XLINKS' MOROCCO-UK POWER PROJECT

Environmental Statement

Volume 2, Appendix 6.2: Construction Noise and Vibration

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RPS

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Xlinks 1 Limited

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Glossary

Term	Meaning
Ambient sound level, $L_{Aeq,T}$	The steady sound level which, over a period of time T, contains the same amount of A-weighted sound energy as the time varying sound over the same period. Also known as the equivalent continuous sound pressure level.
Attenuation	The reduction in magnitude of sound energy.
Basic Noise Level	A measure of traffic source noise prior to development. It is calculated from traffic flows, road speed, and HGV percentage.
Converter station	Part of an electrical transmission and distribution system. Converter stations convert electricity from Direct Current to Alternating Current, or vice versa.
Decibel	A unit used to measure or compare the intensity of a sound by comparing it with a given reference level on a logarithmic scale.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Extrapolation	The extension of a graph, curve, or range of values by inferring unknown values from trends in the known data.
Fast Fourier Transform	A computational algorithm which allows for the conversion of a time signal to a representation in the frequency domain.
Free-field	A situation in which the radiation from a sound source is entirely unaffected by the presence of any reflective boundaries.
Landfall	The proposed area in which the offshore cables make landfall in the United Kingdom (come on shore) and the transitional area between the offshore cabling and the onshore cabling. This term applies to the entire landfall area at Cornborough Range, Devon, between Mean Low Water Springs and the transition joint bays inclusive of all construction works, including the offshore and onshore cable routes, and landfall compound(s).
Noise	An unwanted or unexpected sound.
Onshore HVDC Cable Corridor	The proposed corridor within which the onshore High Voltage Direct Current cables would be located.
Onshore Infrastructure Area	The proposed infrastructure area within the Order Limits landward of Mean High Water Springs. The Onshore Infrastructure Area comprises the transition joint bays, onshore HVDC Cables, converter stations, HVAC Cables, highways improvements, utility diversions and associated temporary and permanent infrastructure including temporary compound areas and permanent accesses.
Peak Particle Velocity	An indicator of the magnitude of ground vibration which refers to the movement of molecular particles within the ground.
Propagation	The transmission of acoustic energy through a medium via a sound wave.
Proposed Development	The element of the Xlinks Morocco-UK Power Project within the UK. The Proposed Development covers all works required to construct and operate the offshore cables (from the UK Exclusive Economic Zone to Landfall), Landfall, onshore Direct Current and Alternating Current cables, converter stations, and highways improvements.
Sound	Fluctuations of pressure within a medium (gas, solid or fluid) within the audible range of loudness and frequencies which excite the sensation of hearing.
Sound Power Level, L_w	The total sound energy emitted by a source per unit time.
Sound Pressure Level, L_p	The amount of force a sound wave exerts on a surface area perpendicular to the direction of travel. A measure of the variation of sound level over a distance.
Spectrum	The presentation of sound in terms of the amount of energy at different frequencies.

Term	Meaning
Study area	This is an area which is defined for each environmental topic which includes the Order Limits as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each topic is intended to cover the area within which an impact can be reasonably expected.
Surface Impedance	A measure of how resistant a surface or material is to allowing sound to pass through. A high surface impedance results in less sound being allowed to transmit through that material and the larger amount of sound energy reflected.
Transmission Loss	A measure of the reduction in sound level of a sound source as it propagates through a medium.
Wavenumber	The number of sound waves in a unit distance.
Xlinks' Morocco UK Power Project	The overall scheme from Morocco to the national grid, including all onshore and offshore elements of the transmission network and the generation site in Morocco (referred to as the 'Project').

Acronyms

Term	Meaning
BNL	Basic Noise Level
BS	British Standard
CoPA	Control of Pollution Act
CRTN	Calculation of Road Traffic Noise
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicles
ISO	International Organisation for Standardisation
LOAEL	Lowest Observed Adverse Effect Level
OS	Ordnance Survey
ES	Environmental Statement
PPV	Peak Particle Velocity
SOAEL	Significant Observed Adverse Effect Level
UK	United Kingdom

Units

Term	Meaning
dB	Decibel
m	Metres
mm	Millimetre
mm/s	Millimetres per second

1 CONSTRUCTION NOISE AND VIBRATION

1.1 Introduction

1.1.1 This document forms Volume 2, Appendix 6.2: Construction Noise and Vibration of the Environmental Statement (ES) prepared for the United Kingdom (UK) elements of the Xlinks Morocco-UK Power Project (the 'Project'). For ease of reference, the UK elements of the Project are referred to as the 'Proposed Development, which is the focus of the Environmental Statement (ES). The ES presents the findings of the Environmental Impact Assessment (EIA) process for the Proposed Development.

1.1.2 This document provides full details of the methodology and results of the construction noise and vibration impact assessment for the Proposed Development. Construction noise and vibration impact criteria have been derived from the baseline sound survey data obtained at the nearest noise-sensitive receptors within the construction noise and vibration study area.

1.1.3 No baseline vibration surveys were undertaken since vibration impacts are assessed against absolute criteria as opposed to criteria derived based on the existing environment which is the case for noise impacts.

1.2 Study Area

1.2.1 The noise and vibration study area focuses on noise and vibration sensitive receptors landward of Mean High Water Springs where potential impacts are more likely to occur. A brief description of each study area is provided below with graphical representations provided in **Figure 1** to **Figure 4.**

1.2.2 The noise and vibration study area has been defined in line with best practice guidance and consider the regions in which potential impacts are most likely to occur at receptors sensitive to noise and vibration.

1.2.3 The construction and decommissioning noise and vibration study area has been defined with reference to the guidance in DMRB LA111 – Noise and Vibration. Note 1 of paragraph 3.5 of DMRB LA111 states the following regarding noise sensitive receptors:

'A study area of 300 m from the closest construction activity is normally sufficient to encompass noise sensitive receptors.'

1.2.4 Similarly, Note 1 of paragraph 3.29 of DMRB LA111 states the following regarding vibration sensitive receptors:

'A study area of 100 m from the closest construction activity with the potential to generate vibration is normally sufficient to encompass vibration sensitive receptors.'

1.2.5 In summary, the noise and vibration study areas to be used in the assessment will be defined as:

- the area of land temporarily or permanently occupied during the construction, operation and maintenance, and decommissioning of the Proposed Development;

- noise sensitive receptors located within 300 m of construction activities; and
- vibration sensitive receptors located within 100 m of construction activities with the potential to generate vibration.

N

0 500 1,000 m

Notes
1. This plan is scaled at paper size A3. If received electronically it is the recipients responsibility to print to the correct scale. Only written dimensions should be used.

Legend

- Order Limits
- Abnormal Indivisible Loads Route Works
- Converter Site
- Compound
- Compound Design B Option
- 300m Study Area

Rev	Description	By	CB	Date
P01	FINAL	SHB	MB	12.11.24

Xlinks

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: Construction Noise Study Area

Status: FINAL

Scale @ A3: 1:35,000

Date Created: Nov 2024

Figure Number: 1

Rev: P01

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0 500 1,000 m

Notes
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Legend

- Order Limits
- Abnormal Indivisible Loads Route Works
- Converter Site
- Compound
- Compound Design B Option
- 100m Study Area

Rev	Description	By	CB	Date
P01	FINAL	MP	PK	12.11.24

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: Construction Vibration Study Area

