Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Environmental Statement

Volume 3

Appendix 23.3 - Construction Noise Assessment

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Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects Environmental Statement **Appendix 23.3: Construction Noise and Vibration Assessments**		
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Glossary of Acronyms

BDC	Broadland District Council
BS	British Standard
BSI	British Standards Institution
DEP	Dudgeon Offshore Wind Farm Extension Project
DOW	Dudgeon Offshore Wind Farm
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drilling
LPA	Local Planning Authority
NNDC	North Norfolk District Council
NSR	Noise Sensitive Receptor
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
PEIR	Preliminary Environmental Information Report
PPG	Planning Practice Guidance
SEP	Sheringham Shoal Offshore Wind Farm Extension Project
SNC	South Norfolk Council
DEP	Dudgeon Extension Project
HDD	Horizontal Directional Drilling
NSR	Noise Sensitive Receptor
PEIR	Preliminary Environmental Information Report
SEP	Sheringham Shoal Extension Project

Glossary of Terms

Order Limits	The area subject to the application for development consent, including all permanent and temporary works for SEP and DEP.
Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
DEP onshore site	The Dudgeon Offshore Wind Farm Extension onshore area consisting of the DEP onshore substation site, onshore cable corridor, construction compounds, temporary working areas and onshore landfall area.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable corridor which would house HDD entry or exit points.
Jointing bays	Underground structures constructed at regular intervals along the onshore cable corridor to join sections of cable and facilitate installation of the cables into the buried ducts.
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
Onshore cable corridor	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 export cables	The cables which would bring electricity from the landfall to the onshore substation. 220 – 230kV.
Onshore Substation	Compound containing electrical equipment to enable connection to the National Grid.
PEIR boundary	The area subject to survey and preliminary impact assessment to inform the PEIR.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.

SEP onshore site	The Sheringham Shoal Wind Farm Extension onshore area consisting of the SEP onshore substation site, onshore cable corridor, construction compounds, temporary working areas and onshore landfall area.
Study area	Area where potential impacts from the project could occur, as defined for each individual Environmental Impact Assessment (EIA) topic.
The Applicant	Equinor New Energy Limited

23.3 CONSTRUCTION NOISE AND VIBRATION ASSESSMENTS

23.3.1 Introduction

1. This appendix of the Environmental Statement (ES) of the proposed Sheringham Shoal Offshore Windfarm Extension Project (hereafter SEP) and Dudgeon Offshore Wind Farm Extension Project (hereafter DEP) details the assumptions on utilised plant per work activity and the predicted noise and vibration impacts.
2. This indicative assessment 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. The outline Construction Environment Management Plan (CEMP) submitted with this application requires that the final CEMP will include a detailed construction noise and vibration assessment, including predictions of construction noise and vibration levels at nearby NSRs 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.

23.3.2 Existing Environment

3. In order to assess construction noise impacts, aerial imagery was used to determine Noise Sensitive Receptor (NSR) locations at the landfall location, along the onshore cable corridor and onshore substation sites.
4. NSR locations were chosen to represent the worst case for each group of residential dwellings along the onshore cable corridor; closest to the proposed works and minimal screening.
5. Some NSR locations were identified to be within 10m of the DCO order limit (60m wide onshore cable corridor for the DCO application) however, it is envisaged that construction works will be undertaken at distances greater than 10m to minimise potential impacts.
6. For the Preliminary Environmental Information Report (PEIR), one NSR location was chosen at the landfall location, 35 NSR locations were chosen along the onshore cable corridor and 10 NSR locations were chosen at the onshore substation sites.
7. Additional NSRs have been identified due to the refinement of the onshore cable corridor for the DCO application. For transparency the NSRs detailed in the PEIR remain included, and where the new receptors fall between previously identified locations, a suffix of A, B, C etc. was added i.e. new receptor between CCR2 and CCR3, labelled as CCR2A, CCR2B as shown in **Table 23.3.1**.
8. The NSR location at the landfall, LFR1, is considered in the assessments for both landfall location construction works and onshore cable corridor construction works.

