NORTH FALLS

Offshore Wind Farm

PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

Appendix 26.3 Construction Noise and Vibration Assessment

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Glossary of Acronyms

AAWT	Annual Average Weekday Traffic
BNL	Basic Noise Level
CEMP	Construction Environment Management Plan
dB	Decibel
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
LiDAR	Light detection and ranging
NVSR	Noise and vibration sensitive receptor
OS	Ordnance Survey
PEIR	Preliminary Environmental Information Report

Glossary of Terminology

The Project Or 'North Falls'	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water
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)	The area between the landfall and the onshore substation sites, within which the onshore cable circuits will be installed along with other temporary works for construction.
Onshore substation	Compound containing electrical equipment to enable connection to the National Grid.
Onshore substation zone	Area within which the onshore substation will be located.
For further explanation of acoustics specific terms, refer to Appendix 26.1 (Volume III).	

1 Introduction

1. This Appendix to the Preliminary Environmental Information Report (PEIR) for the proposed North Falls Offshore Wind Farm (herein 'the Project or 'North Falls') details the construction noise and vibration assessment reported in Chapter 26 Noise and Vibration (Volume I), including plant data, calculation procedures and results.

2. This indicative assessment – and the subsequent update to this assessment which will be undertaken to inform the Project's Environmental Statement (ES) – has been undertaken based on a preliminary understanding of the likely construction schedule, activities and plant to be used. This information may change once a construction contractor is appointed in advance of construction. The outline Construction Environment Management Plan (CEMP) to be submitted with the Project's Development Consent Order (DCO) application will require that the final CEMP, submitted post-consent, will include a detailed construction noise and vibration assessment, including predictions of construction noise and vibration levels at nearby noise and vibration sensitive receptors (NVSRs) for comparison with suitable noise level limits. This assessment will be undertaken based on information provided by the appointed contractor and will identify the final mitigation measures to be incorporated.

2 Construction noise calculations

2.1 Construction scenarios and plant

3. Noise modelling scenarios were derived from the proposed construction phase programme and are as follows. Unless stated otherwise, working hours are assumed to be 07:00 to 19:00 Monday to Saturday:

- Landfall construction:
  - Establish access and temporary construction compounds (including horizontal directional drilling (HDD) compounds);
  - Site preparation, including fencing, haul road construction and topsoil strip; and
  - HDD operations – 24 hours a day.
- Onshore cable corridor(s):
  - Trench excavation and duct installation; and
  - Trench backfill.
- Onshore substation construction:
  - Ground works/formation of platform;
  - Building foundation works;
  - Access road and car parking works; and
  - Building fabrication and high voltage (HV) plant installation.

4. Table 1 outlines the assumed construction phase noise sources that informed the noise predictions. Where possible, noise source levels were taken using those available in BS 5228-1 Annex C and incorporate on-time corrections as outlined in BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.

Table 1 Details of assumed construction plant

Activity	Plant	No.	Reference*	L_{Aeq} (dB) at 10m	On-time (%)
Landfall					
Establish access and temporary construction compounds (including HDD compounds)	D6 Dozer	1	Table C2 - Ref 12	81	100
	30T excavator	2	Table C2 - Ref 16	75	100
	20T Dumper	3	Table C2 - Ref 33	81	100
	Smooth Drum vibro road roller	1	Table C5 - Ref 20	75	100
	21T excavator	1	Table C2 - Ref 3	78	100
	5T Forward Tipping Dumper	1	Table C4 - Ref 7	78	100
	Loading shovel	1	Table C2 - Ref 27	80	100
	Tractor & fencing kit	1	Table C4 - Ref 74	80	100
	Tractor & trailer	1	Table C4 - Ref 75	79	70
	Tractor & Fuel bowser (or self-propelled)	1	Table C6 - Ref 36	89	10
	Grader	1	Table C6- Ref 31	86	100
	Grader	1	Table C6- Ref 31	86	100
	Telehandler	1	Table C4 - Ref 54	79	70
	Mobile self-contained welfare unit	2	Table C4 - Ref 78	66	25
	Mobile generator	2	Table C4 - Ref 84	74	25
	Temporary lighting	6	Table C4 - Ref 86	65	25
	Road surface paver & roller	1	Table C5 - Ref 32	84	25
Site preparation, including fencing, haul road construction and topsoil strip	D6 Dozer	1	Table C2 - Ref 12	81	100
	30T excavator	2	Table C2 - Ref 16	75	100
	20T Dumper	3	Table C2 - Ref 33	81	100
	Smooth Drum vibro road roller	1	Table C5 - Ref 20	75	100
	21T excavator	1	Table C2 - Ref 3	78	100
	5T Forward Tipping Dumper	1	Table C4 - Ref 7	78	100
	Loading shovel	1	Table C2 - Ref 27	80	100
	Tractor & fencing kit	1	Table C4 - Ref 74	80	100
	Tractor & trailer	1	Table C4 - Ref 75	79	70
	Tractor & Fuel bowser (or self-propelled)	1	Table C6 - Ref 36	89	10
	Tractor & Water bowser (for dust suppression)	1	Table C6 - Ref 38	83	25
	Grader	1	Table C6- Ref 31	86	100
	Telehandler	1	Table C4 - Ref 54	79	70
	Mobile self-contained welfare unit	1	Table C4 - Ref 78	66	25
	Mobile generator	2	Table C4 - Ref 84	74	25