Status	Scale @ A3	Date Created
FINAL	1:35,000	Nov 2024

Figure Number: **2**

Rev: **P01**

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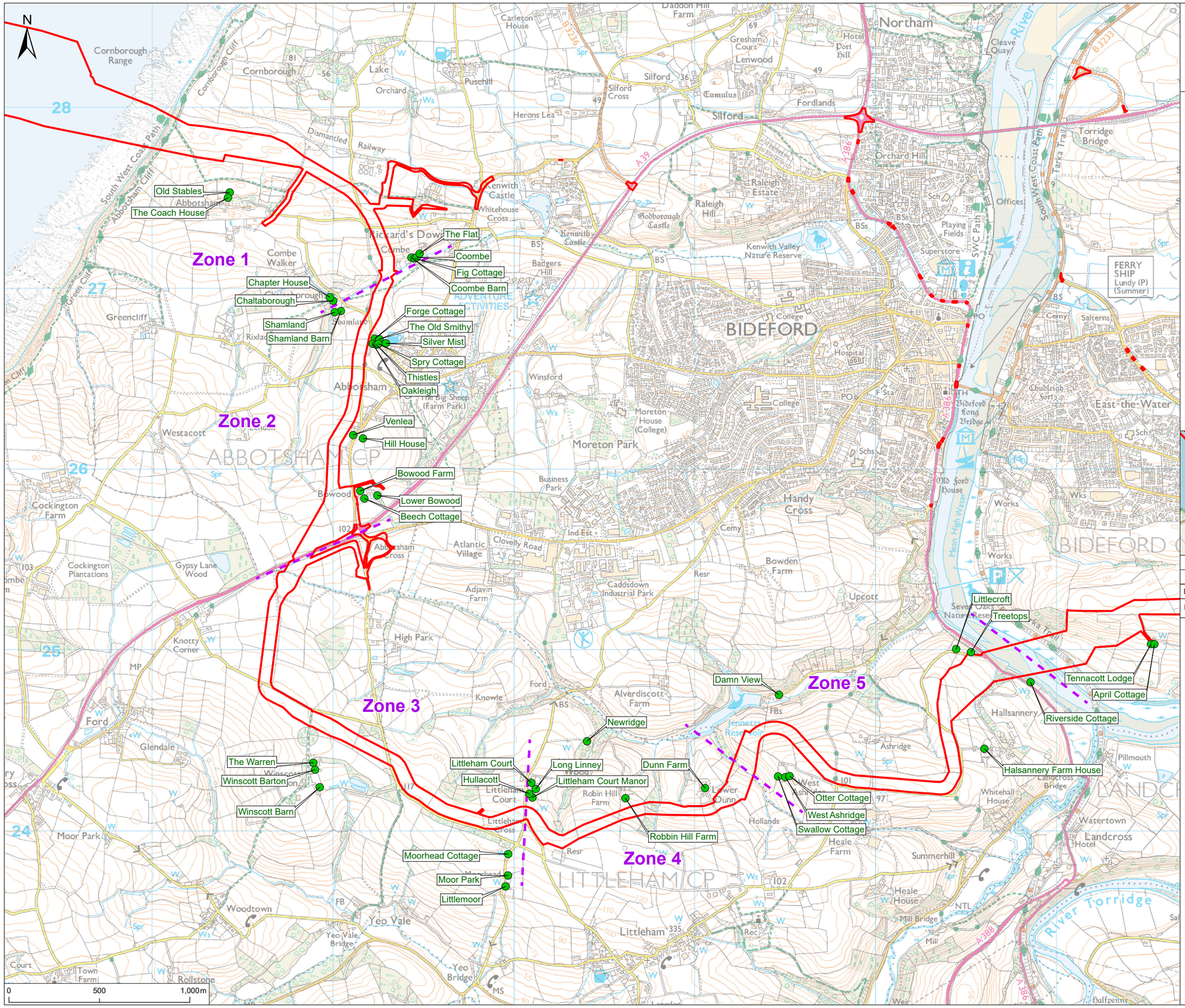

Notes
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Legend

- Order Limits
- Zone Boundary
- Noise Receptor - Construction

Rev	Description	By	CB	Date
P01	FINAL	MP	PK	12.11.24

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: Noise Receptors Considered in the Assessment

Status: FINAL

Scale @ A3: 1:20,000

Date Created: Nov 2024

Figure Number: **3a**

Rev: **P01**

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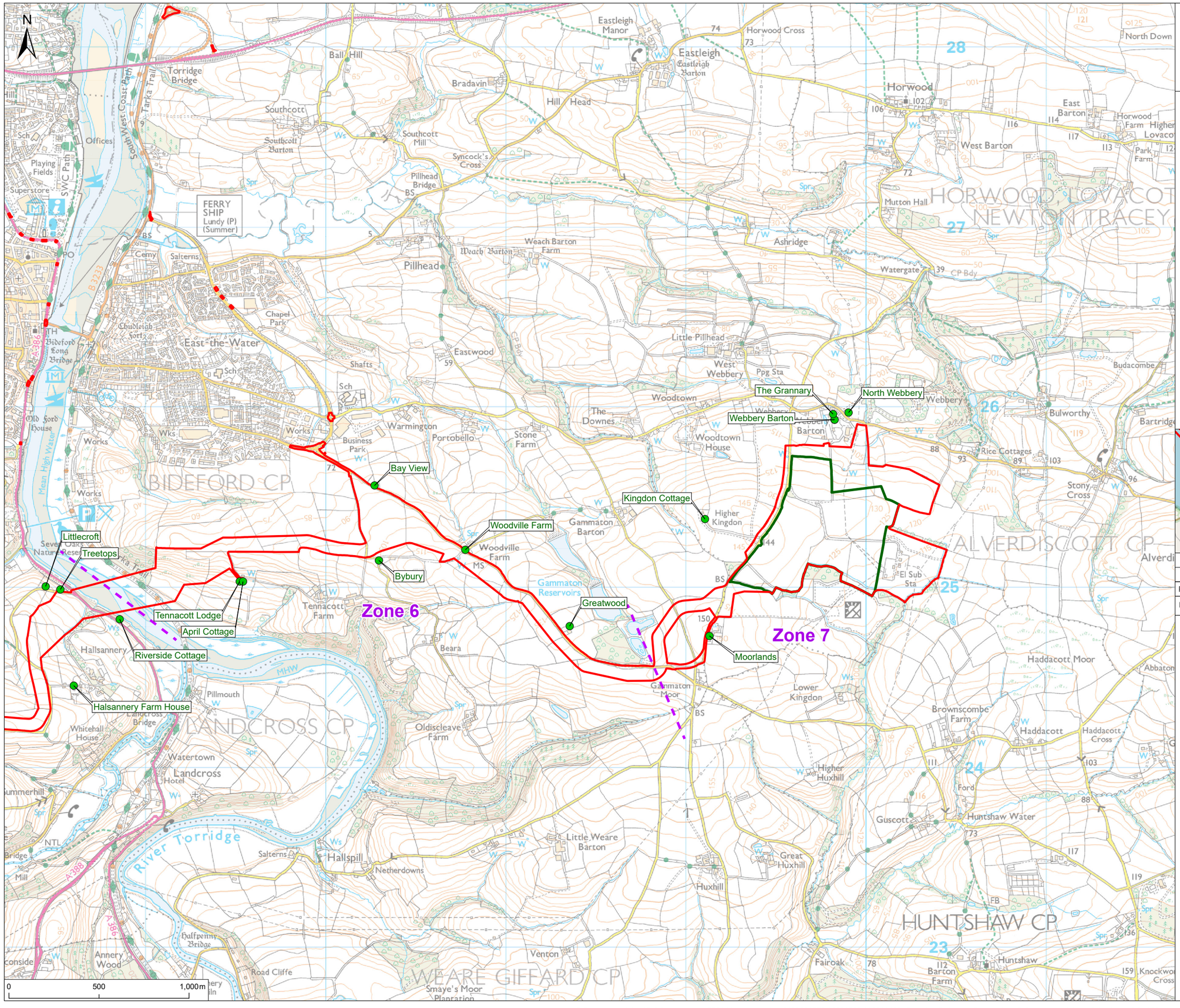

Notes
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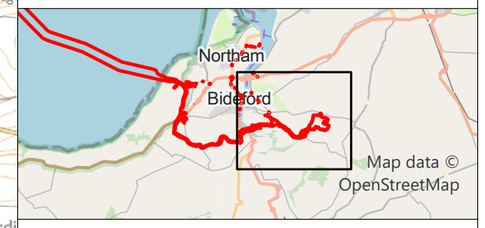
Legend

- Order Limits
- Converter Site
- Zone Boundary
- Noise Receptor - Construction



P01	FINAL	MP	PK	12.11.24
Rev	Description	By	CB	Date

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: Noise Receptors Considered in the Assessment

Status: FINAL

Scale @ A3: 1:20,000

Date Created: Nov 2024

Figure Number: **3b**

Rev: **P01**

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N

0 500 1,000 m

Notes
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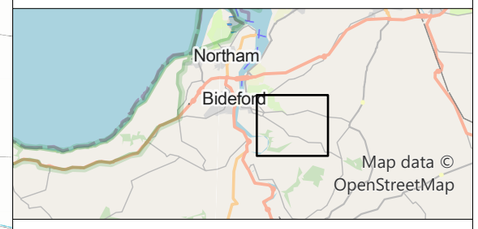
Legend

Order Limits

Noise Level dB(A)

- 40
- 42
- 44
- 46
- 48
- 50
- 52
- 54
- 56



Rev	Description	By	CB	Date
P01	FINAL	MP	MB	12.11.24

Client: Xlinks 1 Limited

Project: Xlinks' Morocco-UK Power Project

Title: Construction Noise Traffic Contours

Status	Scale @ A3	Date Created
FINAL	1:12,500	Nov 2024

Figure Number: **4**

Rev: **P01**

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1.3 Legislation and guidance

1.3.1 This section contains a summary of the relevant guidance and legislation for construction noise and vibration control.

Control of Pollution Act 1974

1.3.2 Section 60 of the Control of Pollution Act 1974 (CoPA) refers to the control of noise on construction sites. It outlines legislation by which Local Authorities can control noise from construction sites and prevent noise disturbance.

1.3.3 British Standards (BS) 5228-1:2009+A1:2014 and BS 5228 2:2009+A1:2014 were approved within The Control of Noise (Code of Practice for Construction and Open Sites) Order 2015 as suitable guidance on appropriate methods for the control of noise from construction and open sites in exercise of the powers conferred on the Secretary of State by sections 71(1)(b), (2), (3), and (6) of the CoPA.

1.3.4 The CoPA provides a Local Authority the power to serve a notice imposing requirements for the way in which construction works are to be carried out in their jurisdiction. This notice can specify the following:

- The plant or machinery permitted for use.
- The hours during which construction work may be undertaken.
- Limits for the emission levels of noise and vibration due to the works at any time or spatial position on site.
- Any other change in circumstance.

1.3.5 Section 61 of the CoPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. Providing consent is granted, and compliance is maintained with the stated method and hours of work, no action may be taken by the Local Authority under Section 60.

