FOREWIND

DOGGER BANK
TEESSIDE A & B

March
2014

Environmental Statement
Chapter 29
Noise and Vibration

Application Reference: 6.29

Cover photograph: Indicative image showing installation of meteorological mast within the Dogger Bank Zone

Document Title	Dogger Bank Teesside A & B Environmental Statement – Chapter 29 Noise and Vibration
Forewind Document Reference	F-ONC-CH-029_Issue 4.1
Date	March 2014

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Date / Reference approval		[signature]	14 February 2014

Title: Dogger Bank Teesside A & B Environmental Statement Chapter 29 Noise and Vibration		Contract No. (if applicable) Onshore ☒ Offshore ☐
Document Number: F-ONC-CH-029	Issue No: 4.1	Issue Date: March 2014

Status:

Issued for 1st Technical Review	☐	Issued for PEI 3	☐
Issued for 2nd Quality Review	☐	Issued for Submission Application	☒

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Revision History

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
9 May 2013	1	Issued for 1st Technical Review	SW	PS	AC
3 June 2013	2	Issued for 2nd Quality Review	SW	PS	AC
26 June 2013	2.1	Issued for Approval	SW	PS	AH
16 August 2013	2.2	Issued for Approval	SW	PS	AH
5 September 2013	2.3	Issued for Review	SW	AH	AH
18 September 2013	2.4	Issued for Approval	SW	AH	AH
7 October 2013	2.5	Issued for Approval	SW	AH	AH
14 October 2013	3	Issued for PEI 3 Approval	SW	AH	AH
21 January 2014	4	Pre-DCO submission review	SW	JD	AH
5 February 2014	4.1	Issued for DCO	SW	JD	AH

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1 Introduction

1.1 Background

1.1.1 This chapter of the Environmental Statement (ES) describes the existing onshore environment with regard to noise and vibration and assesses the potential impacts of Dogger Bank Teesside A & B during the construction, operation and decommissioning phases of the onshore infrastructure. Where the potential for impacts is identified, mitigation measures and residual impacts are presented.

1.1.2 Subsea noise and vibration impacts associated with the construction, operation and decommissioning of the wind turbines is discussed within **Chapter 13 Fish and Shellfish** and **Chapter 14 Marine Mammals**. Given the separation distance of the offshore development and the nearest onshore receptors, an assessment of airborne noise associated with the offshore development has not been included in this assessment.

1.1.3 Potential noise impacts upon terrestrial ecology receptors are discussed within **Chapter 25 Terrestrial Ecology**.

2 Guidance and Consultation

2.1 Policy

National Policy Statements

2.1.1 The assessment of potential impacts upon onshore noise and vibration receptors has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to Dogger Bank Teesside A & B are (refer to **Chapter 3 Legislation and Policy** for further information):

- Overarching NPS for Energy (EN-1) (DECC 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

2.1.2 The specific assessment requirements for noise and vibration, as detailed in the NPSs, are summarised in **Table 2.1**, together with an indication of where each is addressed within the ES. Where any part of the NPS has not been followed within the assessment an explanation as to why the requirement was not deemed relevant, or has been met in another manner, is provided.

Table 2.1 Relevant policies from Development Plan documents

NPS requirement	NPS reference	ES reference
Where noise impacts are likely to arise, the applicant should include: • A description of the noise generating aspects of the development proposal leading to noise impacts including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise; • Identification of noise sensitive premises and noise sensitive areas that may be affected; • The characteristics of the existing noise environment; • A prediction of how the noise environment will change with the proposed development; • In the shorter term such as during the construction period; • In the longer term during the operating life of the infrastructure; • At particular times of the day, evening and night as appropriate; • An assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas; and • Measures to be employed in mitigating noise. • The nature and extent of the noise assessment should be proportionate to the likely noise impact.	EN-1, paragraph 5.11.4	Refer to Sections 5, 6, and 7

NPS requirement	NPS reference	ES reference
The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered.	EN-1, paragraph 5.11.5	Refer to Section 6
Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. Further information on assessment of particular noise sources may be contained in the technology-specific NPSs. In particular, for renewables (EN-3) and electricity networks (EN-5) there are assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.	EN-1, paragraph 5.11.6	Noise assessment described within EN-3 relates to the offshore environment. Those potential noise impacts are considered separately within **Chapter 13 Fish and Shellfish** and **Chapter 14 Marine Mammals**.
The applicant should consult EA and Natural England (NE), or the Countryside Council for Wales (CCW), as necessary and in particular with regard to assessment of noise on protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account.	EN-1, paragraph 5.11.7	Noise impacts on terrestrial protected species or other wildlife is considered within **Chapter 25 Terrestrial Ecology**.
While standard methods of assessment and interpretation using the principles of the relevant British Standards are satisfactory for dry weather conditions, they are not appropriate for assessing noise during rain. This is when overhead line noise mostly occurs, and when the background noise itself will vary according to the intensity of the rain. Therefore an alternative noise assessment method to deal with rain-induced noise is needed, such as the one developed by National Grid as described in report TR (T) 94,199319. This follows recommendations broadly outlined in ISO 1996 (BS 7445:1991) and in that respect is consistent with BS 4142:1997. The NSIP is likely to be able to regard it as acceptable for the applicant to use this or another methodology that appropriately addresses these particular issues.	EN-5, paragraphs 2.9.8 and 2.9.9	Dogger Bank Teesside A & B does not include any requirement for additional overhead lines and so this assessment is not deemed necessary.

