th July 2022.

1.2 Existing Environment

5. Aerial imagery was used to determine NVSR locations at the landfall search area and at the onshore substation zone.
6. Measurement locations (representative of individual or groups of NVSRs) were identified and agreed with Tendring District Council are as shown in Table 1.
7. The NVSR locations at the landfall, are labelled with the prefix LFR (denoting Landfall Receptor), and at the onshore substation with a prefix of SSR (denoting Substation Receptor). Each receptor was given an accompanying individual number. Monitoring and receptor locations are illustrated in Figure 26.1 (onshore substation) and Figure 26.2 (substation) (Document Reference: 3.2.22). Photos of each measurement location are provided in Annex A1.

Table 1: Baseline Sound Survey Measurement Locations

Measurement location identifier	Coordinates		Representative Receptors	Measurement position name
	X	Y		
Landfall locations				
LFM1	623316	218954	LFR1, LFR2 and LFR5	Frinton Golf Course, landfall side
LFM2	623253	219263	LFR3	Frinton Golf Course, Linkside

[1] *Note that since the original revision of this report was published in December 2022, the landfall search area has been refined to the landfall, and the onshore substation zone has been refined to the onshore substation works area.*

Measurement location identifier	Coordinates		Representative Receptors	Measurement position name
	X	Y		
LFM3	622002	219278	LFR4	Frinton Farm Partners, Amen Corner
Onshore substation locations				
SSM1	608736	230032	SSR1	Grange Farm
SSM2	609218	229978	SSR2 and SSR3	Lawfordhouse Farm
SSM3	609148	229057	SSR4	Hollylodge Farm
SSM4	608423	228518	SSR5, SSR6 and SSR7	Normans Farm
SSM5	607190	228928	SSR8 and SSR9	Badley Hall
SSM6	607494	229514	SSR10	Mayfields Farm

8. Some baseline noise monitoring locations have had to be amended since the consultation process was undertaken, as safe and secure access could not be arranged with the occupants of the properties. The previous monitoring locations and changes which have been made are as follows:

- Wormseywood Farm (x: 608076, y: 229898) – this location has been replaced by SSM1 (Grange Farm) which is highly likely to be exposed to similar baseline noise sources and levels and is therefore deemed representative of the Wormseywood Farm location.
- Hollylodge Farm (SSR3) – this location was moved to SSM3 as this is more representative of the NVSR most exposed to onshore substation noise impacts (SSR4). The baseline sound level climate at SSR3 was deemed suitably represented by SSM2.
- Lilley's Farm (SSR7) and Waterhouse Farm (SSR8) – alternative monitoring locations (SSM5 and SSM6 respectively) are highly likely to be exposed to similar baseline noise sources and levels; hence, they are deemed representative of these locations.
- Sluice Gate Cottages (LFR5) – alternative monitoring location LFM1 is highly likely to be exposed to similar baseline noise sources and levels; hence, this was deemed representative.

1.3 Instrumentation

9. The instrumentation used to conduct the surveys is detailed in Table 2.

Table 2: Instrumentation details

Measurement location	Equipment type	Model number	Serial number	Last calibration date (dd/mm/yyyy)
LFM1	Sound level meter (SLM)	Rion NL52	898320	**26/10/2021**
LFM2	SLM	Rion NL52	864982	**30/09/2020**
LFM3	SLM	Rion NL52	864982	**30/09/2020**
SSM1	SLM	Rion NL52	864982	**30/09/2020**
SSM2	SLM	Rion NL52	864982	**30/09/2020**
SSM3	SLM	Norsonic NOR140	1403342	**01/07/2021**
SSM4	SLM	Norsonic NOR140	1406177	**23/07/2020**
SSM5	SLM	Norsonic NOR140	1405219	**06/07/2021**
SSM6	SLM	Rion NL52	864982	**30/09/2020**
All landfall locations	Portable calibrator	Rion NC75	35084983	**31/05/2022**
All onshore substation locations	**Portable calibrator**	**Rion NC74**	**01020506**	**05/08/2021**

10. All the above instrumentation has in-date laboratory calibration certificates which can be provided on request. Each sound level meter (SLM) was calibrated immediately before and after each survey period and no changes greater than + / - 0.2dB were noted.

11. Various sound level indicators were logged every 15-minutes, including the equivalent noise level ($L_{Aeq,T}$), maximum noise level (L_{Amax}) and statistical indices such as background sound levels ($L_{A90,T}$) as well as 1/3 octave band data. The sound measurements were taken at a height which was between 1.2 and 1.5m above ground level and located at least 3.5m from any vertical reflecting surfaces.

1.4 Weather Conditions

12. A portable weather station was deployed to log at 15-minute intervals, alongside noise monitoring equipment throughout the survey periods. Measurement location SSR6 was considered representative of the geographic spread of all other locations in the vicinity of the onshore substation zone.

13. Good practice detailed in BS 4142 recommends that representative environmental noise measurements should be undertaken during favourable weather conditions, i.e. with windspeed <5m/s and no precipitation. Data recorded during periods of precipitation or wind speeds in exceedance of 5m/s were excluded from the analysis.

14. Weather conditions at the landfall locations were observed during the setup and collection of the instrumentation. A visit was also undertaken to each measurement location during the night. Weather conditions were observed to be compliant with the requirements of BS 4142 throughout the survey at the landfall; hence, there was no need to undertake unattended weather condition measurements at the landfall location and no data have been excluded from these measurements.

1.5 Results

Landfall Measurement Locations Data Summary

15. The results of the baseline noise survey at the landfall locations are summarised in Table 3, Table 4 and Table 5 for LFM1, LFM2 and LFM3 respectively over the BS 5228-1 daytime (07:00 to 19:00), evening (19:00 to 23:00) and night-time (23:00 to 07:00) reference periods.

Table 3: Baseline Noise Summary – Measurement Location LFM1 (Unattended)

Period	Measurement start and end date / time	$L_{Aeq,15min}$ (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{Amax,15min}$ (dB)
Daytime (07:00 – 19:00)	07 JUL 2022 / 13:30 to 08 JUL 2022 / 13:15	50	44	35	87
Evening (19:00 – 23:00)		41	41	37	67
Night-time		35	36	33	50

Table 4: Baseline Noise Summary – Measurement Location LFM2 (Unattended)

Period	Measurement start and end date / time	$L_{Aeq,15min}$ (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{Amax,15min}$ (dB)
Daytime (07:00 – 19:00)	07 JUL 2022 / 13:45 to 08 JUL 2022 / 13:45	41	42	34	70
Evening (19:00 – 23:00)		41	40	35	75
Night-time		34	35	32	50

Table 5: Baseline Noise Summary – Measurement Location LFM3 (Unattended)

Period	Measurement start and end date / time	$L_{Aeq,15min}$ (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{Amax,15min}$ (dB)
Daytime (07:00 – 19:00)	07 JUL 2022 / 12:15 to 08 JUL 2022 / 12:30	48	47	36	84
Evening (19:00 – 23:00)		41	38	30	74
Night-time		28	30	24	51

Onshore Substation Measurement Locations Data Summary

22. The results of the unattended baseline noise survey are summarised in this section for the BS 4142 daytime (07:00 to 23:00) reference period, the BS 5228-1 daytime (weekdays 07:00 to 19:00 and Saturday 07:00 to 13:00) and evening and weekend (weekdays 19:00 to 23:00, Saturdays 13:00 to 23:00, Sundays 07:00 to 23:00) periods and the night-time period (23:00 to 07:00 Monday to Sunday in both BS 4142 and BS 5228-1).

23. All samples measured during non-compliant weather conditions have been removed from the data presented in this section.

24. High noise levels were identified in each night-time period from approximately 04:00 hours, these have been assumed to be due to farming activity or the dawn chorus which is seasonal and unrepresentative of the entire year. Hence, they have been manually excluded from the results.

25. The Tendring Farm Show took place on the 9th and 10th July 2022, this is likely to have resulted in increased daytime noise levels; hence, these periods been manually excluded from the results

26. To determine the relevant sound level parameter over the specified time periods, the measured 15-minute data has been processed as follows:

- $L_{Aeq,15min}$ data has been logarithmically averaged;
- $L_{A10,15min}$ and $L_{A90,15min}$ data have been arithmetically averaged; and
- Maximum of the recorded $L_{AMax,15min}$ data.

27. To determine the relevant sound level parameters over the entire measurement, the following procedures have been followed:

- Calculated L_{Aeq} values over each measurement time period has been logarithmically averaged;
- Calculated L_{Amax}, L_{A10} and L_{A90} values have been arithmetically averaged.

Measurement Location SSM1 Data Summary

28. Table 6 summarises the BS 4142 weather compliant unattended baseline survey sound data measured at location SSM1. This measurement was undertaken from 16:00hrs on 8th July to 10:30hrs on 20th July.