Table 23.3.1: Construction noise NSR locations

NSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
Landfall location				
LFR1	610977	343444	Residential	Medium
Onshore cable corridor				
LFR1	610977	343444	Residential	Medium
CCR2	610738	342994	Residential	Medium
CCR2A	611015	342608	Residential	Medium
CCR2B	611091	342616	Residential	Medium
CCR2C	610666	342879	Residential	Medium
CCR2D	610582	342938	Residential	Medium
CCR3	611743	341964	Residential	Medium
CCR4	611862	341489	Residential	Medium
CCR5	612130	341708	Residential	Medium
CCR6	613059	340787	Residential	Medium
CCR7	612750	340262	Residential	Medium
CCR8	613110	339917	Residential	Medium
CCR9	612971	338860	Residential	Medium
CCR10	613483	337381	Residential	Medium
CCR11	613975	335187	Residential	Medium
CCR11A	614236	334696	Residential	Medium
CCR12	613551	333400	Residential	Medium
CCR13	613248	332613	Residential	Medium
CCR14	612711	331184	Residential	Medium
CCR15	612956	329892	Residential	Medium
CCR15A	613416	329768	Residential	Medium
CCR15B	612959	330021	Residential	Medium
CCR15C	612339	329417	Residential	Medium
CCR16	612777	328181	Residential	Medium

NSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
CCR16A	613118	328300	Residential	Medium
CCR16B	614159	326728	Residential	Medium
CCR16C	614792	326537	Residential	Medium
CCR17	614700	325488	Residential	Medium
CCR17A	615025	324879	Residential	Medium
CCR17B	614142	323758	Residential	Medium
CCR18	614130	323640	Residential	Medium
CCR18A	614388	322926	Residential	Medium
CCR19	613983	322333	Residential	Medium
CCR20	613800	321457	Residential	Medium
CCR20A	613914	319331	Residential	Medium
CCR20B	614509	318996	Residential	Medium
CCR20C	613717	318739	Residential	Medium
CCR21	614066	318345	Residential	Medium
CCR21A	613133	317870	Residential	Medium
CCR21B	612966	317545	Residential	Medium
CCR21C	612944	317321	Residential	Medium
CCR22	613092	316787	Residential	Medium
CCR22A	613126	316817	Residential	Medium
CCR22B	612756	316738	Residential	Medium
CCR22C	611493	315925	Residential	Medium
CCR23	611492	314594	Residential	Medium
CCR24	611654	313503	Residential	Medium
CCR24A	611994	313150	Residential	Medium
CCR24B	612036	313011	Residential	Medium
CCR24C	612281	312762	Residential	Medium
CCR24D	612469	312498	Residential	Medium

NSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
CCR24E	611835	311391	Residential	Medium
CCR24F	613169	310979	Residential	Medium
CCR25	612218	309153	Residential	Medium
CCR25A	612345	308688	Residential	Medium
CCR25B	612031	308210	Residential	Medium
CCR26	611931	308038	Residential	Medium
CCR26A	611939	307994	Residential	Medium
CCR26B	611847	307804	Residential	Medium
CCR26C	611834	307336	Residential	Medium
CCR27	611931	307256	Residential	Medium
CCR27A	611992	307086	Residential	Medium
CCR28	612608	306151	Residential	Medium
CCR28A	612585	304678	Residential	Medium
CCR29	612623	304579	Residential	Medium
CCR29A	613289	303617	Residential	Medium
CCR30	614335	303786	Residential	Medium
CCR31	615697	303210	Residential	Medium
CCR31A	615835	303087	Residential	Medium
CCR31B	616275	302609	Residential	Medium
CCR31C	616799	303417	Residential	Medium
CCR32	617330	303386	Residential	Medium
CCR33	618907	303241	Residential	Medium
CRR33A	619412	302848	Residential	Medium
CCR33B	619731	302407	Residential	Medium
CCR34	619759	302045	Residential	Medium
SSR3	621610	301271	Residential	Medium
MCR1	613117	316442	Residential	Medium

NSR identifier	Coordinates		Classification	Sensitivity
	X	Y		
Onshore substation				
SSR1	620863	302329	Residential	Medium
SSR2	621180	301320	Residential	Medium
SSR3	621610	301271	Residential	Medium
SSR4	620339	301806	Residential	Medium
SSR5	622499	302482	Residential	Medium
SSR6	622529	302038	Residential	Medium
SSR7	621575	302924	Residential	Medium
SSR8	621319	303086	Residential	Medium
SSR9	620982	301753	Residential	Medium
SSR10	620997	301476	Residential	Medium

9. From consultation with BDC and SNC it was agreed that no baseline noise measurements would be necessary along the onshore cable corridor to inform the construction phase noise assessment.

23.3.3 Assumptions and Indicative Plant List

10. Noise modelling scenarios were derived from the proposed construction phase programme and are detailed below.

11. Construction impacts will be temporary in nature and include noise and vibration generating activities associated with:

- Construction works at landfall location including:
  - One active HDD rig for all scenarios.
- Construction works along the onshore cable corridor including:
  - Installation of temporary access tracks;
  - Establishing temporary work areas;
  - Installation, ducting and pulling of cables along the onshore cable corridor and landfall location;
  - Trenchless crossing works (HDD) along onshore cable corridor; and
  - Onshore Main Compound.
- Construction of the onshore substation including:

- Impact piling during the daytime only[1]; and
- Concrete pouring with the option to extend into evenings and weekends and night-time reference period.