Activity	Plant	No.	Reference*	L_{Aeq} (dB) at 10m	On-time (%)
	Temporary lighting	12	Table C4 - Ref 86	65	25
HDD operations	Generator	1	Table C4 - Ref 84	74	100
	Telehandler	2	Table C4 - Ref 54	79	75
	Directional Drill Generator	1	Table C4 - Ref 96	77	100
	Mud Pump	1	Provided by Riggall & Associates based on measurements made on previous projects	80	100
	Mixing Tank	1	Provided by Riggall & Associates based on measurements made on previous projects	75	100
	Cuttings / Recycling Tank	1	Provided by Riggall & Associates based on measurements made on previous projects	80	100
Onshore cable corridor(s)					
Trench excavation	30T excavator	2	Table C2 - Ref 16	75	100
	20T Dumper	2	Table C2 - Ref 33	81	100
	21T excavator	2	Table C2 - Ref 3	78	100
	5T Forward Tipping Dumper	2	Table C4 - Ref 7	78	100
	Loading shovel	2	Table C2 - Ref 27	80	50
	Trench Roller	2	Table C2 - Ref 40	73	50
	Tractor & trailer	1	Table C4 - Ref 75	79	50
	Tractor & Fuel bowser (or self-propelled)	1	Table C6 - Ref 36	89	10
	Tractor & Water bowser (for dust suppression)	1	Table C6 - Ref 38	83	25
	Telehandler	1	Table C4 - Ref 54	79	50
	Mobile self-contained welfare unit	1	Table C4 - Ref 78	66	25
	Crawler Crane	1	Table C4 - Ref 52	75	10
	Mobile generator	2	Table C4 - Ref 84	74	25
	Temporary lighting	8	Table C4 - Ref 86	65	25
	Pump	2	Table C6 - Ref 41	78	100
Trench backfill	30T excavator	2	Table C2 - Ref 16	75	100
	20T Dumper	2	Table C2 - Ref 33	81	100
	21T excavator	2	Table C2 - Ref 3	78	100
	5T Forward Tipping Dumper	2	Table C4 - Ref 7	78	100
	Loading shovel	2	Table C2 - Ref 27	80	100
	Trench roller	2	Table C2 - Ref 40	73	75
	Tractor & trailer	1	Table C4 - Ref 75	79	25
	Tractor & Fuel bowser (or self-propelled)	1	Table C6 - Ref 36	89	10
	Tractor & Water bowser (for dust suppression)	1	Table C6 - Ref 38	83	25