Table 6: Baseline Noise Summary – Measurement Location SSM1 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
08/07/22	08/07/22	Daytime (BS 4142)	39	83	40	31
		Daytime (BS 5228)	39	67	40	30
		Evenings & weekend (BS 5228)	39	83	39	31
	09/07/22	Night-time	36	53	39	29
09/07/22		Daytime (BS 4142)	39	77	39	30
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	39	77	39	30
	10/07/22	Night-time	35	56	34	21
10/07/22		Daytime (BS 4142)	40	71	40	30
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	40	71	40	30
	11/07/22	Night-time	31	52	31	24
11/07/22		Daytime (BS 4142)	40	74	40	31
		Daytime (BS 5228)	41	74	41	31
		Evenings & weekend (BS 5228)	35	67	37	30
	12/07/22	Night-time	35	52	36	29
12/07/22		Daytime (BS 4142)	43	77	43	35
		Daytime (BS 5228)	43	77	44	35
		Evenings & weekend (BS 5228)	40	65	42	34
	13/07/22	Night-time	38	59	40	32
13/07/22		Daytime (BS 4142)	42	76	42	34
		Daytime (BS 5228)	43	76	43	34
		Evenings & weekend (BS 5228)	37	66	38	32
	14/07/22	Night-time	32	57	34	27
14/07/22		Daytime (BS 4142)	39	69	40	32
		Daytime (BS 5228)	40	69	41	33

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	36	67	37	28
	15/07/22	Night-time	32	55	34	24
15/07/22		Daytime (BS 4142)	40	76	42	31
		Daytime (BS 5228)	41	76	43	32
		Evenings & weekend (BS 5228)	37	69	40	30
	16/07/22	Night-time	36	55	39	31
16/07/22		Daytime (BS 4142)	41	72	42	31
		Daytime (BS 5228)	40	72	42	29
		Evenings & weekend (BS 5228)	41	69	42	32
	17/07/22	Night-time	33	56	33	22
17/07/22		Daytime (BS 4142)	40	73	42	32
		Daytime (BS 5228)	**	**	**	**
		Evenings & weekend (BS 5228)	40	73	42	32
	18/07/22	Night-time	31	59	31	22
18/07/22		Daytime (BS 4142)	43	74	43	33
		Daytime (BS 5228)	44	74	44	34
		Evenings & weekend (BS 5228)	39	70	42	31
	19/07/22	Night-time	32	57	33	23
19/07/22		Daytime (BS 4142)	47	82	43	34
		Daytime (BS 5228)	48	82	44	35
		Evenings & weekend (BS 5228)	38	61	41	31
	20/07/22	Night-time	39	67	40	31
20/07/22		Daytime (BS 4142)	49	74	49	38
		Daytime (BS 5228)	49	74	49	38
08/07/22	20/07/22	Daytime (BS 4142)	*42*	*75*	*42*	*32*
		Daytime (BS 5228)	44	75	43	33

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	39	70	40	31
		Night-time	35	57	36	26

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.

29. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM1 is presented in Table 7.

Table 7: Baseline L_{A90} Noise Data Analysis – SSM1 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	658	30	32	32	3.1
Night-time	237	31	26	27	4.8

Measurement Location SSM2 Data Summary

30. Table 8 summarises the BS 4142 weather compliant unattended baseline survey sound data (15-minute interval) measured at location SSM2. This measurement was undertaken from 16:30hrs on 8th July to 10:30hrs on 20th July.

Table 8: Baseline Noise Summary – Measurement Location SSM2 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
08/07/22	08/07/22	Daytime (BS 4142)	40	72	42	34
		Daytime (BS 5228)	41	72	44	35
		Evenings & weekend (BS 5228)	39	68	40	34
	09/07/22	Night-time	37	63	39	33
09/07/22		Daytime (BS 4142)	40	70	42	34
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	40	70	42	34

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
	10/07/22	Night-time	35	57	35	23
10/07/22		Daytime (BS 4142)	41	63	41	34
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	41	63	41	34
	11/07/22	Night-time	33	69	31	24
11/07/22		Daytime (BS 4142)	44	76	45	39
		Daytime (BS 5228)	45	76	47	41
		Evenings & weekend (BS 5228)	37	63	39	32
	12/07/22	Night-time	33	53	35	26
12/07/22		Daytime (BS 4142)	45	65	46	40
		Daytime (BS 5228)	46	65	48	42
		Evenings & weekend (BS 5228)	39	61	41	33
	13/07/22	Night-time	36	56	38	31
13/07/22		Daytime (BS 4142)	47	77	47	42
		Daytime (BS 5228)	47	77	49	43
		Evenings & weekend (BS 5228)	43	64	43	37
	14/07/22	Night-time	32	52	34	26
14/07/22		Daytime (BS 4142)	43	67	44	38
		Daytime (BS 5228)	45	67	46	40
		Evenings & weekend (BS 5228)	36	58	38	30
	15/07/22	Night-time	32	51	34	25
15/07/22		Daytime (BS 4142)	42	73	44	37
		Daytime (BS 5228)	43	73	45	38
		Evenings & weekend (BS 5228)	39	61	41	33
	16/07/22	Night-time	35	54	38	31
16/07/22		Daytime (BS 4142)	45	76	46	38
		Daytime (BS 5228)	44	76	46	39

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	46	71	46	38
	17/07/22	Night-time	34	66	34	25
17/07/22		Daytime (BS 4142)	46	74	46	39
		Daytime (BS 5228)	**	**	**	**
		Evenings & weekend (BS 5228)	46	74	46	39
	18/07/22	Night-time	31	53	32	23
18/07/22		Daytime (BS 4142)	46	75	46	40
		Daytime (BS 5228)	47	75	48	42
		Evenings & weekend (BS 5228)	38	63	40	32
	19/07/22	Night-time	33	51	35	25
19/07/22		Daytime (BS 4142)	46	68	47	40
		Daytime (BS 5228)	47	68	48	42
		Evenings & weekend (BS 5228)	39	56	42	34
	20/07/22	Night-time	38	59	40	30
20/07/22		Daytime (BS 4142)	49	85	50	43
		Daytime (BS 5228)	49	85	50	43
08/07/22	20/07/22	Daytime (BS 4142)	45	73***	45	39
		Daytime (BS 5228)	46	72***	47	41
		Evenings & weekend (BS 5228)	43	66***	43	35
		Night-time	34	57	35	26

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.

31. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM2 is presented in Table 9.

Table 9: Baseline L_{A90} Noise Data Analysis – SSM2 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90, 15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	702	43	39	40	4.7
Night-time	231	22	26	26	3.9

Measurement Location SSM3 Data Summary

32. Table 10 summarises the BS 4142 weather compliant unattended baseline survey sound data (15-minute interval) measured at location SSM3. This measurement was undertaken from 16:30hrs on 7th July to 08:00hrs on 19th July.

Table 10: Baseline Noise Summary – Measurement Location SSM3 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
07/07/22	07/07/22	Daytime (BS 4142)	39	74	41	30
		Daytime (BS 5228)	40	58	43	32
		Evenings & weekend (BS 5228)	37	74	39	28
	08/07/22	Night-time	37	68	33	23
08/07/22		Daytime (BS 4142)	42	74	43	31
		Daytime (BS 5228)	43	74	44	31
		Evenings & weekend (BS 5228)	37	64	39	31
	09/07/22	Night-time	32	53	34	27
09/07/22		Daytime (BS 4142)	37	67	39	29
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	37	67	39	29
	10/07/22	Night-time	33	54	35	21
10/07/22		Daytime (BS 4142)	38	70	40	30
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	38	70	40	30
	11/07/22	Night-time	28	54	28	22
11/07/22		Daytime (BS 4142)	41	77	41	32
		Daytime (BS 5228)	42	77	43	33

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	37	66	37	29
	12/07/22	Night-time	30	55	31	24
12/07/22		Daytime (BS 4142)	39	66	41	33
		Daytime (BS 5228)	40	65	42	34
		Evenings & weekend (BS 5228)	37	66	39	30
	13/07/22	Night-time	34	57	36	28
13/07/22		Daytime (BS 4142)	41	71	42	34
		Daytime (BS 5228)	42	71	44	35
		Evenings & weekend (BS 5228)	38	68	39	30
	14/07/22	Night-time	30	52	31	23
14/07/22		Daytime (BS 4142)	40	72	42	32
		Daytime (BS 5228)	41	72	43	33
		Evenings & weekend (BS 5228)	35	60	37	28
	15/07/22	Night-time	29	54	31	22
15/07/22		Daytime (BS 4142)	40	78	41	31
		Daytime (BS 5228)	41	78	41	32
		Evenings & weekend (BS 5228)	37	69	40	29
	16/07/22	Night-time	31	55	33	27
16/07/22		Daytime (BS 4142)	39	69	40	30
		Daytime (BS 5228)	39	69	41	31
		Evenings & weekend (BS 5228)	38	66	40	30
	17/07/22	Night-time	32	56	32	22
17/07/22		Daytime (BS 4142)	38	68	41	31
		Daytime (BS 5228)	**	**	**	**
		Evenings & weekend (BS 5228)	38	68	41	31
	18/07/22	Night-time	31	55	31	22

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
18/07/22		Daytime (BS 4142)	38	77	40	31
		Daytime (BS 5228)	38	77	40	31
		Evenings & weekend (BS 5228)	38	60	40	31
	19/07/22	Night-time	32	54	33	23
19/07/22		Daytime (BS 4142)	39	62	40	34
		Daytime (BS 5228)	39	62	40	34
07/07/22	19/07/22	Daytime (BS 4142)	40	73	41	31
		Daytime (BS 5228)	41	73	42	33
		Evenings & weekend (BS 5228)	38	67	39	30
		Night-time	32	55	32	24

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.

33. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM3 is presented in Table 11.

Table 11: Baseline L_{A90} Noise Data Analysis – SSM3 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,\ 15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	650	31	32	31	2.8
Night-time	262	23	24	23	2.6

Measurement Location SSM4 Data Summary

34. Table 12 summarises the BS 4142 weather compliant unattended baseline survey sound data (15-minute interval) measured at location SSM4. This measurement was undertaken from 16:45hrs on 7th July to 23:15hrs on 18th July.