12. It is assumed that all construction works will be undertaken during the BS 5228-1 daytime reference period only, with the exception of concrete pouring activities at the onshore substation, HDD works along the onshore cable corridor and landfall location, and power generation plant, which are proposed to have the option to be undertaken 24 hours a day.

13. **Table 23.3.2** 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. Noise from on-site measurements of similar project's equipment form part of Royal HaskoningDHV's (RHDHV's) library and have been used for the calculation of construction noise, where suitable.

Table 23.3.2: Details of assumed construction plant

Plant	No.	BS 5228 reference	L_{Aeq} (dB) at 10m	On-time correction (%)
Landfall location				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	1	C4.53	77	85
Drilling rig	1	RHDHV	77	100
Mixing tank	1	C4.23	61	100
Circulation pump 6in	1	C2.45	65	100
Generator	1	C4.76	61	100
Tractor and Trailer	1	C4.75	79	85
Butt fusion jointing machine cabin & generator	1	C3.32	73	85
Onshore cable corridor - cable duct and installation				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85

[1] Impact piling is considered as the worst-case for the purpose of the assessment and may not be implemented as a construction method.

Plant	No.	BS 5228 reference	L_{Aeq} (dB) at 10m	On-time correction (%)
Hiab wagon	1	C4.53	77	85
Dozer 28t	1	C2.11	79	85
Generator	1	C4.76	61	85
Tractor and trailer	1	C4.75	79	85
Wacker plater	1	C2.41	80	85
Water pump 6in	1	C2.45	65	85
Onshore cable corridor - cable pull				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	1	C4.53	77	85
Cable winch	1	C4.50	71	85
Drum trailer	1	C4.75	79	85
Compressor	1	C3.19	75	85
Generator	1	C4.76	61	85
Tractor and trailer	1	C4.75	79	85
Onshore cable corridor - installation of temporary access tracks				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	1	C4.53	77	85
Dozer 28t	1	C2.11	79	85
Asphalt spreader and roller	1	C5.29	82	85
Onshore cable corridor - establishing temporary work areas				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	1	C4.53	77	85

Plant	No.	BS 5228 reference	L_{Aeq} (dB) at 10m	On-time correction (%)
Onshore cable corridor - trenchless crossings				
Tracked excavator 40t	2	C2.14	79	85
Low loader 23t	1	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	1	C4.53	77	85
Drilling rig	1	RHDHV	77	100
Mixing tank	1	C4.23	61	100
Circulation pump 6in	1	C2.45	65	100
Generator	1	C4.76	61	100
Tractor and Trailer	1	C4.75	79	85
Butt fusion jointing machine cabin & generator	1	C3.32	73	85
Onshore Main Compound				
Tipper Wagon	2	C1.11	80	85
Tracked Excavator	2	C2.14	79	85[1]
Low Loader	2	C6.34	76	85
Telehandler	1	C2.35	71	85
Hiab wagon	1	C4.35	77	85[1]
Mobile Telescopic Crane	1	C4.39	77	85
Generator	1	C4.76	61	100
Batching Plant	1	Ref A	80	100
Angle Grinder	1	C4.93	80	85[1]
Handheld Welder	1	C3.31	73	85[1]
Petrol handheld circular saw	1	C4.70	91	85[1]
Handheld cordless nail gun	1	C4.95	73	85[1]
[1] – For the Onshore Main Compound, this plant will operate during daytime construction hours only, with all other plant items within compound assumed as 24hrs **[A] - Occupational Noise Monitoring Survey For Aggregate Industries UK Limited Contracting - Sitebatch Technologies Woodhall Spa Mobile Concrete Plant Lincolnshire**				
Onshore substation zone				
Hydraulic hammer piling rig	1	C3.2	89	35

Plant	No.	BS 5228 reference	L_{Aeq} (dB) at 10m	On-time correction (%)
Tracked excavator 40t	4	C2.14	79	85
Low loader 23t	2	C6.34	76	85
Telehandler 10t	1	C2.35	71	85
Hiab wagon	2	C4.53	77	85
Dozer 28t	1	C2.11	79	85
Tractor and trailer	1	C4.75	79	85
Tipper wagons 29t	2	C1.11	80	85
Compacting roller 4.5t	1	C5.25	75	85
Ride on roller	1	C2.42	78	85
Wacker plate	1	C2.41	80	85
Dumpers	1	C6.26	79	85
Dozer 11t	1	C2.13	78	85
Cement mixer truck	1	C4.18	75	85
Truck mounted concrete pump	1	C4.32	78	85
Generator	2	C4.76	61	85

23.3.4 Predicted Construction Noise Levels

14. Temporary increases in noise levels at nearby receptors are expected during the construction of the Projects. Calculations of these temporary noise increases were undertaken using the construction equipment assumptions displayed in **Table 23.3.2** in accordance with method procedure provided in formulae F.1 and F.2 of BS 5228-1.