1.3.6 Section 71 of the CoPA refers to the preparation and approval of codes of practice for minimising noise.

1.3.7 Section 72 of the CoPA refers to BPM, which is defined as:

'In that expression, 'practicable' means reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. Whilst 'Means' includes the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures.'

Environmental Protection Act 1990

1.3.8 Section 79, Part of the Environmental Protection Act (EPA) contains a list of matters that amount to statutory nuisances and places a duty on Local Authorities to regularly inspect areas in their jurisdiction to determine where statutory nuisances may exist.

1.3.9 The Local Authority must serve an abatement notice where it is satisfied of the existence of a statutory nuisance or the likelihood of a statutory nuisance arising or reoccurring. Section 80 of the EPA provides Local Authorities with the power to serve an abatement notice to prohibit or restrict its occurrence or recurrence; and to carry out works or other action necessary to abate the nuisance.

1.3.10 Section 82 of the EPA allows a Magistrates' court to act on a complaint made by any person on the grounds that they are aggrieved by a statutory nuisance, such as noise. The procedures for appeals against abatement notices are detailed in the Statutory Nuisance (Appeals) Regulations 1995.

1.3.11 A Statutory Nuisance Statement is provided with the application (document reference 7.6).

British Standard 5228

1.3.12 British Standard (BS) comprises two parts:

- BS 5228-1:2009+A1:2014 – *'Code of practice for noise and vibration control on construction and open sites'* – Part 1: Noise
- BS 5228-2:2009+A1:2014 – *'Code of practice for noise and vibration control on construction and open sites'* – Part 2: Vibration.

1.3.13 The Standard provides guidance, information, and procedures for the control of noise and vibration from demolition and construction sites. BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014 gained approval as guidance on appropriate methods for minimising noise from construction and open sites under the relevant sections of the CoPA.

1.3.14 There are no set standards for the definition of the significance of construction noise effects. However, noise example criteria are provided in BS 5228-1:2009+A1:2014 Annex E and vibration example criteria are provided in BS 5228-2:2009+A1:2014 Annex B.

1.3.15 BS 5228-1:2009+A1:2014 provides basic information and recommendations for methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels. It includes sections on:

- community relations;
- noise and persons on site;
- neighbourhood nuisance;
- project supervision; and
- the control of noise.

1.3.16 The annexes include information on legislative background, noise sources, remedies, and their effectiveness (mitigation options); current and historic sound level data for on-site equipment and site activities; significance of noise effects; calculation procedures estimating sound emissions from sites and sound level monitoring; types of piling; and air overpressure.

1.3.17 BS 5228-2:2009+A1:2014 contains information and recommendations for basic methods of vibration control arising from construction and open sites where work activities/operations generate significant levels of vibration. It includes sections on community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement. BS 5228-

2:2009+A1:2014 refers to BS International Organisation for Standardisation (ISO) 4866:2010; BS 7385-2:1993; BS 6472-1:2008, and BS 6472-2:2008 for further advice on the significance of vibration.

Design Manual for Roads and Bridges – LA111 – Noise and Vibration

1.3.18 The Design Manual for Roads and Bridges (DMRB) LA111 Revision 2 (Highways England, Transport Scotland, Llwyodraeth Cymru, Department for Infrastructure, 2020), provides guidance on methods for assessing noise and vibration from construction traffic.

1.3.19 The magnitude of noise impacts is assessed using the predicted change in the Basic Noise Level (BNL) on the closest public roads to a receptor following the introduction of construction traffic.

1.3.20 The noise change is calculated using the methods outlined in the Calculation of Road Traffic Noise (CRTN) (Department for Transport, 1988) which considers the following:

- the change in traffic flow due to construction traffic;
- vehicle speed; and
- the percentage of Heavy Goods Vehicles (HGVs).

1.3.21 Paragraph 3.19 of DMRB LA111 states the following:

'Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- *10 or more days or nights in any 15 consecutive days or nights*
- *A total number of days exceeding 40 in any 6 consecutive months.*'

1.3.22 Additional guidance is provided for the determination of construction noise impact criteria in terms of the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL). This is summarised in Table 6.3 of Volume 2, Chapter 6: Noise and Vibration, of the ES, and is reproduced in **Table 1.1** below for brevity and ease of reference.

Table 1.1: Summary of noise exposure hierarchy from NPSE and PPG

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level (NOEL)			
Not present	No effect.	No Observed Effect.	No specific measures required.
No Observed Adverse Effect Level (NOAEL)			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour, attitude, or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect.	No specific measures required.

Response	Examples of Outcomes	Increasing Effect Level	Action
Lowest Observed Adverse Effect Level (LOAEL)			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g., turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect.	Mitigate and reduce to a minimum.
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g., avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening, and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect.	Avoid.
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g., auditory and non-auditory.	Unacceptable Adverse Effect.	Prevent.

1.4 Assessment criteria

1.4.1 Based on the guidance above, the following impact criteria have been adopted for the assessment of construction noise and vibration impacts.

Construction noise

1.4.2 Impact criteria for construction noise have been determined in accordance with the guidance in DMRB LA111 and Annex E of BS 5228-1:2009+A1:2014. DMRB LA 111 provides the following guidance in **Table 1.2** for determining the LOAEL and SOAEL for construction noise and in **Table 1.3** for determining the magnitude of impact.

Table 1.2: Construction time period – LOAEL and SOAEL

Time Period	LOAEL	SOAEL
Weekdays (7am-7pm) and Saturdays (7am-1pm)	Baseline noise levels, $L_{Aeq,T}$	Threshold level determined as per BS 5228-1:2009+A1:2014.
Evening (7pm-11pm) and Weekends (1pm-11pm on Saturdays and 7am-11pm on Sundays)		
Night (11pm-7am)		

Table 1.3: Construction noise impact magnitude criteria

Magnitude of Impact	Construction Noise Level
High	$L_{Aeq,T} \geq$ SOAEL + 5 dB
Medium	SOAEL $\leq L_{Aeq,T} <$ SOAEL +5 dB
Low	LOAEL $\leq L_{Aeq,T} <$ SOAEL
Negligible	$L_{Aeq,T} <$ LOAEL

1.4.4 The threshold levels which quantify the LOAEL and SOAEL have been derived from Example Method 2 in Annex E 3.3 of BS 5228-1:2009+A1:2014 which states the following:

'Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB L_{Aeq}, from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect.'

1.4.5 Section 3 of DMRB LA 111 states, provides alternative durations when considering the significance of effect of transient construction works. Since many of the construction works undertaken are indeed likely to be transient in nature, the following durations are considered in the assessment of significant effects:

'Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days in any 15 consecutive days or nights;

2) a total number of days exceeding 40 in any 6 consecutive months'

1.4.6 Given the low ambient sound climate in the area surrounding the Proposed Development, the lower cut-off values above provide the SOAEL against which construction noise impacts will be assessed.

1.4.7 The core construction working hours proposed are 7am - 7pm on weekdays and 7pm - 1pm on Saturdays. However, some construction activities may require works outside of these times and thus criteria have been derived for all possible construction periods outlined in BS 5228:2009+A1:2014.

Construction traffic

1.4.8 There may be a change in local noise levels due to contributions from construction traffic on local road networks and temporary diversion networks during the construction of the Proposed Development.

1.4.9 The impact assessment will take account of the absolute level of the road traffic noise and the existing sound levels at the nearest receptors.

1.4.10 Impact criteria for these changes have been obtained from the guidance in DMRB LA 111 and are presented in **Table 1.4** below.

Table 1.4: Construction traffic noise criteria

Magnitude of Impact	Increase in Basic Noise Level (BNL) of closest public road used for construction traffic (dB)
High	BNL ≥ 5
Medium	3 ≤ BNL < 5
Low	1 ≤ BNL < 3
Negligible	BNL < 1

Construction vibration

1.4.11 Impact criteria for vibration from construction have been identified based on guidance provided in BS 5228-2:2009+A1:2014. The following outline criteria in defined in **Table 1.5** in terms of Peak Particle Velocity (PPV) can be used to identify potential significant impacts on nearby receptors.

Table 1.5: Construction vibration criteria

Magnitude of Impact	Vibration Level, Peak Particle Velocity (PPV), mm/s
High	1 ≤ PPV < 10
Medium	0.3 ≤ PPV < 1
Low	0.14 ≤ PPV < 0.3
Negligible	PPV < 0.14

1.4.12 As with construction noise, the durations outlined in **paragraph 1.4.5** above are considered in the assessment of significant effects as per in Section 3 of DMRB LA 111.

1.5 Construction noise assessment

Methodology

1.5.1 The construction noise impacts have been predicted based upon a construction plant list for each of the various activities required within the Onshore Infrastructure Area. The full list of plant for each scenario is presented in **Annex A**. The source data presented in **Annex A** has been corrected for the 'on-time' which has been defined as the proportion of the day, evening, or night-time period for which the plant is likely to be in operation.

1.5.2 The construction working hours proposed are 7am to 7pm from Monday to Friday and 7am to 1pm on Saturday. Construction noise impacts due to trenchless techniques have been assessed against the night-time criteria due to the potential for night-time working.