Table 12: Baseline Noise Summary – Measurement Location SSM4 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
07/07/22	08/07/22	Daytime (BS 4142)	37	67	38	27

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Daytime (BS 5228)	38	65	39	28
		Evenings & weekend (BS 5228)	37	67	38	26
	08/07/22	Night-time	43	71	35	24
08/07/22		Daytime (BS 4142)	39	70	40	29
		Daytime (BS 5228)	39	70	40	28
		Evenings & weekend (BS 5228)	39	67	38	30
	09/07/22	Night-time	41	70	34	25
09/07/22		Daytime (BS 4142)	35	59	38	23
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	35	59	38	23
	10/07/22	Night-time	38	69	36	22
10/07/22		Daytime (BS 4142)	42	73	40	29
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	42	73	40	29
	11/07/22	Night-time	35	60	30	23
11/07/22		Daytime (BS 4142)	44	83	40	30
		Daytime (BS 5228)	45	83	42	31
		Evenings & weekend (BS 5228)	38	64	36	28
	12/07/22	Night-time	36	64	33	23
12/07/22		Daytime (BS 4142)	38	68	40	32
		Daytime (BS 5228)	****	****	****	****
		Evenings & weekend (BS 5228)	38	68	40	32
	13/07/22	Night-time	****	****	****	****
13/07/22		Daytime (BS 4142)	37	68	37	29
		Daytime (BS 5228)	****	****	****	****
		Evenings & weekend (BS 5228)	37	68	37	29

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
	14/07/22	Night-time	****	****	****	****
14/07/22		Daytime (BS 4142)	34	62	36	27
		Daytime (BS 5228)	****	****	****	****
		Evenings & weekend (BS 5228)	34	62	36	27
	15/07/22	Night-time	****	****	****	****
15/07/22		Daytime (BS 4142)	47	80	41	30
		Daytime (BS 5228)	48	80	42	31
		Evenings & weekend (BS 5228)	36	65	38	29
	16/07/22	Night-time	32	55	33	28
16/07/22		Daytime (BS 4142)	39	68	40	28
		Daytime (BS 5228)	40	68	41	29
		Evenings & weekend (BS 5228)	38	68	39	29
	17/07/22	Night-time	32	66	31	24
17/07/22		Daytime (BS 4142)	38	68	40	29
		Daytime (BS 5228)	**	**	**	**
		Evenings & weekend (BS 5228)	38	68	40	29
	18/07/22	Night-time	31	56	32	24
18/07/22		Daytime (BS 4142)	40	73	40	30
		Daytime (BS 5228)	41	73	41	31
		Evenings & weekend (BS 5228)	35	63	36	27
07/07/22	18/07/22	Daytime (BS 4142)	42	72	40	29
		Daytime (BS 5228)	44	75	41	30
		Evenings & weekend (BS 5228)	39	67	38	29
		Night-time	38	64	33	24

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.
**** Data during these periods appeared atypical and has been excluded.

35. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM4 is presented in Table 13.

Table 13: Baseline L_{A90} Noise Data Analysis – SSM4 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90,\ 15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	487	28	29	29	3.3
Night-time	139	24	24	24	2.6

Measurement Location SSM5 Data Summary

36. Table 14 summarises the BS 4142 weather compliant unattended baseline survey sound data (15-minute interval) measured at location SSM5. This measurement was undertaken from 19:15hrs on 7th July to 21:30hrs on 18th July.

Table 14: Baseline Noise Summary – Measurement Location SSM5 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
07/07/22	07/07/22	Daytime (BS 4142)	41	76	42	31
		Evenings & weekend (BS 5228)	41	76	42	31
	08/07/22	Night-time	35	58	37	25
08/07/22		Daytime (BS 4142)	44	79	45	33
		Daytime (BS 5228)	45	79	46	33
		Evenings & weekend (BS 5228)	41	67	42	34
	09/07/22	Night-time	34	54	36	26
09/07/22		Daytime (BS 4142)	41	70	43	29
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	41	70	43	29
	10/07/22	Night-time	37	59	38	23
10/07/22		Daytime (BS 4142)	44	89	44	33
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	44	89	44	33
	11/07/22	Night-time	32	55	32	27

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
11/07/22		Daytime (BS 4142)	50	94	43	34
		Daytime (BS 5228)	51	94	44	35
		Evenings & weekend (BS 5228)	50	94	40	33
	12/07/22	Night-time	36	61	36	28
12/07/22		Daytime (BS 4142)	49	93	45	36
		Daytime (BS 5228)	50	93	46	37
		Evenings & weekend (BS 5228)	44	87	43	33
	13/07/22	Night-time	37	64	38	26
13/07/22		Daytime (BS 4142)	45	74	45	35
		Daytime (BS 5228)	46	74	46	36
		Evenings & weekend (BS 5228)	41	69	41	32
	14/07/22	Night-time	32	56	33	24
14/07/22		Daytime (BS 4142)	44	83	45	34
		Daytime (BS 5228)	45	83	46	36
		Evenings & weekend (BS 5228)	43	66	42	28
	15/07/22	Night-time	31	59	33	25
15/07/22		Daytime (BS 4142)	45	88	44	33
		Daytime (BS 5228)	45	88	45	34
		Evenings & weekend (BS 5228)	39	64	42	31
	16/07/22	Night-time	36	62	38	28
16/07/22		Daytime (BS 4142)	43	74	44	33
		Daytime (BS 5228)	43	70	46	32
		Evenings & weekend (BS 5228)	43	74	43	33
	17/07/22	Night-time	35	56	36	26
17/07/22		Daytime (BS 4142)	45	82	45	34
		Daytime (BS 5228)	**	**	**	**

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	45	82	45	34
	18/07/22	Night-time	37	66	38	28
18/07/22		Daytime (BS 4142)	43	76	44	36
		Daytime (BS 5228)	44	76	44	36
		Evenings & weekend (BS 5228)	41	66	43	34
07/07/22	18/07/22	Daytime (BS 4142)	46	83	44	34
		Daytime (BS 5228)	47	83	45	35
		Evenings & weekend (BS 5228)	44	79	43	32
		Night-time	35	59	36	26

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.

37. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM5 is presented in Table 15.

Table 15: Baseline L_{A90} Noise Data Analysis – SSM5 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90, 15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	644	34	34	34	3.1
Night-time	215	25	26	26	2.4

Measurement Location SSM6 Data Summary

38. Table 16 summarises the unattended baseline survey sound data (15-minute interval) measured at location SSM6. This measurement was undertaken from 17:45hrs on 8th July to 09:45hrs on 20th July.

Table 16: Baseline Noise Summary – Measurement Location SSM6 (Unattended)

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
08/07/22	08/07/22	Daytime (BS 4142)	41	71	40	32
		Daytime (BS 5228)	35	62	37	30
		Evenings & weekend (BS 5228)	42	71	41	32
	09/07/22	Night-time	36	52	39	30
09/07/22		Daytime (BS 4142)	36	70	38	28
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	36	70	38	28
	10/07/22	Night-time	34	55	34	21
10/07/22		Daytime (BS 4142)	42	77	44	35
		Daytime (BS 5228)	*	*	*	*
		Evenings & weekend (BS 5228)	43	77	45	38
	11/07/22	Night-time	36	51	34	28
11/07/22		Daytime (BS 4142)	42	73	43	37
		Daytime (BS 5228)	43	73	44	37
		Evenings & weekend (BS 5228)	39	67	40	36
	12/07/22	Night-time	37	49	37	33
12/07/22		Daytime (BS 4142)	44	76	45	38
		Daytime (BS 5228)	45	75	46	39
		Evenings & weekend (BS 5228)	41	76	41	33
	13/07/22	Night-time	35	54	36	29
13/07/22		Daytime (BS 4142)	45	71	47	39
		Daytime (BS 5228)	46	71	47	39
		Evenings & weekend (BS 5228)	44	59	46	38
	14/07/22	Night-time	38	49	39	34
14/07/22		Daytime (BS 4142)	45	83	45	35
		Daytime (BS 5228)	47	83	47	37

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	35	63	36	27
	15/07/22	Night-time	31	57	33	25
15/07/22		Daytime (BS 4142)	43	86	44	34
		Daytime (BS 5228)	43	86	45	35
		Evenings & weekend (BS 5228)	40	71	42	33
	16/07/22	Night-time	36	55	38	30
16/07/22		Daytime (BS 4142)	42	78	43	33
		Daytime (BS 5228)	42	74	44	33
		Evenings & weekend (BS 5228)	42	78	43	33
	17/07/22	Night-time	33	51	35	24
17/07/22		Daytime (BS 4142)	**	**	**	**
		Daytime (BS 5228)	44	70	46	38
		Evenings & weekend (BS 5228)	43	70	45	37
	18/07/22	Night-time	30	53	30	24
18/07/22		Daytime (BS 4142)	44	78	45	38
		Daytime (BS 5228)	45	78	46	39
		Evenings & weekend (BS 5228)	42	72	44	35
	19/07/22	Night-time	34	68	35	26
19/07/22		Daytime (BS 4142)	43	68	44	36
		Daytime (BS 5228)	43	67	45	38
		Evenings & weekend (BS 5228)	43	68	43	33
	20/07/22	Night-time	44	62	44	33
20/07/22		Daytime (BS 4142)	48	70	50	41
		Daytime (BS 5228)	48	70	50	41
07/07/22	18/07/22	Daytime (BS 4142)	44	76	44	36
		Daytime (BS 5228)	45	76	46	37

Start date (dd/mm/yy)	End date (dd/mm/yy)	Period	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
		Evenings & weekend (BS 5228)	42	72	43	35
		Night-time	36	54	36	28

Note BS4142; daytime period 07:00 to 23:00, night period 23:00 to 07:00. BS5228; Daytime period 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, Evening and Weekend period 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 Saturday and 07:00 to 23:00 Sunday. Both BS4142 and BS 5228 night-time period 23:00 – 07:00 Monday to Sunday.
* This data has been excluded because the Tendering Farm Show took place on these dates (atypical event).
** BS5228 classes all day on Sunday as part of the weekend period.

39. A statistical analysis of the background sound levels ($L_{A90,15min}$) measured during the baseline survey at location SSM6 is presented in Table 17.

Table 17: Baseline L_{A90} Noise Data Analysis – SSM6 (Unattended)

Period	Number of BS 4142 compliant 15-minute samples collected	$L_{A90, 15min}$ analytics (dB)			
		Mode	Average	Median	Standard deviation
Daytime	661	38	36	37	3.9
Night-time	209	29	28	27	4.9

1.6 BS 4142 Background Sound Levels ($L_{A90,15min}$)

40. Statistical analysis of the baseline *background sound level* (L_{A90}) was undertaken following guidance detailed in BS 4142. This process identifies a representative *background sound level* for use in the operational noise assessment, as provided in Table 18.

41. As suggested by BS 4142, histograms of the measured $L_{A90,15min}$ levels during the day and night-time at each onshore substation measurement location are provided in Annex A2.

Table 18: Representative BS 4142 $L_{A90,15min}$ Sound Level per Receptor Location

NVSR identifier	Representative $L_{A90,15min}$ (dB)		Justification
	Daytime	Night-time	
SSM1 relating to SSR1	30	22	Daytime – Mode adopted. Night-time – Bi-modal peaks around 21 / 22 and 31dB; mid-level mode adopted.