Activity	Plant	No.	Reference*	L_{Aeq} (dB) at 10m	On-time (%)
	Telehandler	1	Table C4 - Ref 54	79	25
	Mobile self-contained welfare unit	1	Table C4 - Ref 78	66	25
	Mobile generator	2	Table C4 - Ref 84	74	25
	Temporary lighting	8	Table C4 - Ref 86	65	25
	Pump	2	Table C6 - Ref 41	78	100
Onshore substation (construction)					
Ground works/ formation of platform	Excavator (earthworks)	6	Not provided	74	100
	Excavator (hydraulic breaker)	4		85	100
	Dozer	4		79	75
	Air compressor	4		72	100
	Dump truck	8		77	70
	Generator	2		72	100
	Crusher	2		88	80
Building foundation works	Large rotary bored piling rig	1		83	100
	Tracked drilling rig with hydraulic drifter	1		82	100
	Crane mounted auger	1		79	100
	Mini piling rig	2		76	100
	Compressor for mini piling	1		75	100
	Dump truck	4		77	50
	Truck mixer with pump	2		75	10
	Excavator (earthworks)	3		74	80
	Grinder	5		80	50
	Compressor	2		72	100
	Generator	2		72	100
Access road and car parking works	Excavator	2		74	100
	Dump truck	4		77	70
	Asphalt spreader with support lorry	1		78	100
	Vibratory roller	2		78	70
	Grader	1		84	100
Building fabrication and HV Plant Installation	Mobile crane	1		74	50
	Lorry	3		75	25
	MEWP	2		78	75
	Dump truck	4		77	10
	Compressor	1		72	100
	Forklift truck	2		77	50
	Grinder	5		80	50
	Pneumatic chipper/drill	3		86	50
	Scaffolding	1		72	25

Activity	Plant	No.	Reference*	L_{Aeq} (dB) at 10m	On-time (%)
* Refers to BS5228-1 unless stated otherwise					

2.2 Modelling procedures

5. The calculations of construction noise were undertaken using SoundPLAN (V8.2) noise modelling software. This software implements the sound propagation calculation methodology set out in BS5228-1. Calculations were undertaken for each construction phase specified in Table 1.

6. Construction noise levels at NVSRs around the landfall have been calculated by creating an area source, representing all construction plant operating simultaneously, at the closest approach of the landfall search area to each NVSR, and at one alternative location representative of the centre of the landfall search area. The size of the area source was 50% of the landfall construction compound area i.e. around 10,000m^2. This is considered to represent a reasonable worst-case in that it is unlikely that all construction plant will be operational within this area, even if the landfall is located at the closest approach to the NVSR.

7. Construction noise levels due to onshore cable route works have been calculated using an area source with a width of the likely onshore cable route construction footprint for open cut trenching (60m) and length equal to the distance likely to be completed by the works in one month as specified in the Chapter 26 Noise and Vibration (Volume I). This has been used to determine the distance from the works at which the monthly average construction noise level will exceed the Threshold Levels identified in the Chapter 26 Noise and Vibration (Volume I).

8. Construction noise levels at NVSRs around the onshore substation zone have been calculated in a similar method to the landfall, using an area source at the closest approach of the onshore substation zone to each NVSR. The size of the area source was 50% of the anticipated total permanent footprint of the onshore substation (i.e. around 0.05km^2).

2.2.1 Modelling input data

9. Inputs into the noise models of the landfall and onshore substation construction noise include ground topography, ground type, and buildings to form a 3D representation of the study area. Modelling input data for these calculations are detailed in Table 2.

Table 2 Noise model input data

Data	Usage	Source file	Origin
OS mapping	Locations of buildings in study area	OS_MasterMap_669253_880737	Emapsite
		OS_MasterMap_717065_930746	North Falls Offshore Wind Ltd
LiDAR composite Digital Terrain	Ground topography in study area	LIDAR-DTM-1m-2020-TM02ne LIDAR-DTM-1m-2020-TM21nw	Environment Agency (2020) LIDAR Composite DSM 2020 – 1m. Defra Data Services Platform. Available at https://environment.data.gov.uk/

Data	Usage	Source file	Origin
Model			DefraDataDownload/?Mode=survey
Construction plant information	Plant type, numbers, sound power levels, %on-time for each construction activity	North Falls Landfall and Onshore Cable Route Construction Metrics (Section 5 CR01 Variation).xlsx	North Falls Offshore Wind Ltd
		PDS Onshore Substation Metrics.xlsx	

10. Modelling of onshore cable corridor(s) construction noise was undertaken on a simplified basis of one area source representing the works passing a theoretical NVSR. This disregards the actual site layout and the potential for screening from topography or buildings and is therefore representative of a worst-case. Hence, no additional input data was required beyond the construction plant information.