2.2 Local Planning Policy

2.2.1 EN-1 states in paragraph 4.1.5 that

"*Other matters that the Infrastructure Planning Commission (IPC) may consider important and relevant to its decision-making may include Development Plan Documents or other documents in the Local Development Framework. In the event of a conflict between these or any other documents and an NPS, the NPS prevails for the purposes of IPC decision making given the national significance of the infrastructure*".

2.2.2 **Table 2.2** provides details of the local planning policy documents and the policies contained within these relevant to noise.

Table 2.2 Local planning policies

Document	Policy / Guidance	Policy / Guidance purpose
Redcar & Cleveland Local Development Framework (Redcar & Cleveland Borough Council (RCBC), 2007)	DP6	Development that would give rise to increased levels of noise or vibration or which would add to air, land or water pollution, by itself or in accumulation with existing or other proposed uses, will only be permitted it is acceptable in terms of: • Human health and safety; • Environment; and • General amenity. Where pollution is unavoidable, mitigation measures to reduce pollution levels will be required in order to meet acceptable limits.

2.3 Other legislation, standards and guidance

2.3.1 In addition, the following legislation, standards and guidance have been used and considered in the course of the noise assessment:

- The Control of Pollution Act, 1974 (COPA);
- The Environmental Protection Act, 1990 (EPA);
- Noise Policy Statement for England (NPSE) (Department for Environment, Food and Rural Affairs (DEFRA) 2010);
- British Standard (BS) 7445-2:1991 "Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use" (British Standards Institute (BSI) 1991);
- BS5228-1:2009 "Code of practice for noise and vibration control on construction and open sites. Noise" (BSI 2009);
- BS4142:1997 "Method for rating industrial noise affecting mixed residential and industrial areas" (BSI 1997);
- BS8233:1999 "Sound insulation and noise reduction for buildings. Code of practice" (BSI 1999);
- Calculation of Road Traffic Noise (Department of Transport 1988); and
- Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 "Noise and Vibration" (Highways Agency (HA) 2011).

2.4 Consultation

2.4.1 To inform the ES, Forewind has undertaken a thorough pre-application consultation process, including the following key stages:

- Scoping Report submitted to the Planning Inspectorate (May 2012);
- Scoping Opinion received from the Planning Inspectorate (June 2012);

- First stage of statutory consultation (in accordance with sections 42 and 47 of the Planning Act 2008) on Preliminary Environmental Information (PEI) 1 (report published May 2012); and
- Second stage of statutory consultation (in accordance with sections 42, 47 and 48 of the Planning Act 2008) on the ES (published November 2013) designed to allow for comments before final application to the Planning Inspectorate).

2.4.2 In addition, consultation associated with the Dogger Bank Creyke Beck application (Forewind August 2013) has been-taken into account for Dogger Bank Teesside A & B where appropriate.

2.4.3 In between the statutory consultation periods, Forewind consulted specific groups of stakeholders on a non-statutory basis to ensure that they had an opportunity to inform and influence the development proposals. Consultation undertaken throughout the pre-application development phase has informed Forewind's design decision making and the information presented in this application. Further information on the consultation process is presented in **Chapter 7 Consultation**. A Consultation Report is also provided alongside this ES as part of the overall planning submission.

2.4.4 A summary of the consultation carried out at key stages throughout the project, of particular relevance to Noise and Vibration, is presented in **Table 2.3**. This table only includes the key items of consultation that have defined the assessment. In these cases, the issue in question has not been captured in **Table 2.3**. A full explanation of how the consultation process has shaped the ES, as well as tables of all responses received during the statutory consultation periods, is provided in the Consultation Report.

Table 2.3 Summary of consultation issues raised by consultees

Date	Consultee	Summary of issue	ES reference
May 2012 (Scoping Report)	Planning Inspectorate	The Scoping Report focuses on onshore noise and it is stated that offshore noise is considered in the project description. The Secretary of State advises that offshore noise and vibration must be considered as part of the assessment. Appropriate cross-reference should be made to the fish and shellfish and the marine mammals topics in the ES. Information should be provided on the types of vehicles and plant to be used during the construction phase to inform the prediction of noise and vibration impacts. Consideration should be given to the monitoring of and procedure for dealing with noise complaints during the construction and operation of the development.	Refer to Sections 6 and 7
June 2012	Planning Inspectorate	The Secretary of State draws attention both to the general points and those	Refer to Sections 6 and 7

Date	Consultee	Summary of issue	ES reference
(Scoping Opinion)		made in respect of each of the specialist topic areas in this Opinion. The main potential issues identified are: Offshore: • Impacts on Statutory International Designated Sites; • Impacts on bird species, including disturbance/displacement during construction and barrier/collision risk during operation; • Impacts on marine mammals, particularly during construction; • Impacts on fish and shell fish, including disturbance/displacement during construction; • Impacts on intertidal and sub tidal ecology, particularly during installation of infrastructure; • Socio-economic impacts on commercial fisheries; and • Impacts on marine and costal archaeology. Onshore: • Impacts on landscape and visual character; • Impacts on tourism and recreation, particularly during construction; • Impacts on loss of and disturbance to habitats; • Impacts on Statutory National Designated sites; • Noise and vibration during construction, including from traffic; • Air quality impacts arising from the emission of fugitive dust from construction activities; • Cultural heritage impacts on setting of listed buildings and Conservation Areas; and • Traffic and access during construction. The Secretary of State provided agreement on the planned ES Structure.	
November 2012 (Non-statutory)	RCBC Environmental Health Department	Concern about potential noise and vibration from construction of cable routes and converter station, as well as noise associated with operation.	Refer to Sections 6 and 7
January 2013 (Non-	RCBC Council Environmental Health	Agreement on baseline noise assessment methodology and impact criteria, concerning potential noise and vibration from construction of	Refer to Section 3