NVSR identifier	Representative $L_{A90,15min}$ (dB)		Justification
	Daytime	Night-time	
SSM2 relating to SSR2 & SSR3	33	22	Daytime – Multiple peaks in the dataset, lowest representative level adopted as a conservative value. Night-time – Mode adopted.
SSM3 relating to SSR4	29	21	Daytime – Modal group between 29 and 34dB, lowest adopted. Night-time – Modal group between 21 and 27dB, lowest adopted.
SSM4 relating to SSR5, SSR6 and SSR7	26	23	Daytime – Modal group between 26 and 32dB, lowest adopted. Night-time – Modal group between 21 and 29dB, level adopted towards the lower end of the range.
SSM5 relating to SSR8 and SSR9	32	25	Daytime – Modal group between 32 and 36dB, lowest adopted. Night-time – Good correlation between mode and average statistical parameters.
SSM6 relating to SSR10	34	24	Daytime – Two modal groups at 34 and 38dB lower value adopted. Night-time – Two modal groups at 24 and 29dB lower value adopted.

1.7 References

British Standards Institute (BSI) (1991) BS 7445-2:1991 - Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use. London.
BSI (2003) BS EN 61672-1:2003 - Electroacoustics. Sound level meters. Specifications. London.
BSI (2014). BS 5228-1:2009+A1:2014 “Code of practice for noise and vibration control on construction and open sites – Part 1: Noise”.
BSI (2019) BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound. London.