2.2.2 Acoustic model settings

11. Acoustic modelling has been undertaken using the following model settings:

- Maximum search radius of 3000m;
- Maximum number of reflections: 3;
- Daytime and evening/weekend noise predictions carried out at ground floor level i.e. 1.5m above ground. Night-time predictions carried out at first floor level i.e. 4m above ground;
- Side diffraction enabled;
- Building heights set to 6m; and
- Ground absorption has been set G = 0.9 (90% soft ground, considered representative of the study area).

3 Predicted construction noise levels

12. The results of the landfall construction noise calculations are presented in Table 3.

Table 3 Calculated landfall construction noise levels

Activity	Activity location (i.e. in proximity to identified NVSR or in the centre of the landfall search area)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)	
			Daytime	Night-time
Establish access and temporary construction compounds (including HDD compounds)	LFR1	LFR1	56	N/a
		LFR2	56	
		LFR3	53	
		LFR4	44	
		LFR5	40	
	LFR2	LFR1	55	
		LFR2	57	

Activity	Activity location (i.e. in proximity to identified NVSR or in the centre of the landfall search area)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)	
			Daytime	Night-time
		LFR3	55	
		LFR4	44	
		LFR5	39	
	LFR3	LFR1	53	
		LFR2	56	
		LFR3	57	
		LFR4	45	
		LFR5	39	
	LFR4	LFR1	44	
		LFR2	44	
		LFR3	45	
		LFR4	57	
		LFR5	41	
	LFR5	LFR1	39	
		LFR2	38	
		LFR3	37	
		LFR4	41	
		LFR5	52	
	Centre	LFR1	44	
		LFR2	43	
		LFR3	42	
		LFR4	47	
		LFR5	45	
Site preparation, including fencing, haul road construction and topsoil strip	LFR1	LFR1	56	N/a
		LFR2	56	
		LFR3	52	
		LFR4	44	
		LFR5	40	
	LFR2	LFR1	55	
		LFR2	57	
		LFR3	55	
		LFR4	44	
		LFR5	39	
	LFR3	LFR1	53	
		LFR2	56	
		LFR3	57	
		LFR4	45	
		LFR5	39	

Activity	Activity location (i.e. in proximity to identified NVSR or in the centre of the landfall search area)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)	
			Daytime	Night-time
	LFR4	LFR1	44	
		LFR2	43	
		LFR3	45	
		LFR4	57	
		LFR5	41	
	LFR5	LFR1	39	
		LFR2	38	
		LFR3	37	
		LFR4	41	
		LFR5	52	
	Centre	LFR1	44	
		LFR2	43	
		LFR3	42	
		LFR4	46	
		LFR5	45	
HDD operations	LFR1	LFR1	54	54
		LFR2	53	54
		LFR3	50	50
		LFR4	41	41
		LFR5	37	38
	LFR2	LFR1	53	53
		LFR2	54	55
		LFR3	52	52
		LFR4	41	41
		LFR5	36	37
	LFR3	LFR1	50	50
		LFR2	53	54
		LFR3	54	54
		LFR4	42	42
		LFR5	36	37
	LFR4	LFR1	41	41
		LFR2	41	41
		LFR3	42	42
		LFR4	54	54
		LFR5	39	39
	LFR5	LFR1	36	36
		LFR2	35	36
		LFR3	34	34

Activity	Activity location (i.e. in proximity to identified NVSR or in the centre of the landfall search area)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)	
			Daytime	Night-time
		LFR4	38	39
		LFR5	49	50
	Centre	LFR1	41	42
		LFR2	40	41
		LFR3	39	39
		LFR4	44	44
		LFR5	42	43

13. The complete results of the onshore cable construction noise level predictions are presented in the Chapter 26 Noise and Vibration (Volume I); hence, these are not duplicated here.

14. The results of the onshore substation construction noise calculations are presented in Table 3. The calculated noise levels do not exceed the daytime Threshold Value (65dB L_{Aeq}), those which are equal to or exceed the evening and weekend Threshold Value (65dB L_{Aeq}) are highlighted in bold.