1.5.3 As a guiding practice, noise emissions will be minimised as far as is reasonably practicable in accordance with the approved code of practice BS 5228:2009+A1:2014. Table B.1 in Annex B of BS 5228-1:2009+A1:2014 outlines typical losses associated with construction noise mitigation measures. A summary of the mitigation measures used to inform the assessment is provided in **Table 1.6** below.

Table 1.6: Noise reduction levels for typical construction plant mitigation

Mitigation Measure	Indicative Reduction in Noise Level (dB)	Justification/Source
Enhanced sound reduction equipment on diesel or petrol engines.	Between 5 and 10 dB	Table B.1, Annex B, BS 5228 - 1:2009+A1:2014
Ventilated enclosures around breakers and rock drills.	Up to 20 dB	Table B.1, Annex B, BS 5228 - 1:2009+A1:2014
Ventilated acoustic shed for the use of rotary drills and boring plant.	Up to 15 dB	Table B.1, Annex B, BS 5228 - 1:2009+A1:2014

1.5.4 Other effective mitigation measures which may be used as alternative measures or in conjunction with the measures outlined in **Table 1.6** include the following:

- limiting the use of loud equipment during the night-time;
- increasing the distance between concurrent construction works;
- positioning plant items away from noise-sensitive receptors; and
- avoiding the simultaneous operation of loud plant items, where possible.

1.5.5 Two methodologies have been adopted to determine the potential noise impacts depending on whether the activity is likely to be concentrated within a single area or spread along sections of the Onshore HVDC Cable Corridor, as detailed below.

1.5.6 The impact magnitude bands are inserted as spatial buffers around the Onshore Infrastructure Area at the distance at which the impact magnitude changes. The distance after which a significant adverse effect is not expected to occur has been calculated based on the worst-case phase of works for each construction activity.

Construction activities concentrated within one area

1.5.7 Construction activities likely to be concentrated within one area have been modelled using 3D acoustic modelling software (SoundPLAN v8.2). The works assessed using this method include:

- establishing access and temporary construction compounds;
- excavation of joint bays (including the transition joint bay;
- joint bay (including the transition joint bays) construction (walls and base);
- jointing of cables in the transition joint bays and joint bays;
- backfill over the transition joint bays and joint bays; and,

- Converter Site construction:
  - Groundworks;
  - building foundation works, including rock bolting; and
  - building fabrication and plant installation.

1.5.8 Construction compounds are an essential part of the works undertaken as part of the construction of the Onshore HVDC Cable Corridor, and the Converter Site. As the exact layout and use of each compound is not yet known, a detailed assessment of the noise impacts due to works required to establish the compounds has been carried out. The assessment of the noise impacts due to the works to establish compounds has been undertaken assuming the construction plant associated with their construction are spread across each compound area.

1.5.9 It is understood that as part of the Onshore HVDC Cable Corridor construction works, up to 34 joint bays will be constructed every 800 – 1200 m to connect lengths of cable, in addition to two transition joint bays at Landfall to connect the offshore and onshore cables. Although the exact locations of the joint bays along the Onshore HVDC Cable Corridor cannot be determined at this stage, a worst case has been assumed by situating the joint bays close to residential dwellings bordering the Order Limits. The detailed assessment has been undertaken assuming the construction plant associated with these activities are situated within the Order Limits but close to noise sensitive receptors.

1.5.10 The Converter Site is understood to comprise valve hall buildings, cooling equipment and converter transformers and associated plant required to converter Direct Current (DC) into Alternating Current (AC) electricity for onward transmission to the national grid. Works associated with the construction of the Converter Site have been assessed to establish any likely adverse impacts at nearby noise sensitive receptors. A detailed assessment of the noise impacts associated with the construction of the Converter Site has been undertaken assuming the construction plant associated with these activities are situated close to noise sensitive receptors. Following review of information available online, Sound Power Levels generated by a Tracked Mobile Drilling Rig, are considered to be representative of rock bolting, used in the construction of the Converter Site. These are shown in **Annex A**.

1.5.11 Equipment expected to be used as part of each activity has been considered, with noise generated during each phase of works calculated, and is shown in **Annex A**. The noise levels generated during each phase of works, at the nearest receptors are shown in **Annex B**.

1.5.12 The transition joint bays at Landfall have been assessed separately, and the results are shown in **Table 1.7** below.

Table 1.7: Transition joint bay construction noise assessment

Receptors	LOAEL	SOAEL	Predicted Worst Case Noise Level (dB)	Magnitude of Impact
Old Stables	43	65	50	Low
The Coach House	43	65	48	Low

Transient construction activities along the Onshore HVDC Cable Corridor

1.5.13 There are some construction activities which are expected to be more transient in nature than those listed above and noise from these will move along sections of the Onshore HVDC Cable Corridor. It is not known exactly where these works will occur at any given time and, as such, there would be a high degree of uncertainty in the output of any 3D acoustic model constructed to predict potential noise impacts.

1.5.14 An alternative method has been adopted whereby construction activities which are likely to be transient and move along the Onshore HVDC Cable Corridor have been predicted at various distances to determine where the impact magnitudes change within the proposed noise and vibration study areas.

1.5.15 The impact magnitude bands are inserted as spatial buffers around the Onshore HVDC Cable Corridor at the distance at which the impact magnitude changes.

1.5.16 The works assessed using this method include:

- site preparation;
- fencing;
- topsoil strip;
- haul road construction;
- trench excavation and duct installation;
  - trench backfill;
  - trench route and topsoil reinstatement; and
  - haul road removal.

1.5.17 Equipment expected to be used as part of each activity has been considered, with noise generated during each phase of works calculated. The phase of works at each stage of the trenching works, which generates the highest noise levels has been used to establish the magnitude of impact bands. The phases of works considered for each stage of the trenching works, and the noise levels generated by these are shown in **Table 1.8**.

Table 1.8: Noise levels generated as part of the transient construction works

Activity	Phase of Works	Sound Power from Each Phase of Works (SWL dB(A))
Transient Cable Route Works	Site Preparation	111
	Trench Excavation	110
	Trench Backfill	109
	Trench Route Reinstatement	110
	Haul Road Removal	110

Results

1.5.18 The results of the construction noise assessment for works spread along the Onshore HVDC Cable Corridor are presented in **Table 1.9** below. The impacts

have been predicted based upon the LOAEL at receptors where baseline sound levels were lowest to inform a robust assessment.

Table 1.9: Construction noise impact bands

Activity	Dominant Phase of Works	Impact Magnitude Band Distance (m)			Number of receptors per magnitude band		
		High	Medium	Low	High	Medium	Low
Open-cut Trenching Works	Site Preparation/Ground Works	45	80	1,000	1	6	1740

1.5.19 The results of the 3D acoustic modelling undertaken for the Horizontal Directional Drilling (HDD) works and joint bays along the Onshore HVDC Cable Corridor are tabulated in **Annex C** and **Annex D**, respectively.

Trenchless techniques

1.5.20 The majority of the Onshore HVDC Cable Corridor will be installed via open-cut trenching methods. However, cable ducting will be installed via HDD or other trenchless techniques where the Onshore HVDC Cable Corridor crosses existing infrastructure and sensitive habitats such as major roads, rivers or woodland.

1.5.21 The maximum design scenario for the installation of cable ducts at Landfall is represented by the use of HDD with the Landfall compound situated to the west of Bideford. Up to 6 HDD crossings (inclusive of Landfall), which comprise 2 entry/exit pits per crossing, have been assessed as part of the maximum design scenario. The seaward end of the Landfall HDD has not been assessed.

1.5.22 The trenchless works will be undertaken to assist with the connection of the offshore and onshore cables in the transition joint bay and ultimately to the converter stations. The HDD compounds have been modelled in SoundPLAN in a location close to residential receptors to ensure a robust and conservative assessment of the likely noise impacts.

1.5.23 The detailed assessment of noise impacts associated with trenchless techniques have been undertaken assuming the construction plant associated with the works are located within the HDD compound closest to the receptors that occur within the established 300 m study area.

1.5.24 Details of all modelling inputs for the equipment required are presented in **Annex A**, with all mitigation and corrections for equipment quantity and operational time applied. Results of the noise modelling are shown in **Annex D**.

1.6 Construction vibration assessment

Methodology

1.6.1 The use of vibratory rollers for the dynamic compaction during the construction of the haul road, construction compounds, and Converter Site platform has been assessed to determine the likelihood of adverse impacts on nearby receptors.

1.6.2 The assessment has been undertaken with reference to the guidance in Table E.1 of BS 5228-2:2009+A1:2014. This guidance provides empirically derived formula for the prediction of vibration impacts arising from mechanised construction works.

During start up and run down, the resultant PPV v_{res} may be calculated using the following equation:

$$v_{res} = k_t\sqrt{n_d}\left[\frac{A}{x + L_d}\right]^{1.5} \quad (1)$$

1.6.3 The impacts with distance during steady state vibratory compaction works may be predicted using the following:

$$v_{res} = k_s\sqrt{n_d}\left[\frac{A^{1.5}}{(x + L_d)^{1.3}}\right] \quad (2)$$

- v_{res}: PPV (mm/s)
- k_t and k_s: scaling factors associated with the probability of exceedance
- n_d: number of vibrating drums
- A: maximum amplitude of drum vibration (mm)
- x: source-receiver separation distance along the ground surface (m)
- L_d: vibrating roller drum width (m).