15. Effects from screening have not been included in the construction noise predictions and ground has been assumed to be acoustically absorptive (i.e. soft).

16. Only construction activities associated with landfall location and trenchless crossings works were calculated for night-time and evenings and weekends reference periods as all other activities are assumed to be limited to daytime working hours.

23.3.4.1 Landfall location

17. It is proposed that there will be one active HDD rig operating at the landfall location for all scenarios.

18. Noise predictions at the landfall location were undertaken assuming all plant is simultaneously operating at the proposed onshore HDD location.

19. Predicted construction noise levels at the landfall location are displayed in **Table 23.3.3**.

Table 23.3.3: Predicted construction noise levels - landfall location

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
LFR1	50	Negligible	Negligible	Low

23.3.4.2 Onshore cable corridor

20. Noise predictions along the onshore cable corridor were undertaken assuming all construction plant is simultaneously operating at the DCO order limits for each activity, excluding for trenchless crossing works. This approach is considered to display the worst-case scenario for noise levels within the work areas and assumes all plant is operating at the nearest location to NSRs.

21. As detailed previously in **Section 23.3.2**, some of the identified NSRs are within 10m of the DCO order limits. It is envisaged that Best Practicable Measures (BPM) will be implemented during the construction works. For the purposes of assessing a worst-case scenario, the predicted unmitigated noise levels are based on the closest position from the DCO order limits to the receptor, without screening or BPM.

22. Upon refinement of the work areas for each construction activity the separation distance between construction works and NSRs may be increased; and therefore, a lower noise level will be predicted.

23. Trenchless crossing works assume all plant to be in simultaneous operation at the proposed HDD locations.

24. Predicted construction noise levels along the onshore cable corridor are displayed in **Table 23.3.4**

Table 23.3.4: Predicted construction noise levels - onshore cable corridor- unmitigated