Date	Consultee	Summary of issue	ES reference
statutory)	Department	cable routes and substation, as well as noise associated with operation.	
February 2013 (Non-statutory)	RCBC Environmental Health Department	Agreement on baseline noise assessment monitoring locations for cable corridor construction area and converter station operational area.	Refer to Section 3
March 2013 (Non-statutory)	RCBC Environmental Health Department	Agreement on use of Geoff Taylor's Wilton baseline data as a surrogate for P1, following the vandalism of equipment.	Refer to Section 4
September 2013 (Non-statutory)	RCBC Environmental Health Department	No further comments from RCBC regarding the methodology with respect to noise during the construction phase. Comment was also made that if the contractors had an exceptional reason to work during the night, it would be advantageous to have advanced notice of the work and the rationale behind the decision.	Refer to Section 6
11 December 2013 (Statutory)	RCBC	Meeting regarding the Draft ES (where noise was discussed) and invitation to provide their comments on the submission.	**Chapter 29 Noise and Vibration**
December 2013 (Statutory)	RCBC Environmental Health Department	Consultation with RCBC - response from Draft ES. RCBC requested additional information on: • The agreed working hours during the construction phase; • The consideration of frequency analysis as part of the converter station noise assessment; • Recent reduction in night time baseline noise levels across the Wilton site; and • The use of acoustic bunding or screening as part of the converter station development.	Refer to Section 6 Refer to Section 7 Refer to Section 4 Refer to Section 7

3 Methodology

3.1 Study area

3.1.1 For the purpose of the noise and vibration impact assessment three study areas have been defined to assess the direct and indirect impacts associated with noise impacts arising from the project. These are:

- A corridor within which the High Voltage Direct Current (HVDC) cable route is located;
- A corridor within which the High Voltage Alternating Current (HVAC) cable route is located and the enabling works at existing National Grid Electricity Transmission (NGET) substation at Lackenby; and
- Sensitive residential receptors surrounding the converter stations site.

3.1.2 These study areas are shown on **Figure 3.1**.

3.2 Characterisation of existing environment – methodology

3.2.1 In order to characterise the existing environment within these study areas a baseline noise survey was undertaken. Measurements of the ambient noise level were taken at locations that were representative of nearby noise sensitive receptors that have the potential to be affected by the construction, operation or decommissioning of the development. The noise survey included the following general descriptors of noise:

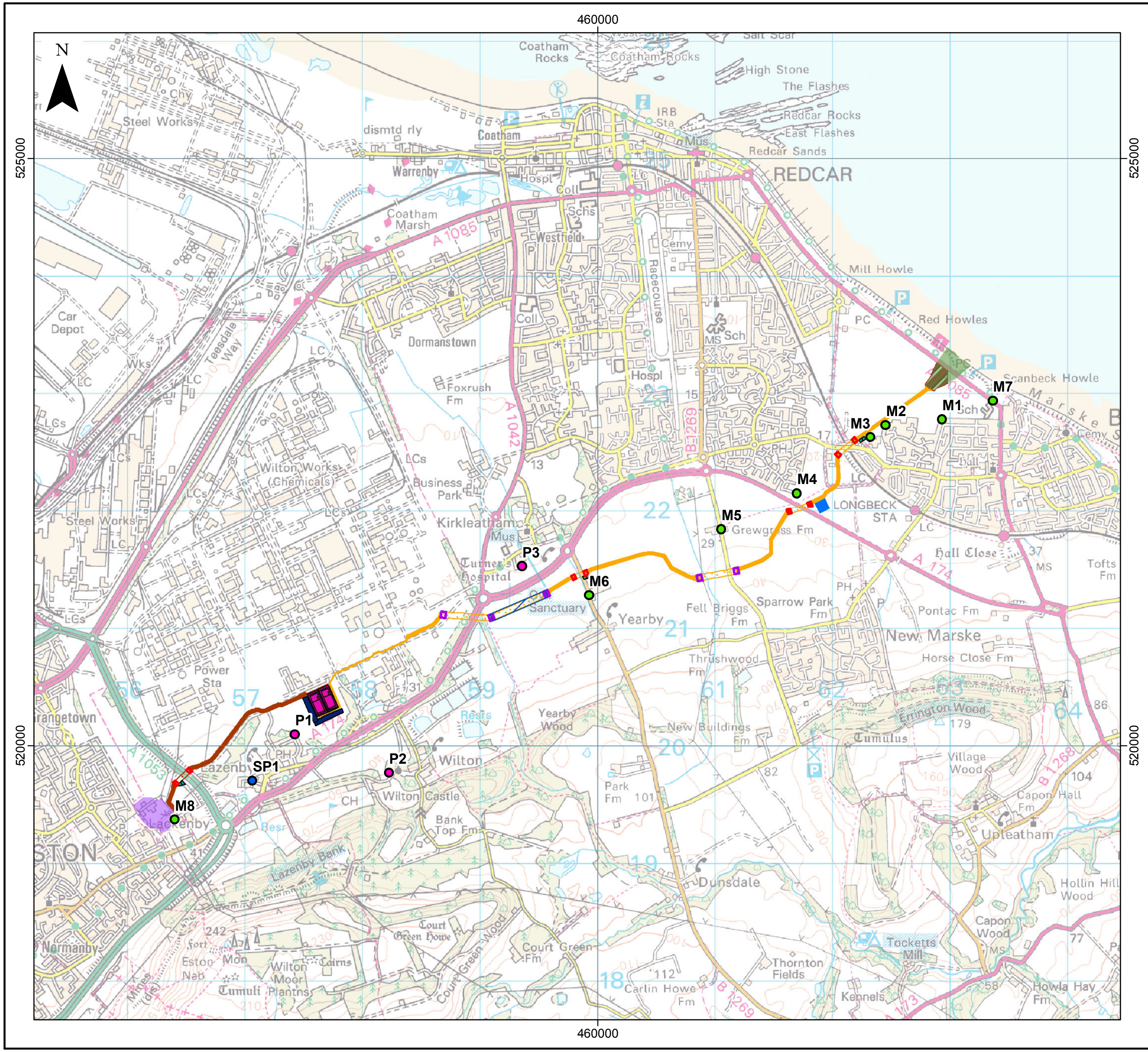
- L_{Aeq} – the equivalent continuous sound pressure level over the measurement period. This parameter was standardised as pertinent for land use within BS7445-2;
- L_{Amax} – the maximum sound pressure level occurring within the defined measurement period; and
- L_{A90} – the sound pressure level exceeded for 90% of the measurement period and is indicative of the background noise level.