1.6.4 It is understood that vibratory piling may be required for the installation of the HDD entry and exit pits, as well as for the construction of the Converter Site platform. The potential vibration impacts have been predicted based on the guidance in Table E.1 of BS 5228-2:2009+A1:2014 which provides the following equation for the prediction of vibration impacts with distance due to vibratory piling:

$$v_{res} = \frac{k_v}{x^{\delta}} \quad (3)$$

- v_{res}: PPV (mm/s)
- k_v: scaling factor associated with the probability of exceedance
- x: source-receiver separation distance along the ground surface (m)
- δ: dimensionless empirical constant
  - Start up and run-down: δ = 1.2
  - All operations: δ = 1.3
  - Steady state operations: δ = 1.4

Results

1.6.5 Impact magnitude bands have been generated to determine the magnitude of impact at difference distances during the dynamic compaction of the haul road, construction of the temporary construction compounds, and the construction of the Converter Site platform. Consideration has also been given to the potential vibration impacts arising due to piling activities for the installation of the HDD entry/exit pits. The results are presented in **Table 1.10** below.

Table 1.10: Number of receptors per construction vibration impact bands at each phase of works

Construction Activity	Impact Magnitude Band Distance (m)			Number of receptors per magnitude band		
	High	Medium	Low	High	Medium	Low
Works Carried Out Along the Cable Route						
Dynamic compaction - compounds	13	71	160	0	1	8
Dynamic compaction - haul road compaction	13	71	160	0	15	50
HDD Works Along the Cable Route						
Vibratory piling– HDD entry and exit pits	12	73	186	0	1	14
Works Associated with Construction of Converter Site, Compounds, and Haul Road						
Dynamic compaction - compounds	13	71	160	0	1	1
Dynamic compaction - haul road compaction	13	71	160	0	1	3

1.6.6 It should be noted that the assessment has not accounted for any vibration control measures included within the Outline Onshore Construction Environmental Management Plan (On-CEMP) (document reference 7.7) and that the results of the assessment present the highest possible vibration levels within the parameters of the empirical formulae used for predictions.

1.7 Construction traffic

Existing Highway Network

1.7.1 The noise impacts due to the introduction of additional construction vehicles on the local highway network around the Proposed Development may increase noise levels at nearby receptors.

1.7.2 The assessment has been informed by predicted construction traffic flows from the transport and traffic assessments set out in Chapter 5 of the ES. The construction traffic assessment presents the number of vehicle movements generated during the construction phase across 17 links. These are shown in **Table 1.11** below.

Table 1.11: Construction Traffic Flows (Peak Daytime Construction Traffic Flows)

Highway link	Base traffic flows		Construction traffic flows		% increase	
	Total vehicles	HGVs	Total vehicles	HGVs	Total vehicles	HGVs
Link 1: A39 between Lake Roundabout and Roundswell Roundabout	33,805	1,031	710	105	2.1%	10.2%

Highway link	Base traffic flows		Construction traffic flows		% increase	
	Total vehicles	HGVs	Total vehicles	HGVs	Total vehicles	HGVs
Link 2: A39 between Roundswell Roundabout and B3233	21,377	760	710	105	3.3%	13.8%
Link 3: A39 between B3233 and Heywood Road Roundabout	25,001	861	710	105	2.8%	12.2%
Link 4: A39 between Heywood Road Roundabout and B3236 Buckleigh Road	16,229	521	714	105	4.4%	20.1%
Link 5: A39 between B3236 Buckleigh Road and Abbotsham Cross Roundabout	14,782	427	718	105	4.9%	24.6%
Link 6: A39 between B3236 Buckleigh Road and Abbotsham Cross Roundabout	7,725	243	170	105	2.2%	43.2%
Link 7: B3233 Barnstaple Street between Barnstaple Street Roundabout and Manteo Way	12,180	487	548	77	4.5%	15.8%
Link 8: Manteo Way between Barnstaple Street and Gammaton Road	8,616	295	548	77	6.4%	26.1%

Highway link	Base traffic flows		Construction traffic flows		% increase	
	Total vehicles	HGVs	Total vehicles	HGVs	Total vehicles	HGVs
Link 9: Gammaton Road between Manteo Way and Tennacott Lane	833	10	548	77	65.8%	737.1%
Link 10: Gammaton Road between Tennacott Lane and Moorview House	833	10	0	0	0.0%	0.0%
Link 11: Gammaton Moor Road between Moorview House and Alverdiscott Substation access	91	5	0	0	0.0%	0.0%
Link 12: A386 between Heywood Road Roundabout and Wooda Road (and incorporating Wooda Road)	4,656	67	0	0	0.0%	0.0%
Link 13: A386 between Heywood Road Roundabout and Ford Rise	14,231	481	39	35	0.3%	7.3%
Link 14: A386 between Ford Rise and Wesleyan Chapel	9,850	324	39	35	0.4%	10.8%
Link 15: B3236 Buckleigh Road between A39	2,015	21	39	35	1.9%	165.9%

Highway link	Base traffic flows		Construction traffic flows		% increase	
	Total vehicles	HGVs	Total vehicles	HGVs	Total vehicles	HGVs
and Pusehill Road						
Link 16: Bowood Farm Road between Abbotsham Cross Roundabout and Construction Compound Access 2	1,634	36	647	35	39.6%	97.9%
Link 17: Littleham Road between Abbotsham Cross Roundabout and Construction Compound Access 3	1,869	110	39	35	2.1%	31.7%

1.7.3 The increase in noise levels due to construction vehicles on the roads considered above, has been established based on the increase of the vehicles and HGVs on each link road considered above, in accordance with the methodology set out in CRTN and DMRB. The increase in noise levels, and their impact, are shown in **Table 1.12** below.

Table 1.12: Assessment of Construction Phase Road Traffic Noise

Highway link	Base traffic flows		Traffic flows during construction phase		Noise Levels Generated at Roadside (dB $L_{A10,18hr}$)		
	Total vehicles	HGVs	Total vehicles	HGVs	Baseline	During Construction	Difference
Link 1	33,805	1,031	34,515	1,136	77.3	77.4	+0.1
Link 2	21,377	760	22,087	865	75.4	75.5	+0.1
Link 3	25,001	861	25,711	966	76.1	76.2	+0.1
Link 4	16,229	521	16,943	626	74.1	74.4	+0.3
Link 5	14,782	427	15,500	532	73.6	73.9	+0.3
Link 6	7,725	243	7,895	348	70.9	71.2	+0.3
Link 7	12,180	487	12,728	564	73.1	73.2	+0.1
Link 8	8,616	295	9,164	372	71.4	71.8	+0.4

Highway link	Base traffic flows		Traffic flows during construction phase		Noise Levels Generated at Roadside (dB $L_{A10,18hr}$)		
	Total vehicles	HGVs	Total vehicles	HGVs	Baseline	During Construction	Difference
Link 9	833	10	1,381	87	53.1	60.5	+7.4
Link 10	833	10	833	10	53.1	53.1	+0.0
Link 11	91	5	91	5	7.2	7.2	+0.0
Link 12	4,656	67	4,656	67	68.4	68.4	+0.0
Link 13	14,231	481	14,270	516	73.5	73.6	+0.1
Link 14	9,850	324	9,889	359	71.9	72.1	+0.2
Link 15	2,015	21	2,054	56	63.1	63.6	+0.5
Link 16	1,634	36	2,281	71	61.4	64.6	+3.2
Link 17	1,869	110	1,908	145	63.4	63.9	+0.5

1.7.4 **Table 1.12** shows that with the exception of two road links, Link 9 and 16, construction traffic will generate an increase of less than +0.5 dB on the local road network. The impact of construction phase traffic on the vast majority of the local road network is therefore negligible in accordance with DMRB LA111 assessment methodology.

1.7.5 As shown in the table above, Link 9 has the potential to generate a **high** impact at receptors located nearest to the link, which includes Bay View. This link is located between the junction of Gammaton Road and Tenacott Lane, and site access into the Gammaton Road Logistics Compound. Annex E within Volume 2, Appendix 5.6 of the ES shows that the site access will be located a minimum of 55 m away from the nearest receptor (Bay View). Therefore, as there are no construction traffic noise sensitive receptors within 50 m of this link and therefore no adverse impacts will result from this change.

1.7.6 As detailed design of the Gammaton Road Compound is not yet available, an assessment of traffic movement within the compound has not been carried out. The compound should be designed appropriately such that no impacts are introduced by vehicle movements through the compound.

1.7.7 An increase in noise level of 3.2 dB on Link 16, which leads into the A39 compound, has been predicted. However, there are no construction traffic noise sensitive receptors within 50m of this link and therefore no adverse impacts will result from this change.

Haul Roads

1.7.8 Off-road haul roads will be used during the construction phase to avoid putting traffic on to Devon lanes. Save for HDD locations, a continuous haul road will run along the Onshore HVDC Cable Corridor from Landfall to Converter Site. The haul road will serve as a link between the Gammaton Road logistics compound and the Converter Site and will transport materials and personnel between the sites.