A1 Annex 1: Measurement Location Photos

LFM1 Frinton Golf Course, landfall side

LFM2 Frinton Golf Course, Linkside

LFM3 Frinton Farm Partners, Amen Corner

SSM1 Grange Farm

SSM2 Lawfordhouse Farm

SSM3 Hollylodge Farm

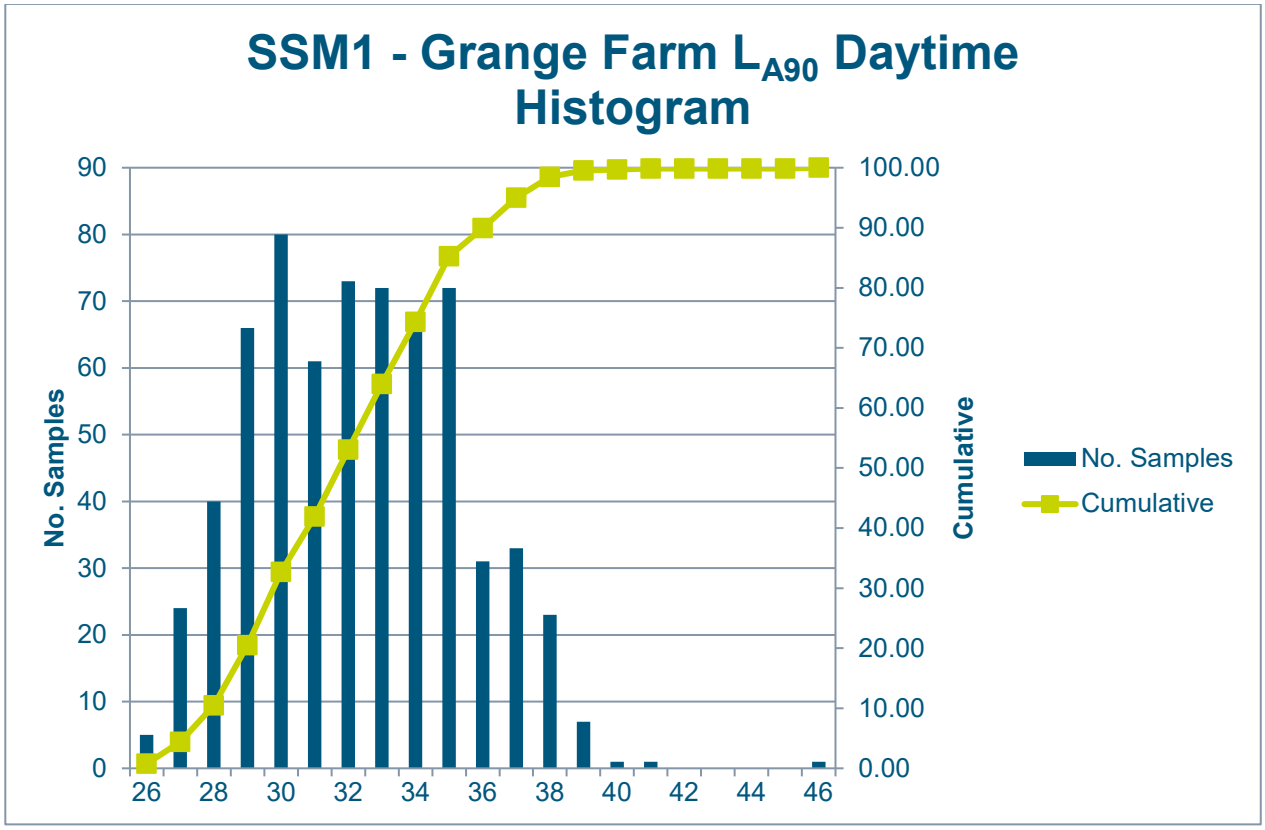
Royal HaskoningDHV

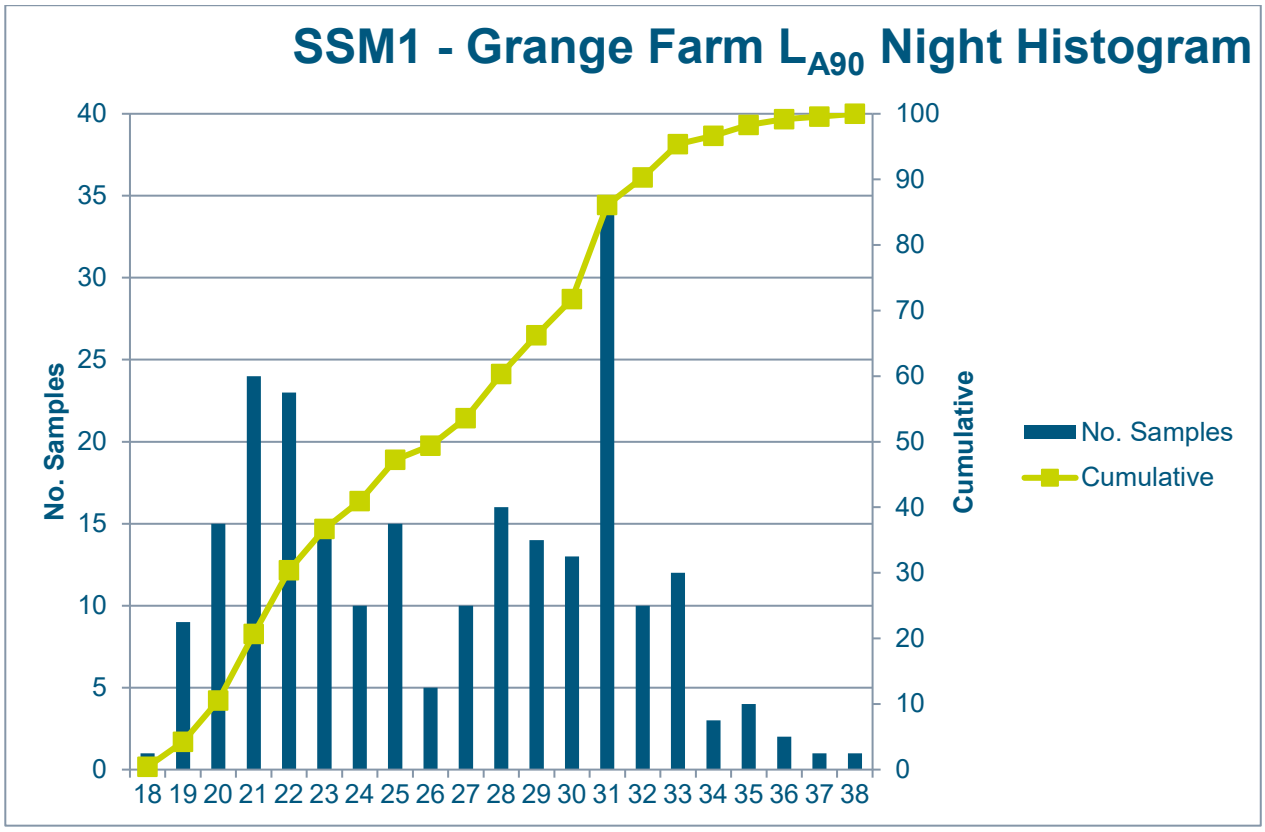
SSM4 Normans Farm

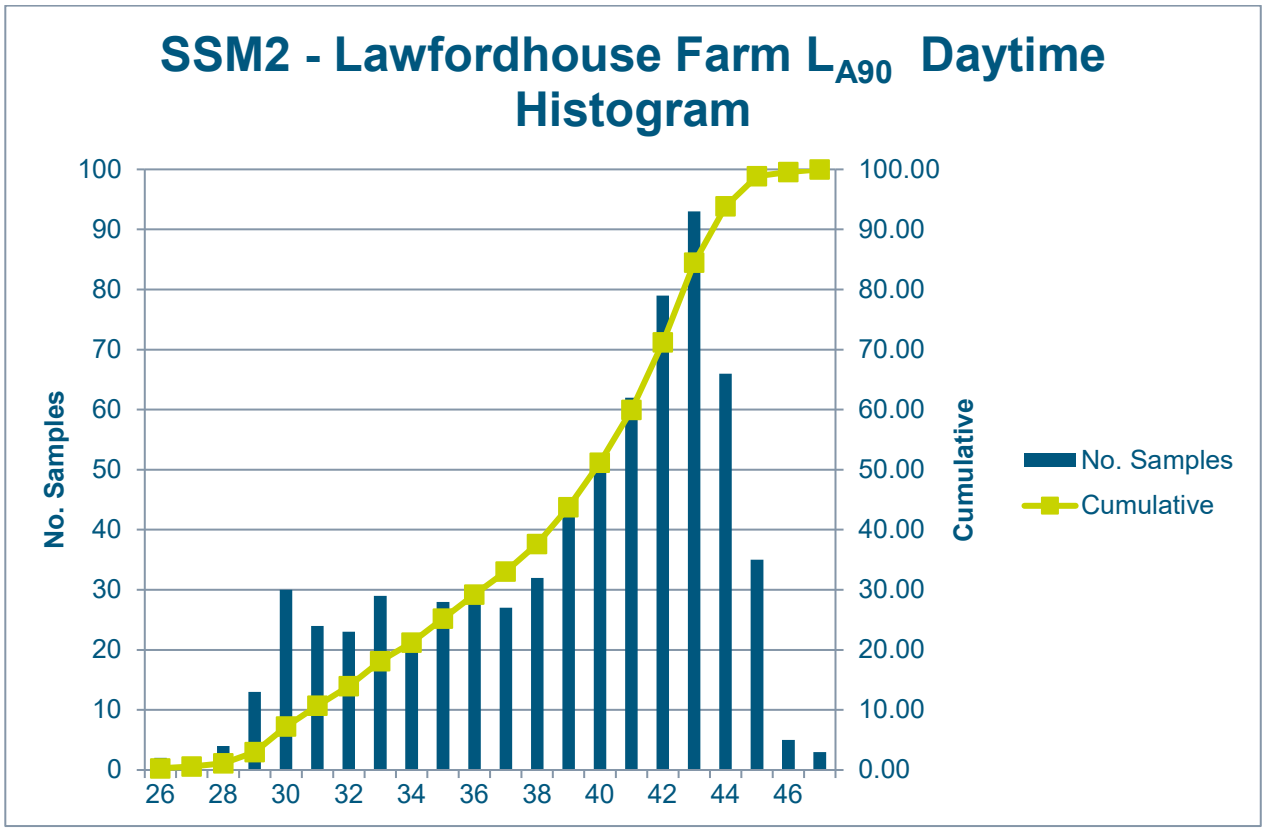
SSM5 Badley Hall

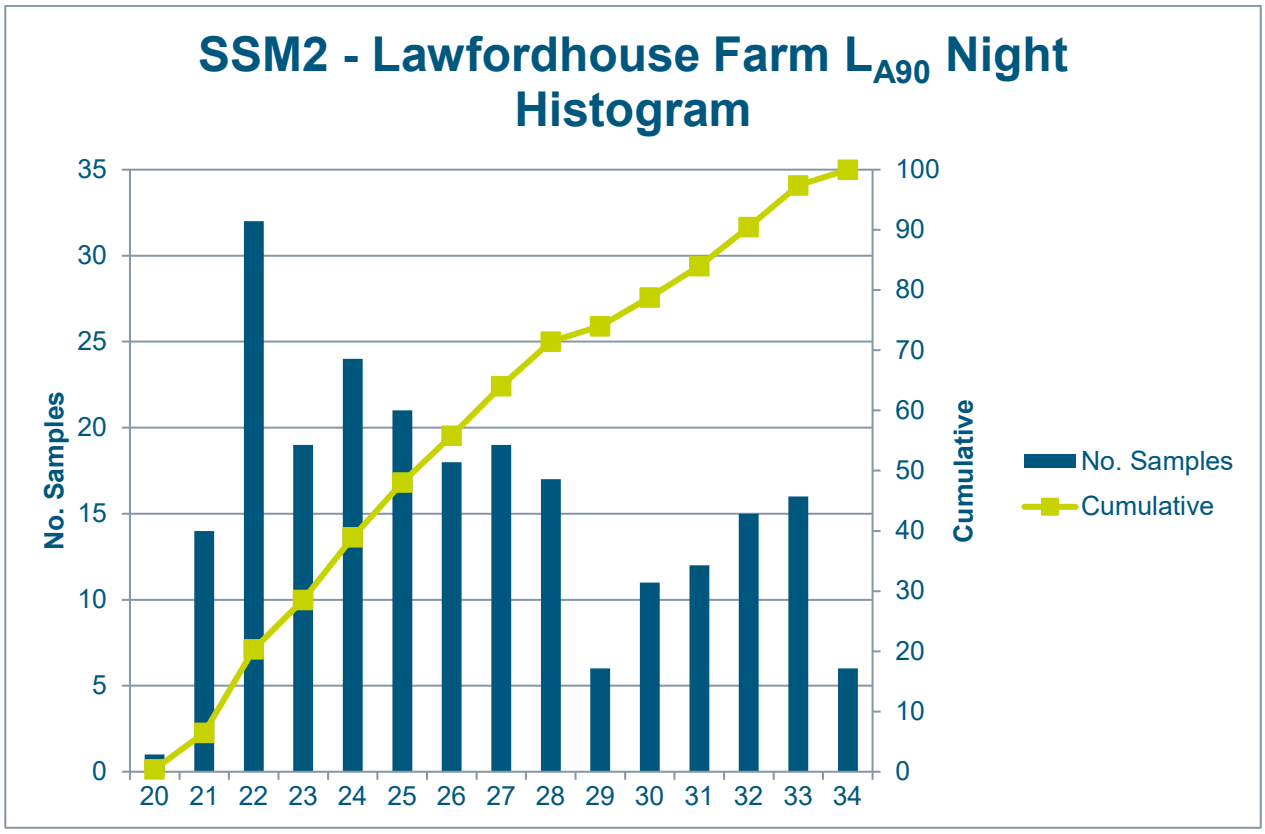