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
Cable duct and installation				
LFR1	55	Negligible	N/A	N/A
CCR2	88	High	N/A	N/A
CCR2A	52	Negligible	N/A	N/A
CCR2B	51	Negligible	N/A	N/A
CCR2C	90	High	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR2D	63	Negligible	N/A	N/A
CCR3	53	Negligible	N/A	N/A
CCR4	46	Negligible	N/A	N/A
CCR5	79	High	N/A	N/A
CCR6	62	Negligible	N/A	N/A
CCR7	48	Negligible	N/A	N/A
CCR8	83	High	N/A	N/A
CCR9	90	High	N/A	N/A
CCR10	61	Negligible	N/A	N/A
CCR11	55	Negligible	N/A	N/A
CCR11A	47	Negligible	N/A	N/A
CCR12	65	Low	N/A	N/A
CCR13	58	Negligible	N/A	N/A
CCR14	65	Low	N/A	N/A
CCR15	59	Negligible	N/A	N/A
CCR15A	53	Negligible	N/A	N/A
CCR15B	62	Negligible	N/A	N/A
CCR15C	39	Negligible	N/A	N/A
CCR16	57	Negligible	N/A	N/A
CCR16A	56	Negligible	N/A	N/A
CCR16B	70	Medium	N/A	N/A
CCR16C	64	Negligible	N/A	N/A
CCR17	67	Low	N/A	N/A
CCR17A	56	Negligible	N/A	N/A
CCR17B	79	High	N/A	N/A
CCR18	73	Medium	N/A	N/A
CCR18A	50	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR19	64	Negligible	N/A	N/A
CCR20	64	Negligible	N/A	N/A
CCR20A	55	Negligible	N/A	N/A
CCR20B	51	Negligible	N/A	N/A
CCR20C	60	Negligible	N/A	N/A
CCR21	47	Negligible	N/A	N/A
CCR21A	55	Negligible	N/A	N/A
CCR21B	48	Negligible	N/A	N/A
CCR21C	48	Negligible	N/A	N/A
CCR22	60	Negligible	N/A	N/A
CCR22A	60	Negligible	N/A	N/A
CCR22B	53	Negligible	N/A	N/A
CCR22C	51	Negligible	N/A	N/A
CCR23	56	Negligible	N/A	N/A
CCR24	62	Negligible	N/A	N/A
CCR24A	58	Negligible	N/A	N/A
CCR24B	66	Low	N/A	N/A
CCR24C	59	Negligible	N/A	N/A
CCR24D	53	Negligible	N/A	N/A
CCR24E	47	Negligible	N/A	N/A
CCR24F	42	Negligible	N/A	N/A
CCR25	72	Medium	N/A	N/A
CCR25A	48	Negligible	N/A	N/A
CCR25B	55	Negligible	N/A	N/A
CCR26	100	High	N/A	N/A
CCR26A	90	High	N/A	N/A
CCR26B	64	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR26C	59	Negligible	N/A	N/A
CCR27	74	Medium	N/A	N/A
CCR27A	70	Medium	N/A	N/A
CCR28	52	Negligible	N/A	N/A
CCR28A	57	Negligible	N/A	N/A
CCR29	64	Negligible	N/A	N/A
CCR29A	50	Negligible	N/A	N/A
CCR30	50	Negligible	N/A	N/A
CCR31	55	Negligible	N/A	N/A
CCR31A	56	Negligible	N/A	N/A
CCR31B	50	Negligible	N/A	N/A
CCR31C	56	Negligible	N/A	N/A
CCR32	74	Medium	N/A	N/A
CCR33	52	Negligible	N/A	N/A
CCR33A	51	Negligible	N/A	N/A
CCR33B	52	Negligible	N/A	N/A
CCR34	71	Medium	N/A	N/A
SSR3	48	Negligible	N/A	N/A
MCR1	58	Negligible	N/A	N/A
Cable pull				
LFR1	54	Negligible	N/A	N/A
CCR2	87	High	N/A	N/A
CCR2A	52	Negligible	N/A	N/A
CCR2B	50	Negligible	N/A	N/A
CCR2C	90	High	N/A	N/A
CCR2D	63	Negligible	N/A	N/A
CCR3	53	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR4	46	Negligible	N/A	N/A
CCR5	78	High	N/A	N/A
CCR6	61	Negligible	N/A	N/A
CCR7	48	Negligible	N/A	N/A
CCR8	83	High	N/A	N/A
CCR9	89	High	N/A	N/A
CCR10	60	Negligible	N/A	N/A
CCR11	55	Negligible	N/A	N/A
CCR11A	46	Negligible	N/A	N/A
CCR12	64	Negligible	N/A	N/A
CCR13	57	Negligible	N/A	N/A
CCR14	65	Low	N/A	N/A
CCR15	59	Negligible	N/A	N/A
CCR15A	53	Negligible	N/A	N/A
CCR15B	61	Negligible	N/A	N/A
CCR15C	39	Negligible	N/A	N/A
CCR16	56	Negligible	N/A	N/A
CCR16A	55	Negligible	N/A	N/A
CCR16B	69	Low	N/A	N/A
CCR16C	64	Negligible	N/A	N/A
CCR17	66	Low	N/A	N/A
CCR17A	56	Negligible	N/A	N/A
CCR17B	79	High	N/A	N/A
CCR18	72	Medium	N/A	N/A
CCR18A	50	Negligible	N/A	N/A
CCR19	63	Negligible	N/A	N/A
CCR20	63	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR20A	55	Negligible	N/A	N/A
CCR20B	51	Negligible	N/A	N/A
CCR20C	59	Negligible	N/A	N/A
CCR21	46	Negligible	N/A	N/A
CCR21A	55	Negligible	N/A	N/A
CCR21B	47	Negligible	N/A	N/A
CCR21C	47	Negligible	N/A	N/A
CCR22	59	Negligible	N/A	N/A
CCR22A	60	Negligible	N/A	N/A
CCR22B	53	Negligible	N/A	N/A
CCR22C	50	Negligible	N/A	N/A
CCR23	55	Negligible	N/A	N/A
CCR24	61	Negligible	N/A	N/A
CCR24A	57	Negligible	N/A	N/A
CCR24B	66	Low	N/A	N/A
CCR24C	58	Negligible	N/A	N/A
CCR24D	53	Negligible	N/A	N/A
CCR24E	47	Negligible	N/A	N/A
CCR24F	41	Negligible	N/A	N/A
CCR25	72	Medium	N/A	N/A
CCR25A	48	Negligible	N/A	N/A
CCR25B	54	Negligible	N/A	N/A
CCR26	100	High	N/A	N/A
CCR26A	89	High	N/A	N/A
CCR26B	64	Negligible	N/A	N/A
CCR26C	59	Negligible	N/A	N/A
CCR27	73	Medium	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR27A	70	Medium	N/A	N/A
CCR28	52	Negligible	N/A	N/A
CCR28A	57	Negligible	N/A	N/A
CCR29	64	Negligible	N/A	N/A
CCR29A	49	Negligible	N/A	N/A
CCR30	49	Negligible	N/A	N/A
CCR31	54	Negligible	N/A	N/A
CCR31A	56	Negligible	N/A	N/A
CCR31B	50	Negligible	N/A	N/A
CCR31C	56	Negligible	N/A	N/A
CCR32	73	Medium	N/A	N/A
CCR33	51	Negligible	N/A	N/A
CCR33A	50	Negligible	N/A	N/A
CCR33B	51	Negligible	N/A	N/A
CCR34	70	Medium	N/A	N/A
SSR3	48	Negligible	N/A	N/A
MCR1	57	Negligible	N/A	N/A
Installation of temporary access tracks				
LFR1	55	Negligible	N/A	N/A
CCR2	88	High	N/A	N/A
CCR2A	52	Negligible	N/A	N/A
CCR2B	51	Negligible	N/A	N/A
CCR2C	90	High	N/A	N/A
CCR2D	90	High	N/A	N/A
CCR3	68	Low	N/A	N/A
CCR4	54	Negligible	N/A	N/A
CCR5	79	High	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR6	62	Negligible	N/A	N/A
CCR7	48	Negligible	N/A	N/A
CCR8	83	High	N/A	N/A
CCR9	89	High	N/A	N/A
CCR10	72	Medium	N/A	N/A
CCR11	55	Negligible	N/A	N/A
CCR11A	47	Negligible	N/A	N/A
CCR12	65	Low	N/A	N/A
CCR13	74	Medium	N/A	N/A
CCR14	65	Low	N/A	N/A
CCR15	59	Negligible	N/A	N/A
CCR15A	53	Negligible	N/A	N/A
CCR15B	61	Negligible	N/A	N/A
CCR15C	39	Negligible	N/A	N/A
CCR16	56	Negligible	N/A	N/A
CCR16A	55	Negligible	N/A	N/A
CCR16B	70	Medium	N/A	N/A
CCR16C	64	Negligible	N/A	N/A
CCR17	67	Low	N/A	N/A
CCR17A	56	Negligible	N/A	N/A
CCR17B	79	High	N/A	N/A
CCR18	72	Medium	N/A	N/A
CCR18A	50	Negligible	N/A	N/A
CCR19	63	Negligible	N/A	N/A
CCR20	64	Negligible	N/A	N/A
CCR20A	71	Medium	N/A	N/A
CCR20B	126	High	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR20C	63	Negligible	N/A	N/A
CCR21	47	Negligible	N/A	N/A
CCR21A	55	Negligible	N/A	N/A
CCR21B	48	Negligible	N/A	N/A
CCR21C	48	Negligible	N/A	N/A
CCR22	60	Negligible	N/A	N/A
CCR22A	71	Medium	N/A	N/A
CCR22B	85	High	N/A	N/A
CCR22C	50	Negligible	N/A	N/A
CCR23	73	Medium	N/A	N/A
CCR24	61	Negligible	N/A	N/A
CCR24A	57	Negligible	N/A	N/A
CCR24B	66	Low	N/A	N/A
CCR24C	59	Negligible	N/A	N/A
CCR24D	67	Low	N/A	N/A
CCR24E	47	Negligible	N/A	N/A
CCR24F	44	Negligible	N/A	N/A
CCR25	72	Medium	N/A	N/A
CCR25A	48	Negligible	N/A	N/A
CCR25B	54	Negligible	N/A	N/A
CCR26	100	High	N/A	N/A
CCR26A	89	High	N/A	N/A
CCR26B	64	Negligible	N/A	N/A
CCR26C	59	Negligible	N/A	N/A
CCR27	74	Medium	N/A	N/A
CCR27A	70	Medium	N/A	N/A
CCR28	52	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR28A	84	High	N/A	N/A
CCR29	83	High	N/A	N/A
CCR29A	50	Negligible	N/A	N/A
CCR30	69	Low	N/A	N/A
CCR31	67	Low	N/A	N/A
CCR31A	56	Negligible	N/A	N/A
CCR31B	50	Negligible	N/A	N/A
CCR31C	56	Negligible	N/A	N/A
CCR32	73	Medium	N/A	N/A
CCR33	65	Low	N/A	N/A
CCR33A	51	Negligible	N/A	N/A
CCR33B	52	Negligible	N/A	N/A
CCR34	71	Medium	N/A	N/A
SSR3	57	Negligible	N/A	N/A
MCR1	60	Negligible	N/A	N/A
Establishing temporary work areas				
LFR1	52	Negligible	N/A	N/A
CCR2	85	High	N/A	N/A
CCR2A	49	Negligible	N/A	N/A
CCR2B	48	Negligible	N/A	N/A
CCR2C	87	High	N/A	N/A
CCR2D	60	Negligible	N/A	N/A
CCR3	50	Negligible	N/A	N/A
CCR4	43	Negligible	N/A	N/A
CCR5	76	High	N/A	N/A
CCR6	59	Negligible	N/A	N/A
CCR7	45	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR8	80	High	N/A	N/A
CCR9	87	High	N/A	N/A
CCR10	58	Negligible	N/A	N/A
CCR11	52	Negligible	N/A	N/A
CCR11A	44	Negligible	N/A	N/A
CCR12	62	Negligible	N/A	N/A
CCR13	55	Negligible	N/A	N/A
CCR14	62	Negligible	N/A	N/A
CCR15	56	Negligible	N/A	N/A
CCR15A	50	Negligible	N/A	N/A
CCR15B	59	Negligible	N/A	N/A
CCR15C	36	Negligible	N/A	N/A
CCR16	54	Negligible	N/A	N/A
CCR16A	53	Negligible	N/A	N/A
CCR16B	67	Low	N/A	N/A
CCR16C	61	Negligible	N/A	N/A
CCR17	64	Negligible	N/A	N/A
CCR17A	53	Negligible	N/A	N/A
CCR17B	76	High	N/A	N/A
CCR18	70	Medium	N/A	N/A
CCR18A	47	Negligible	N/A	N/A
CCR19	61	Negligible	N/A	N/A
CCR20	61	Negligible	N/A	N/A
CCR20A	52	Negligible	N/A	N/A
CCR20B	48	Negligible	N/A	N/A
CCR20C	57	Negligible	N/A	N/A
CCR21	44	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR21A	52	Negligible	N/A	N/A
CCR21B	45	Negligible	N/A	N/A
CCR21C	45	Negligible	N/A	N/A
CCR22	57	Negligible	N/A	N/A
CCR22A	57	Negligible	N/A	N/A
CCR22B	50	Negligible	N/A	N/A
CCR22C	48	Negligible	N/A	N/A
CCR23	53	Negligible	N/A	N/A
CCR24	59	Negligible	N/A	N/A
CCR24A	55	Negligible	N/A	N/A
CCR24B	63	Negligible	N/A	N/A
CCR24C	56	Negligible	N/A	N/A
CCR24D	50	Negligible	N/A	N/A
CCR24E	44	Negligible	N/A	N/A
CCR24F	39	Negligible	N/A	N/A
CCR25	69	Low	N/A	N/A
CCR25A	45	Negligible	N/A	N/A
CCR25B	52	Negligible	N/A	N/A
CCR26	97	High	N/A	N/A
CCR26A	87	High	N/A	N/A
CCR26B	61	Negligible	N/A	N/A
CCR26C	56	Negligible	N/A	N/A
CCR27	71	Medium	N/A	N/A
CCR27A	67	Low	N/A	N/A
CCR28	49	Negligible	N/A	N/A
CCR28A	54	Negligible	N/A	N/A
CCR29	61	Negligible	N/A	N/A