1.7.9 Data presented in Volume 2, Chapter 5: Traffic and Transport of the ES, has been used to inform the assessment of noise from the haul roads. From this data it is understood that up to 30 vehicle movements are expected on the cable route haul road, and up to 72 vehicle movements are expected on the Gammaton Road haul road.

1.7.10 The assessment of noise from the haul roads at the nearest receptors respectively is shown in **Table 1.13** below.

Table 1.13: Assessment of noise from haul roads

Nearest Receptor	Source	Approximate Distance from Haul Road (m)	Noise Level at Receptor (dB $L_{Aeq,T}$)	Magnitude of Impact
Oakleigh	Cable Route Haul Road	30	52	Negligible
Bay View	Gammaton Road Haul Road	16	58	Low

1.7.11 While it is likely the haul roads will be audible at other receptors, they are located further away, therefore the impact at these is expected to be less.

Abnormal indivisible loads

1.7.12 Abnormal Indivisible Loads (AILs) may be required to transport components to the site during the construction phase of the Proposed Development.

1.7.13 It is expected that some components essential for construction of the cable route and converter station, such as cable drums and transformers, classify as Abnormal Loads. These are understood to be transported to the proposed construction areas via the local highway network.

1.7.14 The AILs will travel from the main highways and use the haul road to access the various areas of the Proposed Development. The influence on AILs whilst travelling on the haul road will be considered as part of the Environmental Statement.

1.7.15 The AIL routes in are understood to be limited to well-trafficked roads such as the A39 and the A386. It is unlikely that the introduction of AILs as additional vehicles on the local highway network will increase the existing traffic noise levels sufficiently to result in significant adverse effects due to noise. As such, the impact of noise due to AILs on the local highway network has been scoped out of the assessment for the Environmental Statement.

1.8 Cumulative Assessment

1.8.1 It is understood that the construction of the adjacent Alverdiscott Substation Connection Development may overlap with the construction of the Proposed Development. Therefore, an assessment of the cumulative effects of the two sites on nearby receptors is required. The nearest noise sensitive receptor has been identified to be Webbery Barton.

1.8.2 Details of the construction of the Alverdiscott Substation Connection Development are not known, however, based on previous experience reasonable assumptions have been made on noise generating equipment expected to be used on site. One of the most noise generating construction phases is ground and site preparation works. Therefore, these have been considered as part of the cumulative noise assessment. The equipment shown in the table below has been assumed to be used during the groundworks phase of construction of the Alverdiscott Substation Connection Development.

1.8.3 NGET has not published any details about the design or construction schedule for the Alverdiscott Substation Connection Development so without any layout details the assessment approach taken has been to assume the cumulative construction noise radiates uniformly as an area source. This is expected to give an overestimation as to the construction phase noise levels from the substation experienced at Webbery Barton.

Table 1.14: Construction equipment at Alverdiscott Substation used to inform cumulative noise assessment

Plant Item	% On-Time	Quantity	Sound Power Levels (dB(A))
D6 Dozer	100	1	99
30T excavator	100	2	96
20T Dumper (Tipping)	50	3	109
20T Dumper (Empty)	50	3	107
Smooth Drum vibro road roller	100	1	93
21T excavator	100	1	96
5T Forward Tipping Dumper (Idling)	50	1	81
5T Forward Tipping Dumper (Driving)	50	1	92
Loading shovel	100	1	98
Tractor & fencing kit	100	1	98
Tractor & trailer	70	1	96
Tractor & Fuel bowser (or self-propelled)	10	1	97
Tractor & Water bowser (for dust suppression)	25	1	95
Grader	10	1	105
Telehandler	70	1	95
Mobile crane	25	1	93
Mobile generator	25	2	84
Temporary lighting	25	6	80
Tipper lorry	10	3	103
Vibratory piling rig	10	2	109
Road surface paver & roller (Not required for HDD compounds)	25	1	96
Cement Mixer	50	1	77
Mobile concrete pump / concrete mixer truck	50	1	85

Results

1.8.4 An assessment of the simultaneous construction of the Converter Site and the Alverdiscott Substation Connection Development has been carried out. Noise levels generated during the simultaneous construction have been modelled at the nearest receptor, Webbery Barton. The cumulative noise level expected to be experienced by the receptor during construction of both premises is shown in **Table 1.15** below.

Table 1.15: Cumulative construction noise impact

Receptor	Daytime SOAEL Threshold (dB)	Daytime LOAEL Threshold (dB)	Cumulative Predicted Sound Level (dB)
Webbery Barton	65	50	52

1.9 References

British Standards Institution (2014a) *'British Standard 5228-1:2009+A1:2014 (2014) Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'*

British Standards Institution (2014b) *'British Standard 5228-2:2009+A1:2014 (2014) Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration'*

Control of Pollution Act 1974, Chapter 40, Part III

Department of Transport Welsh Office (1988), *Calculation of Road Traffic Noise*

Environmental Protection Act 1990, Chapter 43, Part III

Highways England, Transport Scotland, Llwyodraeth Cymry, Department for Infrastructure (2020), *'Design Manual for Roads and Bridges – LA111: Noise and vibration'*

International Organisation for Standards (1996) *ISO 9613-2:1996 – Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.*

Annex A: Construction Plant Data

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
Construction Compounds											
D6 Dozer	100	1	103	92	94	91	90	96	80	74	99
30T excavator	100	2	93	92	95	94	90	87	84	79	96
20T Dumper (Tipping)	50	3	115	104	108	103	103	104	97	93	109
20T Dumper (Empty)	50	3	106	99	99	99	99	104	89	80	107
Smooth Drum vibro road roller	100	1	108	100	91	90	88	83	77	72	93
21T excavator	100	1	98	101	94	91	90	88	87	84	96
5T Forward Tipping Dumper (Idling)	50	1	93	81	72	74	77	75	66	57	81
5T Forward Tipping Dumper (Driving)	50	1	105	101	87	86	86	86	81	74	92
Loading shovel	100	1	103	101	94	93	93	90	90	79	98
Tractor & fencing kit	100	1	97	89	96	93	96	88	79	73	98
Tractor & trailer	70	1	109	102	92	92	89	88	80	75	96
Tractor & Fuel bowser (or self-propelled)	10	1	88	89	92	89	92	93	84	74	97
Tractor & Water bowser (for dust suppression)	25	1	90	98	96	90	90	89	82	81	95
Grader	10	1	106	105	101	97	102	96	92	83	105
Telehandler	70	1	95	89	82	81	94	82	70	63	95

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
Mobile crane	25	1	102	93	90	86	89	88	81	73	93
Mobile generator	25	2	85	82	86	80	79	75	66	57	84
Temporary lighting	25	6	93	86	81	77	74	70	71	64	80
Tipper lorry	10	3	112	106	98	98	98	97	94	91	103
Vibratory piling rig	10	2	104	103	100	103	105	103	98	88	109
Road surface paver & roller (Not required for HDD compounds)	25	1	99	96	93	92	91	88	86	77	96
Cement Mixer	50	1	76	80	73	73	72	68	66	64	77
Mobile concrete pump / concrete mixer truck	50	1	88	79	71	74	75	83	65	60	85
HDD Works											
Generator	100	3	88	85	89	83	82	78	69	60	86
Directional Drill Generator	100	1	79	85	75	70	75	82	86	79	89
Mounting supports for directional drill (hydraulic hammer)	25	1	98	93	87	87	86	81	78	66	90
Mud Pump	100	2	106	107	113	106	103	101	97	94	110
Mixing Tank	100	3	102	103	109	102	99	97	93	90	106

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
Cuttings / Recycling Tank	100	1	88	101	94	91	90	88	87	84	96
Excavator, 23T	100	1	109	101	85	84	80	77	77	70	90
Submersible Drill Fluid Transfer Pumps	100	1	80	79	76	79	81	79	74	64	85
HDD Drilling Rig	100	1	79	85	75	70	75	82	86	79	89
Trenching Works											
D6 Dozer	100	1	103	92	94	91	90	96	80	74	99
30T excavator	100	2	93	92	95	94	90	87	84	79	96
20T Dumper (Tipping)	10	3	108	97	101	96	96	97	90	86	102
20T Dumper (Empty)	50	3	106	99	99	99	99	104	89	80	107
Smooth Drum vibro road roller	100	1	108	100	91	90	88	83	77	72	93
21T excavator	100	1	98	101	94	91	90	88	87	84	96
5T Forward Tipping Dumper (Idling)	25	1	90	78	69	71	74	72	63	54	78
5T Forward Tipping Dumper (Driving)	50	1	105	101	87	86	86	86	81	74	92
Loading shovel	75	1	102	100	93	92	92	89	89	78	97
Tractor & fencing kit	75	1	96	88	95	92	95	87	78	72	97
Tractor & trailer	70	1	109	102	92	92	89	88	80	75	96