SSM6 Mayfields Farm

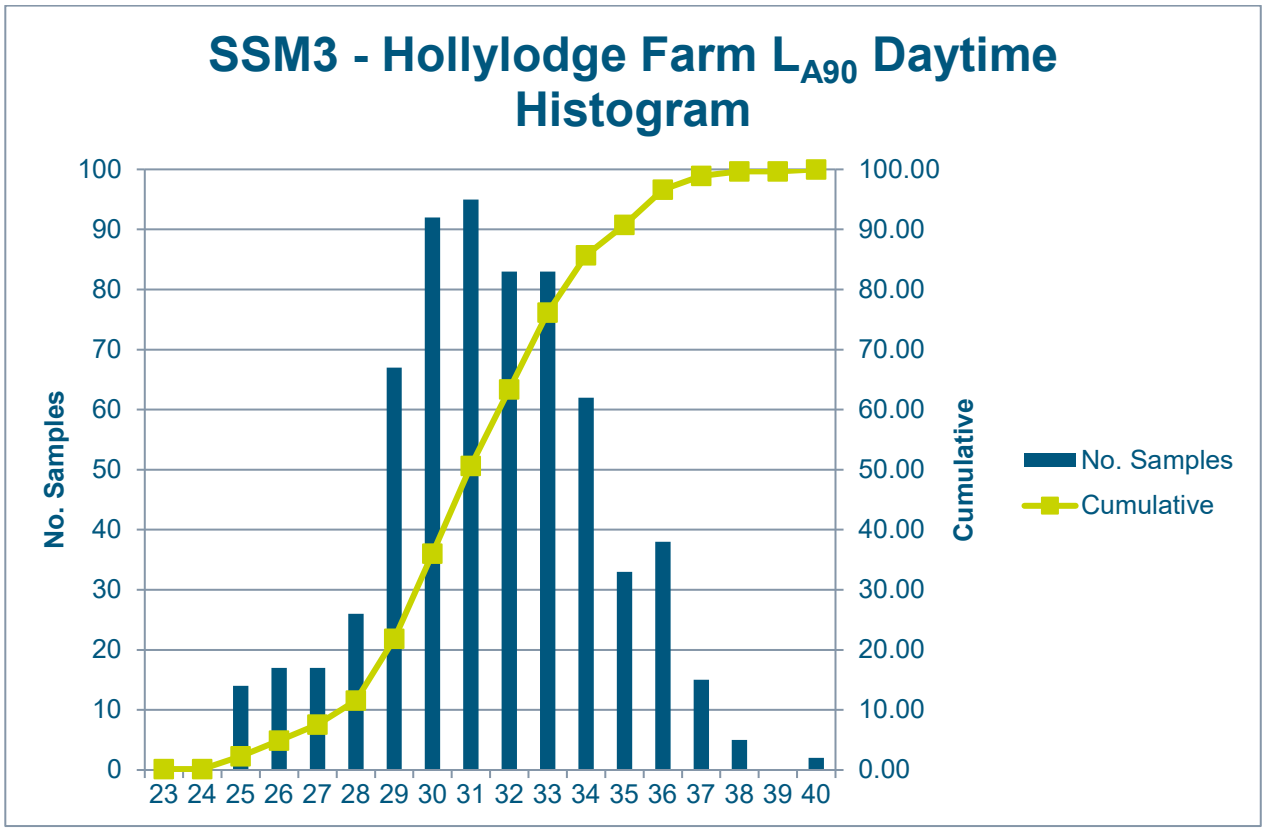
A2 Annex 2: L_{A90} Histograms

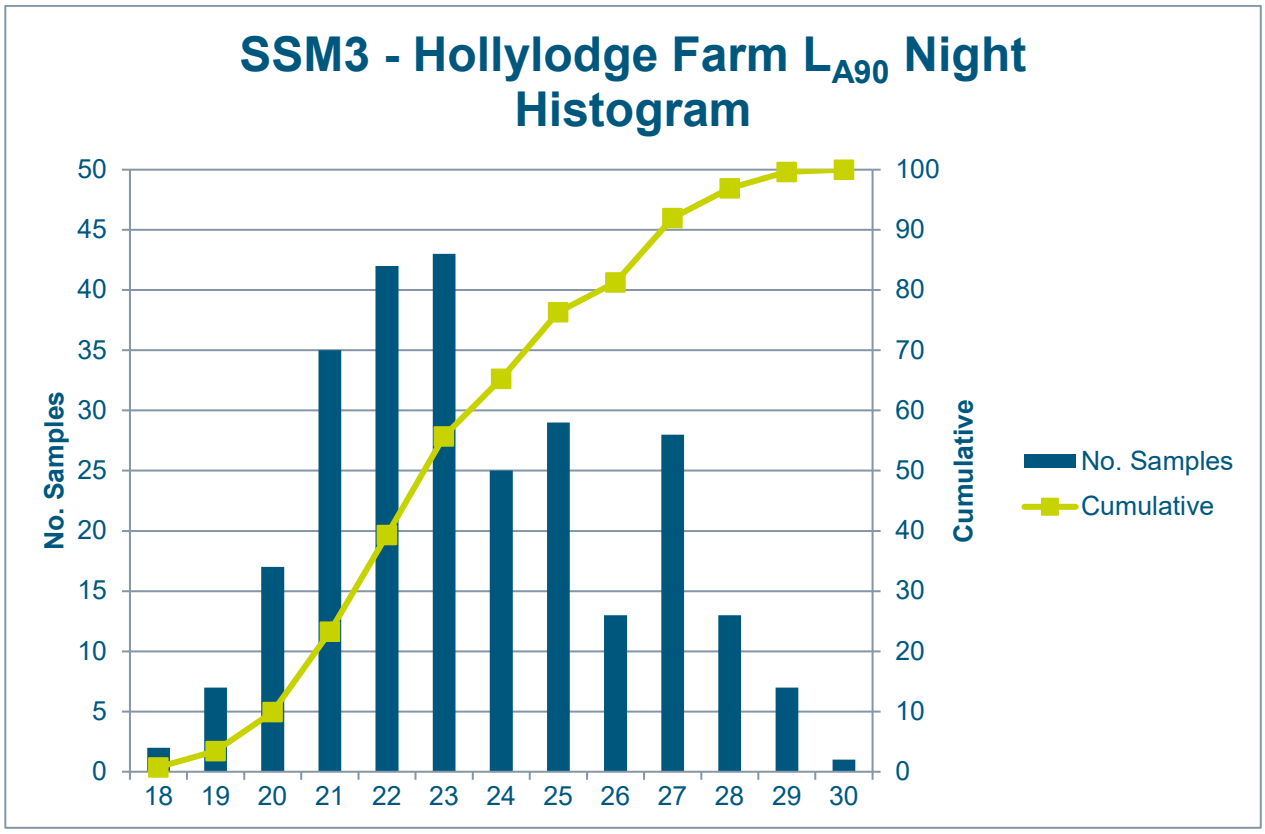


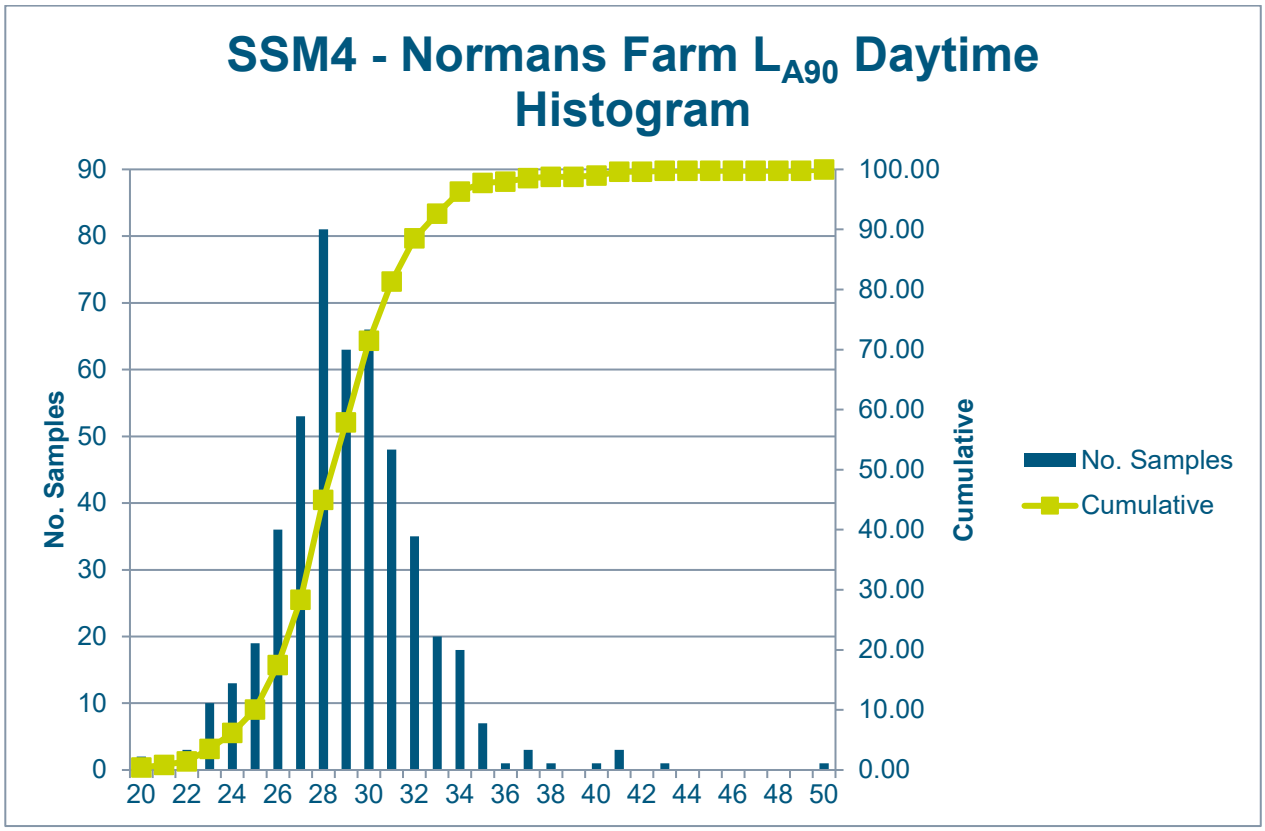


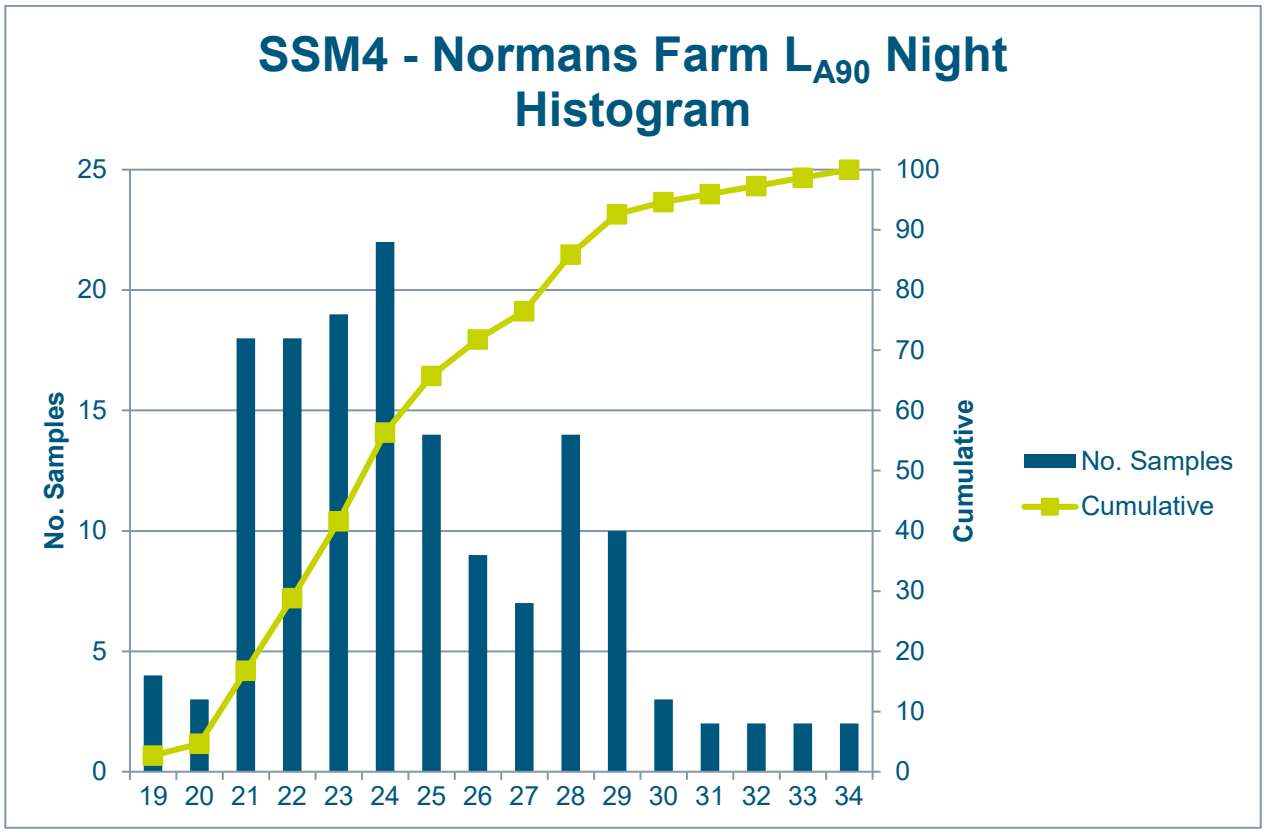

SSM2 - Lawfordhouse Farm L_{A90} Daytime Histogram
No. Samples
Cumulative
100
90
80
70
60
50
40
30
20
10
0
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
26 28 30 32 34 36 38 40 42 44 46
No. Samples
Cumulative