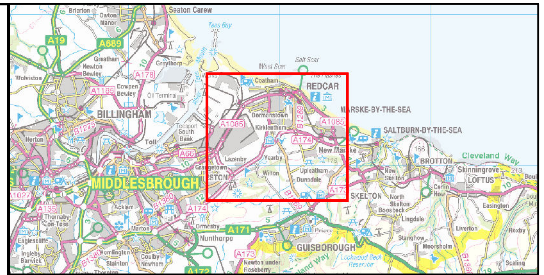
3.2.2 It is the equivalent continuous sound pressure level (L_{Aeq}) defined below which is the conventional descriptor of environmental noise.

$$L_{eq,T} = 10 \times \log\left[\frac{1}{T}\int \frac{\rho^2(t)\partial t}{\rho_0^2}\right] dB$$

3.2.3 Noise measurements are normally taken with an A-weighting (denoted by a subscript ‘A’) to approximate the frequency response of the human ear.

3.2.4 Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise/vibration sensitive commercial premises.





LEGEND

- Teesside A&B cable landfall envelope
- Teesside A&B landfall construction
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation

Noise Monitoring Locations

- Attended Monitoring Locations (M = manned)
- Unattended Monitoring Locations (P = permanent)
- Unattended Monitoring Locations (SP = surrogate position)

0 2
Kilometres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 3.1: Noise measurement locations (cable corridor and converter stations)

VER	DATE	REMARKS	Drawn	Checked
3	04/09/2013	Draft	SEW	SW
4	14/10/2013	Submit for PEI3	SEW	SW
5	10/02/2014	Pre-DCO submission review	SW	RH

DRAWING NUMBER: **F-ONL-MA-615**

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

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3.2.5 The noise survey comprised two distinct elements, which dealt separately with the converter stations study area and the cable corridor study area. Potential impacts from the construction works along the cable route will be temporary in nature, however potential impacts from the operation of the converter stations would be long term in nature, and so the two elements of the survey were designed to reflect this difference.

Converter stations study area noise survey

3.2.6 Prior to conducting the baseline noise survey RCBC provided approval on the proposed methodology and receptor monitoring locations.

3.2.7 The survey within the converter stations study area was conducted using unattended, continuous noise monitoring. This involves the use of self-contained monitoring stations that can be left unattended for a period of time, and which continually log the noise level while in place. Measurements were taken at each location for a period of approximately one week. Three locations were chosen to represent receptors close by to the converter stations site, which are listed in **Table 3.1** and shown in **Figure 3.1**.

Table 3.1 Unattended monitoring locations around the converter stations site

ID	Coordinates	Description	Measurement period
P1	457425 520094	In field 248 metres to north west of Lazenby Farm house and 20m from the rear garden of the nearest residential receptor – south west of the converter station location	Equipment vandalised – no data recovered*
P2	458226 519768	In Wilton Golf Club grounds – 145m to the west from Wilton village - south east of the converter station location	19/02/2013, 11:10 - 26/02/2013, 11:30
P3	459359 521528	Kirkleatham Turner's Hospital – To the east of the cottages, adjacent to the allotment gardens - north east of the converter station location	18/02/2013, 15:25 – 18/02/2013, 20:25**
SP1	457065 519701	In rear garden of 9 Wilton Green – To the west of the proposed converter station location	06/01/12, 23:00 - 17/11/12, 05:00

*Due to the damage to the noise kit and its likely recurrence, Senior Environmental Health Officer, RCBC approved the use of Geoff Taylor's Wilton Complex baseline noise monitoring data as a surrogate for this position (SP1) via an email dated 08th March 2013.
**Battery failed during monitoring.

3.2.8 The equipment left at these locations was set to log the L_{Aeq}, L_{A90} and L_{Amax} noise level at 5-minute intervals while in place. The list below gives details of the equipment used to undertake the converter stations survey:

- Rion NL-32 SLM (S/N 872237) with all-weather kit;
- Brüel and Kjær Type 4230 Sound Calibrator (S/N 861172);
- Rion NL-32 (S/N 620155) with all-weather kit;
- Brüel and Kjær Type 4230 Sound Calibrator (S/N 861172);
- Norsonic Nor116 Sound Level Meter (S/N 31406) with all-weather kit;
- Norsonic Nor1251Sound Calibrator (S/N 24322); and
- G.R.A.S 40AS Microphone (S/N 130800).

3.2.9 All equipment used was calibrated in UKAS accredited laboratories and certificates can be supplied on request.

Cable route area noise survey

3.2.10 The second aspect of the survey comprised measurements taken at selected locations along the cable route. The measurement locations were selected to be representative of general areas along the cable route, rather than specific receptors, in order to provide a snapshot of typical noise levels in areas potentially affected by noise from construction works. The measurements were attended by noise specialists and comprised multiple 15-minute measurements at each location. The cable route survey was conducted on the 19 February 2013.