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
Tractor & Fuel bowser (or self-propelled)	10	1	88	89	92	89	92	93	84	74	97
Tractor & Water bowser (for dust suppression)	25	1	90	98	96	90	90	89	82	81	95
Grader	10	1	106	105	101	97	102	96	92	83	105
Telehandler	70	1	95	89	82	81	94	82	70	63	95
Mobile self-contained welfare unit	25	1	71	74	75	72	65	61	56	49	72
Mobile generator	25	2	85	82	86	80	79	75	66	57	84
Temporary lighting	25	12	96	89	84	80	77	73	74	67	83
Substation Compound											
Large rotary bored piling rig	100	1	92	100	89	88	86	84	76	69	91
Tracked drilling rig with hydraulic drifter	100	1	103	107	104	101	102	107	102	97	110
Crane Mounted Auger	100	1	105	104	95	91	93	90	85	77	97
Mini Piling Rig	100	2	98	88	83	84	82	80	76	68	87
Compressor for mini piling	100	1	83	79	73	78	79	77	70	65	83
20T Dumper (Tipping)	50	4	116	105	109	104	104	105	98	94	110

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
20T Dumper (Empty)	50	2	104	97	97	97	97	102	87	78	105
Truck mixer with pump	10	2	94	85	77	80	81	89	71	66	91
21T excavator	80	3	102	105	98	95	94	92	91	88	100
Grinder	50	5	89	83	84	92	102	109	105	105	112
Air compressor	100	2	95	84	75	70	68	66	69	58	76
Generator	100	2	86	83	87	81	80	76	67	58	85
Rock bolting	100	1	114	114	111	106	108	106	104	99	113
Transition and Cable Route Joint Bays											
30T excavator	1	100	90	89	92	91	87	84	81	76	93
20T Dumper (Empty)	2	100	107	100	100	100	100	105	90	81	108
Smooth drum vibro road roller	1	10	98	90	81	80	78	73	67	62	83
21T excavator	1	50	95	98	91	88	87	85	84	81	93
5T Forward Tipping Dumper (Driving)	1	50	105	101	87	86	86	86	81	74	92
9T Forward Tipping Dumper (Tipping)	1	100	103	92	96	91	91	92	85	81	97
13T Forward Tipping Dumper (Tipping)	1	100	103	92	96	91	91	92	85	81	97
Tractor & Fuel bowser (or self-propelled)	1	10	88	89	92	89	92	93	84	74	97

Plant Item	% On-Time	Quantity	Sound Power Level (dB) at 1/1-Octave Band Centre Frequency (Hz)								dB(A)
			63	125	250	500	1k	2k	4k	8k	
Tractor & Water bowser (for dust suppression)	1	25	90	98	96	90	90	89	82	81	95
Mobile self-contained welfare unit	1	25	71	74	75	72	65	61	56	49	72
Mobile generator	2	25	85	82	86	80	79	75	66	57	84
Temporary lighting	4	25	91	84	79	75	72	68	69	62	79
Pump	2	100	94	87	81	84	85	83	76	69	89
Tractor & trailer	1	50	108	101	91	91	88	87	79	74	94
Concrete poker unit	1	10	96	94	94	87	83	86	84	79	93
Air compressor	1	100	92	81	72	67	65	63	66	55	73
Mobile concrete pump / concrete mixer truck	1	50	88	79	71	74	75	83	65	60	85
Telehandler	1	50	94	88	81	80	93	81	69	62	93
Mobile crane	1	25	102	93	90	86	89	88	81	73	93
Loading shovel	1	100	103	101	94	93	93	90	90	79	98
Trench Roller	1	75	99	95	84	88	84	81	77	74	89
Cement mixer	1	25	73	77	70	70	69	65	63	61	74

Annex B: Noise Impacts due to Construction of Compounds, Joint Bays, and Converter Site

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Establishing Compounds - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact	Joint Bay works - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact
Zone 1	The Flat	65	75	-	-	27	**Negligible**
	Coombe	65	75	-	-	28	**Negligible**
	Coombe Barn	65	75	-	-	30	**Negligible**
	Fig Cottage	65	75	-	-	31	**Negligible**
	Chaltaborough	65	75	-	-	30	**Negligible**
	Chapter House	65	75	-	-	27	**Negligible**
Zone 2	Shamland	65	75	-	-	24	**Negligible**
	Shamland Barn	65	75	-	-	34	**Negligible**
	The Old Smithy	65	75	-	-	46	**Negligible**
	Forge Cottage	65	75	-	-	51	**Negligible**
	Oakleigh	65	75	-	-	51	**Negligible**
	Spry Cottage	65	75	-	-	48	**Negligible**
	Thistles	65	75	-	-	51	**Negligible**
	Silver Mist	65	75	-	-	31	**Negligible**
	Hill House	65	75	40	Negligible	45	**Negligible**
	Venlea	65	75	40	Negligible	50	**Negligible**
	Beech Cottage	65	75	52	Negligible	12	**Negligible**
	Bowood Farm	65	75	49	Negligible	17	**Negligible**
	Lower Bowood	65	75	41	Negligible	13	**Negligible**
Zone 3	The Warren	47	65	-	-	9	**Negligible**
	Winscott Barn	47	65	-	-	5	**Negligible**

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Establishing Compounds - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact	Joint Bay works - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact
	Winscott Barton	47	65	-	-	6	**Negligible**
	Moor Park	56	65	-	-	18	**Negligible**
	Moorhead Cottage	56	65	-	-	27	**Negligible**
	Littlemoor	56	65	-	-	14	**Negligible**
Zone 4	Hullacott	56	65	-	-	41	**Negligible**
	Littleham Court	56	65	-	-	35	**Negligible**
	Littleham Court Manor	56	65	-	-	41	**Negligible**
	Long Linney	56	65	-	-	36	**Negligible**
	Robbin Hill Farm	56	65	-	-	45	**Negligible**
	Dunn Farm	43	65	-	-	16	**Negligible**
	Newridge	56	65	-	-	28	**Negligible**
Zone 5	Otter Cottage	43	65	-	-	22	**Negligible**
	Swallow Cottage	43	65	-	-	26	**Negligible**
	West Ashridge	43	65	-	-	18	**Negligible**
	Damn View	43	65	-	-	19	**Negligible**
	Halsannery Farm House	46	65	-	-	16	**Negligible**
	Littlecroft	46	65	56	**Low**	11	**Negligible**
	Riverside Cottage	46	65	42	**Negligible**	5	**Negligible**
	Treetops	46	65	58	**Low**	11	**Negligible**
Zone 6	April Cottage	46	65	-	-	7	**Negligible**

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Establishing Compounds - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact	Joint Bay works - Maximum Predicted Noise Level $L_{Aeq,T}$ (dB)	Magnitude of impact
	Tennacott Lodge	46	65	-	**-**	6	**Negligible**
	Greatwood	46	65	-	**-**	46	**Negligible**
	Bay View	46	65	54	**Low**	31	**Negligible**
	Bybury	46	65	52	**Low**	50	**Low**

Annex C : HDD Construction Noise Assessment

Location	Receptor	LOAEL (dB)			SOAEL (dB)			Construction Noise Level, $L_{Aeq,T}$ (dB)			Magnitude of Impact		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Zone 1	The Flat	65	58	51	75	65	55	44	48	48	**Negligible**	**Negligible**	**Negligible**
	Coombe	65	58	51	75	65	55	47	48	48	**Negligible**	**Negligible**	**Negligible**
	Coombe Barn	65	58	51	75	65	55	47	49	49	**Negligible**	**Negligible**	**Negligible**
	Fig Cottage	65	58	51	75	65	55	48	50	50	**Negligible**	**Negligible**	**Negligible**
	Chaltaborough	65	58	51	75	65	55	46	47	47	**Negligible**	**Negligible**	**Negligible**
	Chapter House	65	58	51	75	65	55	45	46	46	**Negligible**	**Negligible**	**Negligible**
Zone 2	Shamland	65	58	51	75	65	55	35	38	38	**Negligible**	**Negligible**	**Negligible**
	Shamland Barn	65	58	51	75	65	55	43	46	46	**Negligible**	**Negligible**	**Negligible**
	The Old Smithy	65	58	51	75	65	55	45	46	46	**Negligible**	**Negligible**	**Negligible**
	Forge Cottage	65	58	51	75	65	55	39	44	44	**Negligible**	**Negligible**	**Negligible**
	Oakleigh	65	58	51	75	65	55	41	45	45	**Negligible**	**Negligible**	**Negligible**
	Spry Cottage	65	58	51	75	65	55	40	45	45	**Negligible**	**Negligible**	**Negligible**
	Thistles	65	58	51	75	65	55	43	45	45	**Negligible**	**Negligible**	**Negligible**
	Silver Mist	65	58	51	75	65	55	42	46	46	**Negligible**	**Negligible**	**Negligible**
	Hill House	65	58	51	75	65	55	41	43	43	**Negligible**	**Negligible**	**Negligible**
	Venlea	65	58	51	75	65	55	36	40	40	**Negligible**	**Negligible**	**Negligible**