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR29A	47	Negligible	N/A	N/A
CCR30	47	Negligible	N/A	N/A
CCR31	52	Negligible	N/A	N/A
CCR31A	53	Negligible	N/A	N/A
CCR31B	47	Negligible	N/A	N/A
CCR31C	53	Negligible	N/A	N/A
CCR32	71	Medium	N/A	N/A
CCR33	49	Negligible	N/A	N/A
CCR33A	48	Negligible	N/A	N/A
CCR33B	49	Negligible	N/A	N/A
CCR34	68	Low	N/A	N/A
SSR3	45	Negligible	N/A	N/A
MCR1	54	Negligible	N/A	N/A
Onshore Main Compound				
CCR22	66 / 57[2]	Low	Low	High
CCR22A	66 / 58[2]	Low	Low	High
CCR22B	59 / 51[2]	Negligible	Negligible	Medium
CCR22C	56 / 48[2]	Negligible	Negligible	Low
MCR1	53 / 55[2]	Negligible	Low	High
2 – Evenings and Weekends/Night time Only				
Trenchless crossings (HDD)				
LFR1	50	Negligible	Negligible	Medium
CCR2	87	High	High	High
CCR2A	51	Negligible	Negligible	Medium
CCR2B	48	Negligible	Negligible	Low
CCR2C	89	High	High	High
CCR2D	62	Negligible	Medium	High