3.2.11 The location of the cable route survey locations are described in **Table 3.2** and shown on **Figure 3.1**.

Table 3.2 Attended monitoring locations along the cable route

ID	Coordinates	Description
M1	462933 522777	Car parking area adjacent to allotment gardens, accessed off Marlborough Avenue
M2	462454 522727	Rear garden boundary of De Havilland Drive
M3	462324 522624	East of Ryehills Farm
M4	461783 522671	On a public footpath, adjacent to Seaham Close
M5	461055 521842	Roadside, adjacent to Grewgrass Farm
M6	459928 521281	Roadside, adjacent to Yearby Farm
M7	463367 522935	Bydales school site boundary, adjacent to Coast Road and underground Sewage Pumping Station
M8	456401 519368	Adjacent to existing NGET substation at Lackenby

3.2.12 The following equipment was used for the attended aspect of the survey:

- Norsonic Nor140 Sound Level Meter (S/N 1402924) with all-weather kit;
- Brüel and Kjær Type 4230 Sound Calibrator (S/N 861172);
- Brüel and Kjær Type 2250 Sound Level Meter (S/N 2645080); and
- Brüel and Kjær Type 4239 Sound Calibrator (S/N 2525097.

General survey method (converter stations site and cable route)

3.2.13 Noise measurements were undertaken in accordance with current best practice guidance contained within BS 7445 and BS 4142. The sound level meters were mounted at a height of approximately 1.5m above ground and were located at least 3.5m from the nearest building façade or wall, to ensure ‘free-field’ conditions. The sound level meters were field calibrated, using an appropriate sound calibrator, before and after each set of measurements, to detect any change in the calibration of the equipment. The sound level meters were fitted with wind-shields at all times, to minimise the effect of wind on the measurements.

3.2.14 The timing of the survey was chosen to ensure meteorological conditions during the attended aspect of the survey were suitable for noise measurement, with average wind speeds of less than 5m/s and no rain.

3.2.15 The noise survey methodology and location of monitoring positions were agreed with the Environmental Health Department at RCBC prior to undertaking the survey.

3.3 Calculation methods

3.3.1 This section of the report details the calculation methods used to predict noise and vibration impacts associated with the installation of the two buried cable systems comprising the cable route, and construction of the two converter stations. The assessment takes account of potential impacts from both on-site construction activity and off-site movement of construction related vehicles on public roads. In this respect, the 'construction site' within which 'on-site' activity is deemed to occur, is defined as the 36m wide construction working width for the HVDC cable route, a 39m wide working width for the HVAC cable corridor, the converter stations construction site, and all associated temporary works compound sites.

On-site construction noise

3.3.2 Calculations to predict the noise emitted from on-site construction works, were undertaken in accordance with the guidance from BS 5228-1. A list of typical construction plant used on similar projects has been developed and is presented in **Table 3.3**. The list of plant is not intended to be an exhaustive list of equipment used during construction, but rather focus on the noisiest operations that have the greatest potential to result in impacts at nearby receptors. To establish the impact buffer distances presented in **Table 3.4**, a very much worst case scenario was selected, whereby all possible equipment was assumed to be operating simultaneously at the very edge of the cable corridor, at the closest point to the receptor. This in reality would not occur as equipment would be dispersed and would operate towards the centreline of the 36m wide corridor; however these assumptions serve to indicate the maximum magnitude of construction noise effects.

3.3.3 **Table 3.3** also presents the estimated 'on-time' of each item of plant – the percentage of a typical working day during which the equipment operates – and the source noise level. The source noise levels were obtained from Annex C of BS 5228-1. Construction activities were assumed to occur during the daytime only i.e. 07:00 - 19:00, Monday to Friday and 07:00 - 13:00 on Saturday.

Table 3.3 Assumed construction equipment used for noise calculations (per project)

Activity	Plant	Number	Noise level dB L_{Aeq} @ 10m	On-time %
Landfall works	Excavator	2	75	75
	Dump truck	1	77	75
	Mobile Crane	1	78	75
	HDD drill rig	1	94	75
	Water pump	1	64	75
Haul road construction	Excavator	2	75	75
	Dump Truck	2	77	75
	Aggregate Wagon	10 (per hour)*	81	15 (km/h)**
Cable installation	Excavator	2	75	75
	Dump Truck	2	77	75
	Tractor towing trailer	1	79	75
Operational access construction	Excavator	2	75	75
	Dump Truck	2	77	75
	Aggregate Wagon	10 (per hour)	81	15 (km/h)
HDD (Horizontal Direction Drill)	HDD drill rig	1	94	75
	Water pump	1	64	75
Converter station construction (including construction access from A1079)	Excavator	2	75	75
	Backhoe Loader	2	67	75
	Dozer	2	80	75
	Dump truck	2	77	75
	Mobile Crane	2	78	75
	Cement mixer truck (discharging)	1	75	50
	Truck mounted concrete pump + boom arm	1	78	50
	Piling	1	93***	25
	Generator	2	76	100

* An assumed number of hourly movements, expected to exceed actual number during construction.
** For mobile plant using a well-defined route, a speed (in km/h) is required, rather than a percentage on-time.
*** Activity equivalent continuous sound pressure level L_{Aeq} at 10m (one cycle).

3.3.4 As an initial screening exercise, the distance from construction works at which the construction noise lower impact threshold of 65dB(A) would be exceeded was calculated. This ‘buffer’ distance, within which the construction noise limit would be exceeded, is shown for the different construction activities in **Table 3.4**. The use of the 65dB(A) construction noise limit is discussed further in paragraph 3.4.2.