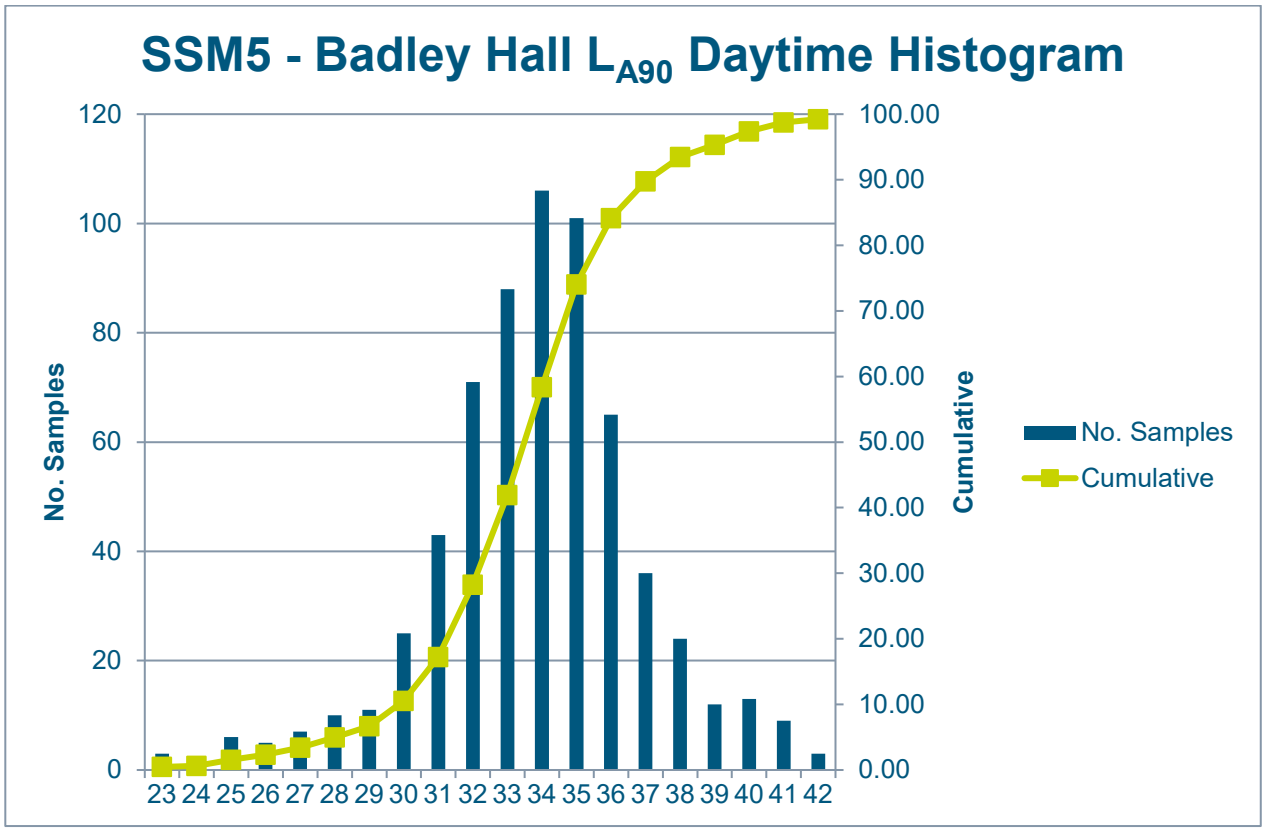

SSM2 - Lawfordhouse Farm L_{A90} Night Histogram
No. Samples
Cumulative
35
30
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
No. Samples
Cumulative

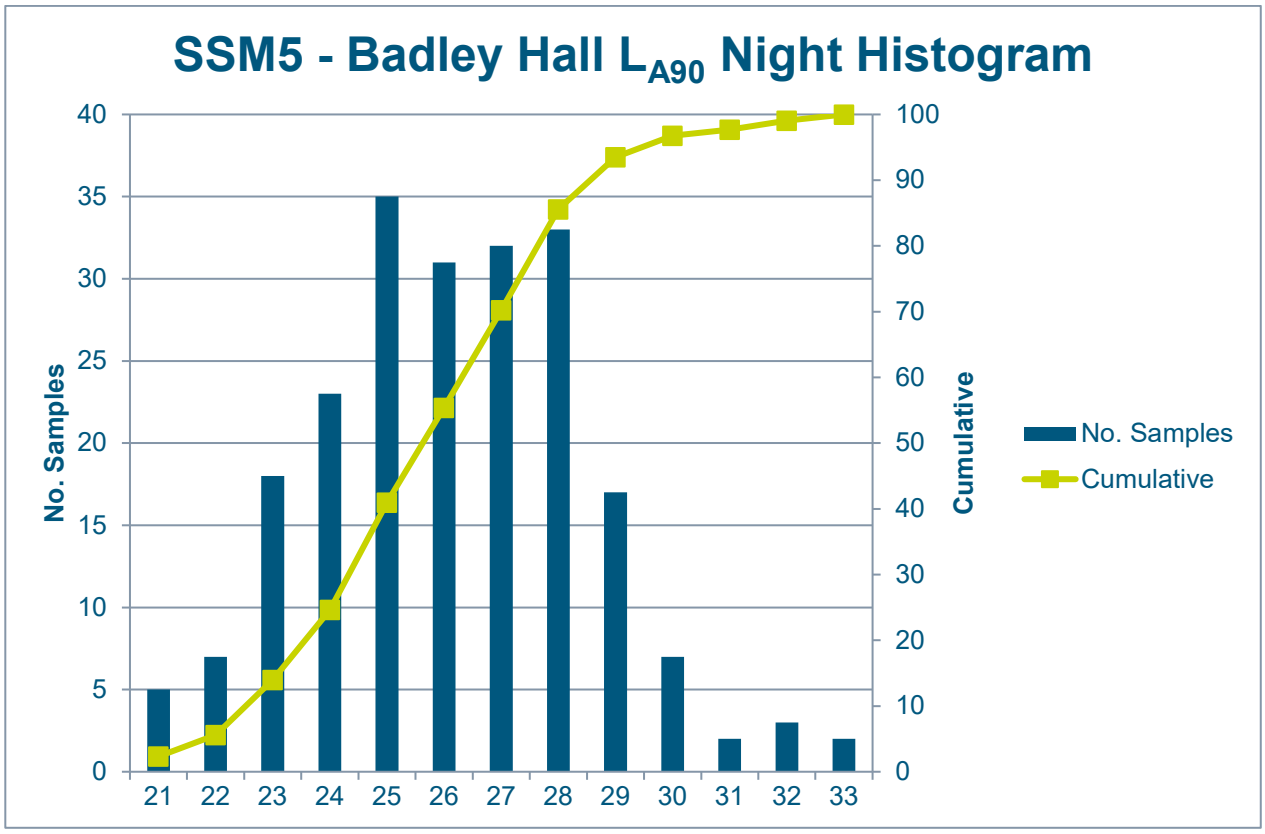

SSM3 - Hollylodge Farm L_{A90} Daytime Histogram
No. Samples
Cumulative
100
90
80
70
60
50
40
30
20
10
0
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
No. Samples
Cumulative

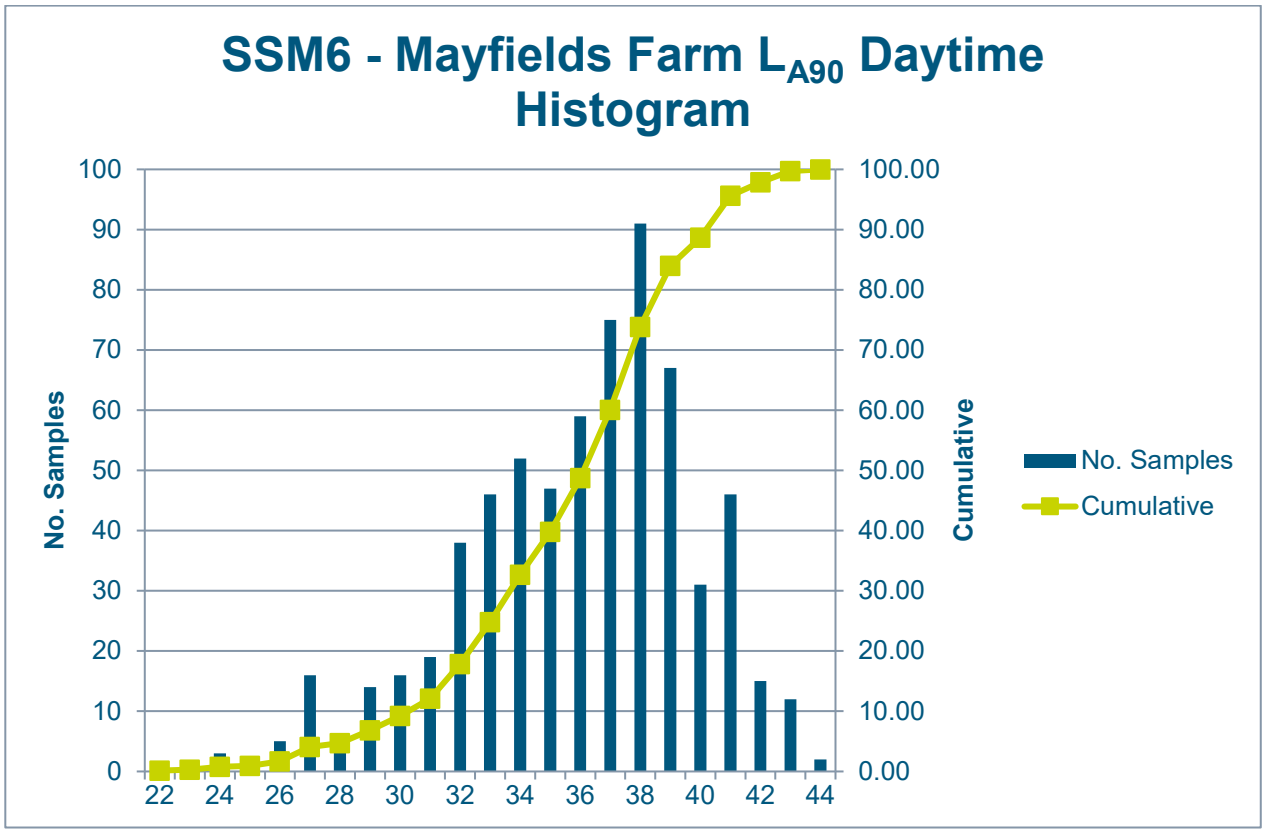

SSM3 - Hollylodge Farm L_{A90} Night Histogram
No. Samples
Cumulative
50
45
40
35
30
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
18 19 20 21 22 23 24 25 26 27 28 29 30
No. Samples
Cumulative