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR3	49	Negligible	Negligible	Low
CCR4	42	Negligible	Negligible	Negligible
CCR5	55	Negligible	Low	High
CCR6	45	Negligible	Negligible	Low
CCR7	46	Negligible	Negligible	Low
CCR8	82	High	High	High
CCR9	34	Negligible	Negligible	Negligible
CCR10	56	Negligible	Low	High
CCR11	52	Negligible	Negligible	Medium
CCR11A	46	Negligible	Negligible	Low
CCR12	38	Negligible	Negligible	Negligible
CCR13	53	Negligible	Negligible	Medium
CCR14	49	Negligible	Negligible	Low
CCR15	54	Negligible	Negligible	Medium
CCR15A	39	Negligible	Negligible	Negligible
CCR15B	56	Negligible	Low	High
CCR15C	38	Negligible	Negligible	Negligible
CCR16	55	Negligible	Low	High
CCR16A	54	Negligible	Negligible	Medium
CCR16B	64	Negligible	Medium	High
CCR16C	61	Negligible	Medium	High
CCR17	60	Negligible	Medium	High
CCR17A	51	Negligible	Negligible	Medium
CCR17B	78	High	High	High
CCR18	61	Negligible	Medium	High
CCR18A	49	Negligible	Negligible	Low
CCR19	57	Negligible	Low	High