Table 3.4 Construction buffer distances for low magnitude impact

Construction phase	Noise buffer distance (m)
Landfall	75
Cable system installation	80
Horizontal Directional Drilling	36
Converter stations construction	120

3.3.5 A distance propagation calculation was performed on each of the sound power levels listed in **Table 3.3** to establish the point at which the 65dB(A) impact level would be achieved for the different construction phases. Using a geographic information system (GIS) it was then possible to determine any areas where residential properties would be exposed to construction noise levels greater than the 65dB(A) impact threshold level. As the 65dB(A) threshold represents the change from negligible to low magnitude effect, it follows that any receptors outside the buffer areas will experience a negligible effect.

Off-site construction traffic noise

3.3.6 Off-site construction related traffic impacts were assessed by calculating the relative increase in road traffic flow on road links used by construction traffic.

3.3.7 Noise level increases due to increases in traffic volume on surrounding local roads were assessed in accordance with the methodology contained in Calculation of Road Traffic Noise (CRTN) and Design Manual for Roads and Bridges (DMRB). The significance of any predicted change in noise level was then assessed in accordance with the criteria contained in DMRB.

3.3.8 Following the methodology contained in DMRB, Volume 11, Section 3, Chapter 3 an initial screening assessment was undertaken to assess whether there were any significant changes in traffic volumes as a result of the development. Any road links with a predicted increase in traffic volume of 25%, or a decrease of 20%, were identified in the initial part of the assessment. Such changes in traffic volume would correspond to a 1dB(A) change in noise level at the relevant road link. A change in noise level of less than 1dB(A) is regarded as imperceptible and therefore negligible with regard to impact significance. If there are no increases greater than 25% or a decrease of 20% or greater, then the guidance indicates that no further assessment needs to be conducted (Highways Agency 2011).

3.3.9 Where road links were predicted to have an increase of greater than 25% or a decrease of 20%, a noise level calculation should be undertaken following the procedure outlined in CRTN.

3.3.10 **Table 3.5** presents the 18-hour Annual Average Weekday Traffic (AAWT) data for the roads used during construction programme; data were sourced from **Chapter 28 Traffic and Access**.

Table 3.5 AAWT traffic data used for the construction traffic noise assessment

Road number	Road name/description	Background 2015 flows AAWT		Baseline + Dogger Bank Teesside A or B in isolation		Baseline + Dogger Bank Teesside A & B concurrently	
		Total vehicles	Total HGVs	Total vehicles	Total HGVs	Total vehicles	Total HGVs
A1085	A1085 (Trunk Road)	21675	497	21675	497	21675	497
A66	A66 (Tees Dock Road)	25339	2028	25566	2181	25754	2318
A1053	A1053 (Greystone Road)	17485	1418	17712	1572	17900	1709
B1380	B1380 (High Street)	9921	457	10044	490	10050	493
A174	A174	28582	1611	28788	1732	28954	1840
A174	A174 (south of Wilton)	44151	1525	44540	1766	44890	2007
A1042	A1042 (Kirkleatham Lane)	16679	383	16727	383	16760	383
A174	A174 (south of Redcar)	30683	1678	30821	1722	30935	1766
B1269	B1269 (Fishponds Road)	6269	254	6301	274	6333	294
Unclassified	Grewgrass Lane	4862	18	4869	22	4876	27
Unclassified	Redcar Road	9490	161	9496	164	9501	168
A1085	A1085 (Coast Road)	12652	128	12699	134	12735	140
A174	A174 (south of Marske)	13221	274	13260	274	13288	274
A174	A174 (south of Redcar)	30683	1678	30781	1694	30855	1710

Construction related vibration

3.3.11 Ground borne vibration can result from construction works and may lead to perceptible levels of vibration within nearby properties, which can at higher levels cause annoyance to residents. In extreme cases, cosmetic or structural building damage can occur, however vibration levels have to be very high and such cases are rare.

3.3.12 High vibration levels generally arise from 'heavy' construction works such as piling, deep excavation, or dynamic ground compaction. In comparison, construction of the cable route, landfall and converter stations will generate relatively low levels of vibration. The use of piling during the construction of the converter stations has not been discounted; however there is a large separation distance present between the construction works and receptors.

3.3.13 There is generally a large separation distance between construction works and residential properties at most project locations, with only a small number of properties within 100 metres of the works. Where properties are located within this distance, the specific receptor distances are deemed large enough to protect receptors from construction related ground borne vibration. It is considered that vibration will not adversely affect receptors and has not been assessed in detail.