Table 4 Calculated onshore substation construction noise levels

Substation location ((i.e. in proximity to identified NVSR)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)			
		Ground works/ formation of platform	Building foundation works	Access road and car parking works	Building fabrication and HV Plant Installation
SSR1	SSR1	49	48	43	49
	SSR2	48	46	41	47
	SSR3	49	48	42	49
	SSR4	54	53	47	54
	SSR5	54	52	47	54
	SSR6	54	52	47	53
	SSR7	45	43	38	45
	SSR8	46	45	39	46
	SSR9	47	46	40	47
	SSR10	47	45	40	47
SSR2, 3 and 4	SSR1	49	47	42	49
	SSR2	48	46	41	47
	SSR3	50	48	43	49
	SSR4	**55**	54	48	**55**
	SSR5	**55**	54	48	**55**
	SSR6	**55**	53	48	54
	SSR7	45	44	38	45
	SSR8	46	44	39	46

Substation location ((i.e. in proximity to identified NVSR)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)			
		Ground works/ formation of platform	Building foundation works	Access road and car parking works	Building fabrication and HV Plant Installation
	SSR9	47	45	40	46
	SSR10	47	45	40	46
SSR5	SSR1	47	45	40	47
	SSR2	46	44	39	45
	SSR3	48	46	41	48
	SSR4	54	52	47	54
	SSR5	**57**	**55**	50	**57**
	SSR6	**59**	**57**	52	**58**
	SSR7	47	45	40	46
	SSR8	48	46	41	47
	SSR9	48	46	41	47
	SSR10	46	45	40	46
SSR6	SSR1	43	42	37	43
	SSR2	42	41	36	42
	SSR3	45	43	38	44
	SSR4	49	47	42	49
	SSR5	**55**	53	48	54
	SSR6	**62**	**60**	**55**	**61**
	SSR7	53	51	46	52
	SSR8	51	49	44	51
	SSR9	49	47	42	48
	SSR10	45	44	38	45
SSR7	SSR1	41	40	34	41
	SSR2	41	39	34	40
	SSR3	43	41	36	42
	SSR4	47	45	40	46
	SSR5	51	50	44	51
	SSR6	**55**	53	48	**55**
	SSR7	**58**	**56**	51	**58**
	SSR8	50	49	44	50
	SSR9	47	45	40	46
	SSR10	43	41	36	43
SSR8	SSR1	44	42	37	43
	SSR2	42	40	35	42
	SSR3	43	42	37	43
	SSR4	47	45	40	47
	SSR5	51	49	44	50

Substation location ((i.e. in proximity to identified NVSR)	NVSR	Calculated construction noise level (dB $L_{Aeq,T}$)			
		Ground works/ formation of platform	Building foundation works	Access road and car parking works	Building fabrication and HV Plant Installation
	SSR6	**55**	53	48	54
	SSR7	52	51	45	52
	SSR8	**55**	53	48	55
	SSR9	53	51	46	53
	SSR10	48	46	41	47
SSR9	SSR1	45	44	38	45
	SSR2	43	42	36	43
	SSR3	44	42	37	44
	SSR4	48	46	41	47
	SSR5	50	48	43	50
	SSR6	53	51	46	53
	SSR7	49	47	42	49
	SSR8	53	52	46	53
	SSR9	54	53	47	54
	SSR10	50	48	43	49
SSR10	SSR1	46	44	39	46
	SSR2	44	42	37	43
	SSR3	45	43	38	44
	SSR4	48	47	41	48
	SSR5	51	49	44	50
	SSR6	53	52	46	53
	SSR7	48	46	41	47
	SSR8	51	50	44	51
	SSR9	53	51	46	53
	SSR10	50	49	43	50

4 Construction vibration calculations

15. The ground compaction predictions have been based on operation of a large twin drum roller which is 1.2m wide and the drum vibration amplitude is 0.5mm. This is considered representative of a reasonable worst-case.

16. The vibration predictions for HDD identified the driving energy of the drill to produce a PPV of 1.0mm.s^{-1} at 7m (measured vibration levels in row 100, Table D.6, BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'). This driving energy (22 kJ) was used to calculate the distances at which the vibration criteria would be predicted.

5 References

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 (2014). BS 5228-2:2009+A1:2014 “Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration”.
Environment Agency (2020) LIDAR Composite DSM 2020 – 1m. Defra Data Services Platform. Available at https://environment.data.gov.uk/DefraDataDownload/?Mode=survey