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR20	37	Negligible	Negligible	Negligible
CCR20A	48	Negligible	Negligible	Low
CCR20B	50	Negligible	Negligible	Medium
CCR20C	59	Negligible	Low	High
CCR21	46	Negligible	Negligible	Low
CCR21A	54	Negligible	Negligible	Medium
CCR21B	47	Negligible	Negligible	Low
CCR21C	47	Negligible	Negligible	Low
CCR22	58	Negligible	Low	High
CCR22A	58	Negligible	Low	High
CCR22B	50	Negligible	Negligible	Medium
CCR22C	50	Negligible	Negligible	Medium
CCR23	49	Negligible	Negligible	Low
CCR24	60	Negligible	Medium	High
CCR24A	51	Negligible	Negligible	Medium
CCR24B	62	Negligible	Medium	High
CCR24C	53	Negligible	Negligible	Medium
CCR24D	52	Negligible	Negligible	Medium
CCR24E	46	Negligible	Negligible	Low
CCR24F	41	Negligible	Negligible	Negligible
CCR25	71	Medium	High	High
CCR25A	42	Negligible	Negligible	Negligible
CCR25B	48	Negligible	Negligible	Low
CCR26	70	Medium	High	High
CCR26A	78	High	High	High
CCR26B	61	Negligible	Medium	High
CCR26C	58	Negligible	Low	High

NSR identifier	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect		
		Daytime	Evenings and weekends	Night-time
CCR27	57	Negligible	Low	High
CCR27A	69	Low	High	High
CCR28	35	Negligible	Negligible	Negligible
CCR28A	56	Negligible	Low	High
CCR29	64	Negligible	Medium	High
CCR29A	49	Negligible	Negligible	Low
CCR30	46	Negligible	Negligible	Low
CCR31	54	Negligible	Negligible	Medium
CCR31A	56	Negligible	Low	High
CCR31B	50	Negligible	Negligible	Medium
CCR31C	55	Negligible	Low	High
CCR32	60	Negligible	Medium	High
CCR33	51	Negligible	Negligible	Medium
CCR33A	50	Negligible	Negligible	Medium
CCR33B	47	Negligible	Negligible	Low
CCR34	66	Low	High	High
SSR3	46	Negligible	Negligible	Low
MCR1	51	Negligible	Negligible	Medium

23.3.4.3 Onshore substation

25. Potential construction noise at the onshore substation site options is assumed to be the same for all of the construction scenarios: SEP or DEP in isolation, SEP and DEP sequential and concurrent.

26. Noise predictions were undertaken assuming all construction plant is simultaneously operating at each of the substation site options. This approach is considered to display the worst-case scenario for noise levels associated with construction of the onshore substation and assumes all plant is operating at the nearest location to NSRs.

27. Predicted construction noise levels associated with construction of the onshore substation are displayed in **Table 23.3.5**.

Table 23.3.5: Predicted construction noise levels - onshore substation

NSR identifier	Predicted $L_{Aeq,T}$ (dB)		Magnitude of effect		
	Daytime	Evenings and weekends and night-time	Daytime	Evenings and weekends	Night-time
SSR1	40	27	Negligible	Negligible	Negligible
SSR2	44	31	Negligible	Negligible	Negligible
SSR3	47	35	Negligible	Negligible	Negligible
SSR4	36	24	Negligible	Negligible	Negligible
SSR5	43	31	Negligible	Negligible	Negligible
SSR6	47	34	Negligible	Negligible	Negligible
SSR7	41	28	Negligible	Negligible	Negligible
SSR8	38	26	Negligible	Negligible	Negligible
SSR9	43	31	Negligible	Negligible	Negligible
SSR10	42	30	Negligible	Negligible	Negligible

23.3.5 Construction Vibration Calculations

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

29. The vibration predictions for HDD identified the driving energy of the drill to produce a PPV of 0.5mm.s^{-1} at 5m (measured vibration levels in row 106, Table D.6, BS 5228-2). This driving energy (11.1 kJ) was used to calculate the distances at which the vibration criteria would be predicted.

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