Operational noise from the converter stations

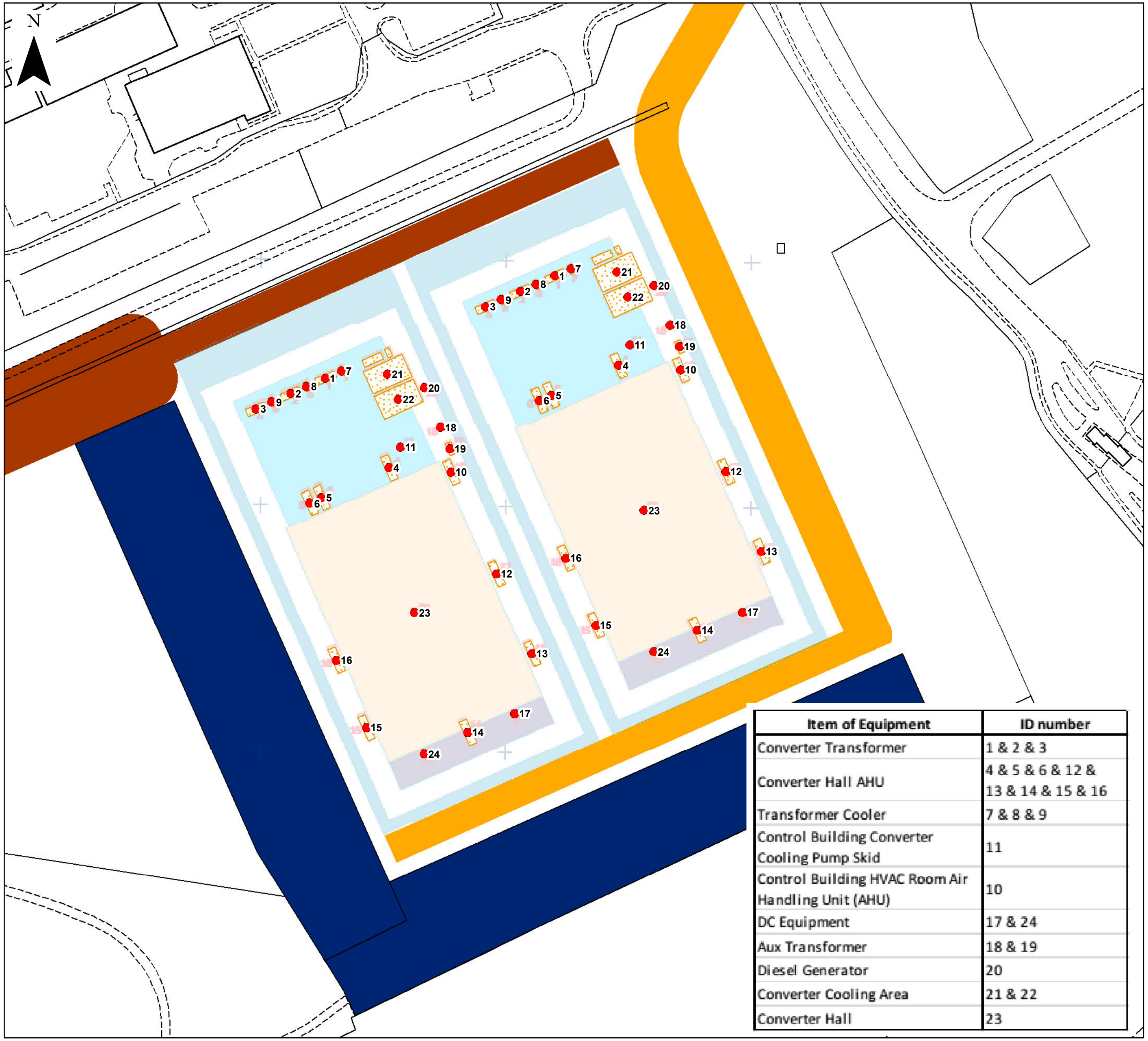
3.3.14 In order to predict the noise levels from the operation of the converter stations that are expected to affect nearby receptors, a computer noise modelling study was undertaken. The *SoundPLAN* software package was used, which is a commercially available package which implements many national and international acoustic calculation standards, including those typically used within the UK.

3.3.15 A 3-dimensional model of the proposed surrounding area was constructed, based on topographical data, ordinance survey mapping and indicative layout plans of the converter stations. Typical noise emission data for the items of electrical equipment and their typical locations was obtained from a potential supplier.

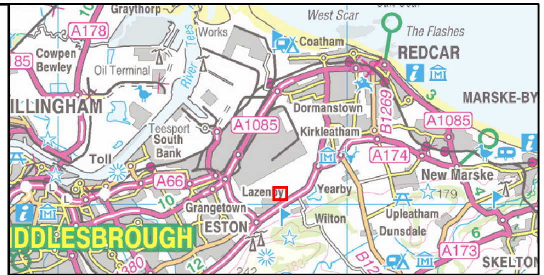
3.3.16 **Table 3.6** presents the source noise data for all converter station equipment that will emit significant levels of noise. It should be noted that the equipment in **Table 3.6** accounts for a single converter station; and therefore two co-located converter stations will each comprise the equipment located in **Table 3.6**. The indicative location of the converter stations noise sources within the noise model are shown in **Figure 3.2**.

Table 3.6 Source noise levels for a single converter station

Equipment	Indicative quantity per project	Indicative sound level *dB (L_{WA})*	Height above ground level (m)
Aux Transformer	2	75	2
Control Building Converter Cooling Pump Skid	1	85	2
Control Building HVAC Room Air Handling Unit (AHU)	1	88	10
Converter Cooling Area	2	90	4
Converter Hall	1	80	20
Converter Hall AHU	8	93	10
Converter Transformer	3	100	5
DC Equipment	2	89	8
Diesel Generator	1	90	2
Transformer cooler	3	93	5



Item of Equipment	ID number
Converter Transformer	1 & 2 & 3
Converter Hall AHU	4 & 5 & 6 & 12 & 13 & 14 & 15 & 16
Transformer Cooler	7 & 8 & 9
Control Building Converter Cooling Pump Skid	11
Control Building HVAC Room Air Handling Unit (AHU)	10
DC Equipment	17 & 24
Aux Transformer	18 & 19
Diesel Generator	20
Converter Cooling Area	21 & 22
Converter Hall	23



LEGEND

- Teesside A&B HVDC, Open trench
- Teesside A&B HVAC, Open trench
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Noise source locations
- Electrical unit
- AC Yard
- DC Yard
- HVDC Converter Hall
- Road

0 100
Metres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 3.2: Assumed converter station noise source locations