Location	Receptor	LOAEL (dB)			SOAEL (dB)			Construction Noise Level, $L_{Aeq,T}$ (dB)			Magnitude of Impact		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
	Beech Cottage	65	58	51	75	65	55	42	45	45	**Negligible**	**Negligible**	**Negligible**
	Bowood Farm	65	58	51	75	65	55	45	48	48	**Negligible**	**Negligible**	**Negligible**
	Lower Bowood	65	58	51	75	65	55	34	39	39	**Negligible**	**Negligible**	**Negligible**
Zone 3	The Warren	47	39	37	65	55	45	44	47	47	**Negligible**	**Low**	**Medium**
	Winscott Barn	47	39	37	65	55	45	36	41	41	**Negligible**	**Low**	**Low**
	Winscott Barton	47	39	37	65	55	45	38	44	44	**Negligible**	**Low**	**Low**
	Moor Park	56	46	41	65	55	45	30	33	33	**Negligible**	**Negligible**	**Negligible**
	Moorhead Cottage	56	46	41	65	55	45	31	34	34	**Negligible**	**Negligible**	**Negligible**
	Littlemoor	56	46	41	65	55	45	29	33	33	**Negligible**	**Negligible**	**Negligible**
Zone 4	Dunn Farm	43	40	35	65	55	45	46	50	50	**Low**	**Low**	**Medium**
Zone 5	Otter Cottage	43	40	35	65	55	45	41	45	45	**Negligible**	**Low**	**Low**
	Swallow Cottage	43	40	35	65	55	45	47	48	48	**Low**	**Low**	**Medium**
	West Ashridge	43	40	35	65	55	45	40	42	42	**Negligible**	**Low**	**Low**
	Damn View	43	40	35	65	55	45	35	42	42	**Negligible**	**Low**	**Low**
	Littlecroft	46	43	41	65	55	45	50	51	51	**Low**	**Low**	**High**

Location	Receptor	LOAEL (dB)			SOAEL (dB)			Construction Noise Level, $L_{Aeq,T}$ (dB)			Magnitude of Impact		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
	Riverside Cottage	46	43	41	65	55	45	44	46	46	**Negligible**	**Low**	**Medium**
	Treetops	46	43	41	65	55	45	50	53	53	**Low**	**Low**	**High**
Zone 6	April Cottage	46	43	41	65	55	45	32	38	38	**Negligible**	**Negligible**	**Negligible**
	Tennacott Lodge	46	43	41	65	55	45	38	40	40	**Negligible**	**Negligible**	**Negligible**

Annex D: Joint Bay Construction Noise Assessment

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Joint Bay Excavation		Joint Bay Base Construction		Cable Jointing		Joint Bay Backfill	
				Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact
Zone 1	Old Stables	43	65	2.3	**Negligible**	1.2	**Negligible**	0	**Negligible**	2.4	**Negligible**
	The Coach House	43	65	17.3	**Negligible**	15.4	**Negligible**	4	**Negligible**	16.9	**Negligible**
	The Flat	65	75	26.9	**Negligible**	25.4	**Negligible**	9.9	**Negligible**	26.8	**Negligible**
	Coombe	65	75	28	**Negligible**	26.6	**Negligible**	10.2	**Negligible**	27.8	**Negligible**
	Coombe Barn	65	75	30	**Negligible**	28.8	**Negligible**	9.6	**Negligible**	29.9	**Negligible**
	Fig Cottage	65	75	30.9	**Negligible**	29.5	**Negligible**	12.4	**Negligible**	30.8	**Negligible**
	Chaltaborough	65	75	29.5	**Negligible**	27.4	**Negligible**	14.3	**Negligible**	30.4	**Negligible**
	Chapter House	65	75	26.4	**Negligible**	24.5	**Negligible**	2.8	**Negligible**	27.3	**Negligible**
Zone 2	Shamland	65	75	22.8	**Negligible**	20.2	**Negligible**	0	**Negligible**	24.4	**Negligible**
	Shamland Barn	65	75	33.5	**Negligible**	32.2	**Negligible**	5.1	**Negligible**	33.1	**Negligible**
	The Old Smithy	65	75	45.4	**Negligible**	44.2	**Negligible**	0.4	**Negligible**	45.7	**Negligible**
	Forge Cottage	65	75	49.9	**Negligible**	47.1	**Negligible**	10.5	**Negligible**	51.2	**Negligible**
	Oakleigh	65	75	50.1	**Negligible**	49.2	**Negligible**	1.1	**Negligible**	51.4	**Negligible**
	Spry Cottage	65	75	46.5	**Negligible**	46	**Negligible**	0.9	**Negligible**	47.5	**Negligible**
	Thistles	65	75	49.4	**Negligible**	49.3	**Negligible**	1.1	**Negligible**	50.9	**Negligible**
	Silver Mist	65	75	30.8	**Negligible**	30	**Negligible**	6.3	**Negligible**	31.3	**Negligible**
	Hill House	65	75	44.4	**Negligible**	43.9	**Negligible**	35.3	**Negligible**	45.2	**Negligible**
	Venlea	65	75	48.6	**Negligible**	47.4	**Negligible**	38.9	**Negligible**	49.7	**Negligible**
	Beech Cottage	65	75	11.6	**Negligible**	10.4	**Negligible**	3.4	**Negligible**	11.6	**Negligible**
	Bowood Farm	65	75	16.6	**Negligible**	15.1	**Negligible**	8.5	**Negligible**	16.6	**Negligible**

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Joint Bay Excavation		Joint Bay Base Construction		Cable Jointing		Joint Bay Backfill	
				Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact
	Lower Bowood	65	75	13.1	**Negligible**	11.5	**Negligible**	4.7	**Negligible**	13.1	**Negligible**
Zone 3	The Warren	47	65	8.4	**Negligible**	7.4	**Negligible**	0.8	**Negligible**	8.9	**Negligible**
	Winscott Barn	47	65	4.3	**Negligible**	3.7	**Negligible**	0	**Negligible**	5.1	**Negligible**
	Winscott Barton	47	65	5.8	**Negligible**	4.5	**Negligible**	0	**Negligible**	5.9	**Negligible**
	Moor Park	56	65	18.2	**Negligible**	16.9	**Negligible**	10.2	**Negligible**	18.2	**Negligible**
	Moorhead Cottage	56	65	27.2	**Negligible**	25.9	**Negligible**	18.8	**Negligible**	27.3	**Negligible**
	Littlemoor	56	65	13.5	**Negligible**	12.4	**Negligible**	5.4	**Negligible**	13	**Negligible**
Zone 4	Hullacott	56	65	40.6	**Negligible**	39.3	**Negligible**	31.4	**Negligible**	40.5	**Negligible**
	Littleham Court	56	65	34.5	**Negligible**	33.2	**Negligible**	25.6	**Negligible**	34.4	**Negligible**
	Littleham Court Manor	56	65	41	**Negligible**	39.8	**Negligible**	32.1	**Negligible**	41.1	**Negligible**
	Long Linney	56	65	36.4	**Negligible**	34.1	**Negligible**	26.9	**Negligible**	36.3	**Negligible**
	Robbin Hill Farm	56	65	44.5	**Negligible**	43.1	**Negligible**	35.1	**Negligible**	44.1	**Negligible**
	Dunn Farm	43	65	16.1	**Negligible**	15	**Negligible**	7.9	**Negligible**	16.1	**Negligible**
	Newridge	56	65	27.9	**Negligible**	26.4	**Negligible**	18.8	**Negligible**	27.7	**Negligible**
Zone 5	Otter Cottage	43	65	21.7	**Negligible**	20.2	**Negligible**	12.9	**Negligible**	21.7	**Negligible**
	Swallow Cottage	43	65	26.2	**Negligible**	24.6	**Negligible**	17.1	**Negligible**	26.1	**Negligible**
	West Ashridge	43	65	17.7	**Negligible**	16.6	**Negligible**	9.3	**Negligible**	17.9	**Negligible**
	Damn View	43	65	19.3	**Negligible**	17.7	**Negligible**	10.6	**Negligible**	19.2	**Negligible**
	Halsannery Farm House	46	65	15.7	**Negligible**	14	**Negligible**	7.1	**Negligible**	15.6	**Negligible**

Location	Receptor	LOAEL (dB)	SOAEL (dB)	Joint Bay Excavation		Joint Bay Base Construction		Cable Jointing		Joint Bay Backfill	
				Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact	Level (dB)	Impact
	Littlecroft	46	65	11	**Negligible**	9.6	**Negligible**	2.8	**Negligible**	11.2	**Negligible**
	Riverside Cottage	46	65	4.4	**Negligible**	3.4	**Negligible**	-3.1	**Negligible**	4.7	**Negligible**
	Treetops	46	65	10.5	**Negligible**	9	**Negligible**	2.2	**Negligible**	10.6	**Negligible**
Zone 6	April Cottage	46	65	7.1	**Negligible**	5	**Negligible**	-1.8	**Negligible**	6.4	**Negligible**
	Tennacott Lodge	46	65	5.7	**Negligible**	4.5	**Negligible**	-2.2	**Negligible**	6	**Negligible**
	Greatwood	46	65	45.6	**Negligible**	44.6	**Negligible**	35.7	**Negligible**	45.4	**Negligible**
	Bay View	46	65	30.9	**Negligible**	29.6	**Negligible**	21.9	**Negligible**	30.9	**Negligible**
	Bybury	46	65	49.7	**Low**	49.2	**Low**	40	**Negligible**	50	**Low**
	Woodville Farm	46	65	51.2	**Low**	50.1	**Low**	41.7	**Negligible**	51.1	**Low**
Zone 7	Webbery Barton	46	65	9.6	**Negligible**	8.1	**Negligible**	1.4	**Negligible**	9.7	**Negligible**