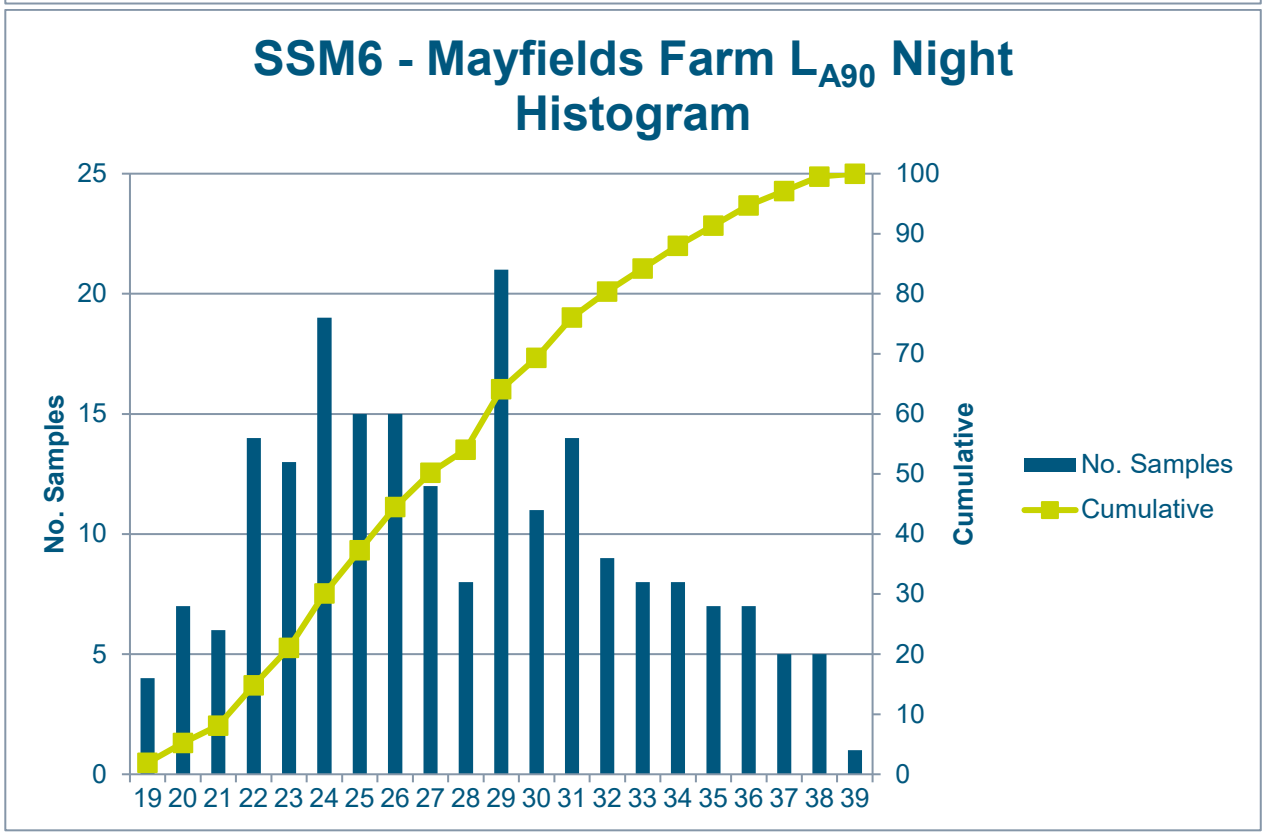

SSM4 - Normans Farm L_{A90} Daytime Histogram
No. Samples
Cumulative
90
80
70
60
50
40
30
20
10
0
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
No. Samples
Cumulative


SSM4 - Normans Farm L_{A90} Night Histogram
No. Samples
Cumulative
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
No. Samples
Cumulative


SSM5 - Badley Hall L_{A90} Daytime Histogram
No. Samples
Cumulative
120
100
80
60
40
20
0
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
No. Samples
Cumulative


SSM5 - Badley Hall L_{A90} Night Histogram
No. Samples
Cumulative
40
35
30
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
21 22 23 24 25 26 27 28 29 30 31 32 33
No. Samples
Cumulative


SSM6 - Mayfields Farm L_{A90} Daytime Histogram
No. Samples
Cumulative
100
90
80
70
60
50
40
30
20
10
0
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
22 24 26 28 30 32 34 36 38 40 42 44
No. Samples
Cumulative


SSM6 - Mayfields Farm L_{A90} Night Histogram
No. Samples
Cumulative
25
20
15
10
5
0
100
90
80
70
60
50
40
30
20
10
0
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
No. Samples
Cumulative

2 ACOUSTIC TERMINOLOGY

This document provides a layperson's explanation of the acoustics terms that commonly appear in reports. It is not intended to give full scientific definitions or explain why these terms are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

Table A.19: Common acoustic terms

Term	Description
Sound	The physical phenomenon of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.
Level	Values measured in decibels
Loudness	The human perception of the level of sound
Noise	No strict definition and is often used interchangeably with sound however it is usually taken to mean unwanted sound
Index	A value based on the mathematical processing of raw data
Indicator	A value used to indicate the likelihood of a particular response of effect e.g. $L_{10,18hr}$ is an index based on statistical processing of sound pressure data that is used as an indicator for road traffic noise response.
Weighted	Spectral values have been modified to reflect a frequency sensitivity.
Directivity	The amount by which a source radiates more sound in one direction than another.
Decibels dB	A logarithmic ratio of two values of a variable. The decibel is not a true measurement unit nor is it exclusive to acoustics. Decibels are used because they can represent very wide ranges of ratios (from trillionths and billionths to billions and trillions) with a small range of decibel values. Decibels can be used to represent measured values by using a known reference value in the ratio. When using decibels to measure something it is therefore important to specify what variable is being measured and what reference level has been used. This is done by adding a reference value statement in the form "dB re x units", where the units indicate the variable being measured and x is the reference value. Decibels are used in acoustics because the human ear responds to sound pressure in a logarithmic way and the quantities measured in acoustics vary over wide ranges. As the decibel is used in acoustics to represent a range of sound level parameters, there is a standardised notation system. This takes the form of an italic capital letter 'L' (referring to 'level') and subscript characters which give specific details of what is being represented. Because decibels are logarithmic, they must be added, subtracted, multiplied, divided and averaged using different techniques from normal numbers.

Term	Description
Sound Pressure Level L_p obsolete – SPL	The basic measure of how much sound there is at a given location. It is a measure of the size of the pressure fluctuations in the air that we perceive as sound. Sound Pressure Level is expressed in decibels with a reference level of $20x10^{-6}$ Pa (L_p in dB re 20µPa)
Sound Power Level L_W obsolete – SWL	The total amount of sound produced by a source. It cannot be measured directly but it can be calculated from Sound Pressure Level measurements in known conditions. It can be used to predict the Sound Pressure Level at any point. Sound Power Level is expressed in decibels with a reference level of $1x10^{-12}$ W (L_W in dB re 1pW).
A-weighting L_A or L_{pA}, L_{WA}, similar – C-weighting L_C or L_{pC}, L_{WC}	Is an electronic filter which is equal to the frequency sensitivity of the human ear. Our sensitivity is at a maximum at around 2kHz and steadily decreases above and below. Below 20Hz and above about 20kHz we can't hear at all. Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would hear. When considering impacts on humans, it is therefore often necessary to apply an A-weighting to the measured sound frequency spectrum. When A-weighted, the Sound Pressure Level L_p becomes L_{pA} (or L_A) and the Sound Power Level L_W becomes L_{WA}. The response of the human ear varies depending on how loud the sound is. A-weighting matches the response of a sound level meter to human hearing at low levels (~ 40-90dB). For higher levels there are other weightings, the most common of which is the C-weighting.
Near and far-fields	Are the regions of the radiation field of a sound source. In the near field, the sound pressure and acoustic particle velocity are not in phase and there is no simple relationship between sound pressure level and distance from the source. The near field is limited to a distance from the source of around a wavelength of sound or three times the largest dimension of the sound source (whichever is the larger). The far field is the region of the sound field in which sound pressure level decreases predictably with distance. For a point source, the sound pressure level decreases by 6dB for each doubling of distance. It extends from the near field to infinity.

Table A.20: Different types of decibels commonly used in acoustics

Term	Description
L_p L_{pA} (or L_A) L_{AF}, L_{AS}	*The instantaneous sound pressure level* (L_p) *The A-weighted instantaneous sound pressure level* (L_{pA} or L_A) This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on

Term	Description
	the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125s (FAST time constant) or the previous 1s (SLOW time constant). The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.
L_{max} L_{Amax} L_{AFmax} L_{min} , L_{Fmin}	*The maximum instantaneous sound pressure level* (L_{max}), *The A-weighted maximum instantaneous sound pressure level* (L_{Amax}) *The A-weighted maximum instantaneous sound pressure level with a FAST time constant* (L_{AFmax}). This is the highest instantaneous sound pressure level reached during a measurement period. The opposite of the L_{max} is the *minimum instantaneous sound pressure level* or L_{min} etc. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{N,T}$ $L_{AN,T}$ $L_{AFN,T}$ $_N$ = %age value, 0-100 $_T$ = measurement time e.g. L_{A90}, L_{A10}, $L_{AF90,\ 5\ min}$	The percentage exceedance sound pressure level (LN,T), The A-weighted percentage exceedance sound pressure level (LAN,T), the A-weighted percentage exceedance sound pressure level with a FAST time constant (LAFN,T). This is the sound pressure level exceeded for N% of the time T. e.g. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as LA10,1hr = x dB. LA0 (the level exceeded for 0 % of the time) is equivalent to the LAmax and LA100 (the level exceeded for 100 % of the time) is equivalent to the LAmin. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{eq,T}$ $L_{Aeq,T}$ $_T$ = measurement time eg. $L_{Aeq,5min}$	The *equivalent continuous sound pressure level over period T* ($L_{eq,T}$), *The A-weighted equivalent continuous sound pressure level over period T* ($L_{Aeq,T}$).

Term	Description
	This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value. The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation

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