VER	DATE	REMARKS	Drawn	Checked
2	29/07/2013	Draft	SEW	SW
3	04/09/2013	Submit for PEI3	SEW	SW
5	13/02/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-616**

SCALE	1:2,500	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

3.3.17 The following points should be taken into account regarding the noise model:

- All noise emitting equipment was modelled as a point source, at a height of 3m above ground;
- All converter station equipment was assumed to be operating concurrently, including all cooling/air handling units;
- The ground surrounding each converter station was assumed to be 'soft' (i.e. grassland), which is representative of the actual ground conditions, whereas within the converter station the ground was assumed to include hard and acoustically reflective surfaces, such as concrete;
- Acoustic propagation effects were calculated using the ISO 9613 method;
- Free field noise levels were calculated at first floor height for each receptor, as the results were slightly higher than at ground floor level; and
- A +5dB 'acoustic feature' penalty, as defined in BS 4142, was added to the noise level calculated at each receptor. This is to account for the tonal nature of noise from converter stations, and represents a conservative approach.

3.3.18 The noise levels were calculated at the closest noise sensitive receptors to the converter station sites. Three different operational scenarios were considered. These three different scenarios are listed below; and each includes the peak noise magnitude generated by the convertor stations in the respective scenarios.

- One single converter station operating for Dogger Bank Teesside A;
- One single converter station operating for Dogger Bank Teesside B; and
- Both converter stations operating concurrently.

3.3.19 Noise contour plots (isopleths) were created to graphically demonstrate noise propagation from the converter stations.

Operational vibration from the converter stations

3.3.20 Ground borne vibration may potentially arise from the operation of electrical substations and associated plant. There is a very large separation distance between the converter stations site and residential properties. Where properties are located outside of the 100m buffer zone, the distances are deemed large enough to protect receptors from operational related ground borne vibration. No receptors are located inside of the 100m buffer zone. It is considered that vibration from a converter stations in operation will not adversely affect receptors and has not been quantified in detail.

Enabling works at the existing NGET substation at Lackenby

3.3.21 National Grid has confirmed that additional super transformers will not be required to accommodate the additional electricity generated by the scheme. Enabling works at the existing NGET substation at Lackenby will be required to allow the acceptance of the HVAC cables.

Offshore construction and operation impacts

3.3.22 Due to the significant distance of the proposed wind farm from the shore, the construction or operation of the development will not result in any impact to onshore noise receptors and is therefore not considered within this chapter.

Decommissioning phase impacts

3.3.23 The decommissioning activities with the potential to have an impact on noise and vibration would be similar to those occurring during the construction phase, assuming the infrastructure is removed. As such, the potential noise and vibration impacts associated with the decommissioning phase were assessed qualitatively with reference to the potential impacts associated with the construction phase.

3.4 Impact Assessment - methodology

Receptor sensitivity

3.4.1 To identify the significance of any potential noise and vibration impacts the sensitivity of each receptor was considered based on the criteria provided within **Table 3.7**.

Table 3.7 Definition of terms relating to the sensitivity of generic receptors

Sensitivity	Definition
High	Hospitals (e.g. operating theatres or high dependency units), care homes at night
Medium	Residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, during the day; and temporary holiday accommodation at all times
Low	Offices, shops, outdoor amenity areas, long distance footpaths, doctors surgeries, sports facilities and places of worship
Negligible	Warehouses, light industry, car parks, agricultural land

Impact magnitude – on-site construction noise

3.4.2 The construction noise criteria presented in **Table 3.8** are based on the guidance contained within BS 5228. Annex E of BS 5228 proposes 65dB L_{Aeq} as a potential daytime construction noise limit, where the existing ambient (L_{Aeq}) noise level is itself below 65dB(A). As the majority of locations surveyed within the cable corridor had average daytime L_{Aeq} values below 65dB(A), this ‘limit’ was deemed an appropriate value to use in this assessment as the threshold level for a negligible magnitude effect.

Table 3.8 Construction noise impact magnitude criteria

Construction noise level at receptor (dB $L_{Aeq,11h}$)	Impact magnitude
<64dB	Negligible
65 – 69dB	Low
70 – 74dB	Medium

Construction noise level at receptor (dB $L_{Aeq,11h}$)	Impact magnitude
> 75dB	High

Impact magnitude – construction related traffic noise

3.4.3 **Table 3.9** shows noise impact criteria for the assessment of changes in road traffic noise due to the addition of project related construction traffic. This table has been derived from Table 3.1 of DMRB.

Table 3.9 Construction traffic noise impact magnitude criteria

Increase in traffic noise level (dB $L_{Aeq,11h}$)	Impact magnitude
0.0 – 0.9dB	Negligible
1.0 – 2.9dB	Low
3.0 – 4.9dB	Medium
>= 5.0dB	High

Impact magnitude – converter stations operational noise

3.4.4 The impact magnitude criteria for noise from the operation of the converter stations are presented in **Table 3.10**. The criteria are based on the guidance from BS 4142. The assessment method defined in this standard involves the comparison of the noise rating level (converter stations noise, derived from Siemens design information) to the existing background noise level. However, it also states that the standard may not apply where existing background noise levels are "very low" (below 30dB L_{A90}).

3.4.5 Typically, a target noise rating level would be set with reference to the lowest existing background level during the day; as the converter stations will operate continuously this will generally be at night. The night time background noise levels at the closest residential receptors in the converter stations study were therefore derived from the mean measured baseline noise level at Wilton: this was 42dB $L_{A90\ (6hr)}$, based on a ten month average (2012) from the surrogate noise monitoring position (SP1) adjacent to the Wilton Complex, as defined in **Table 3.1**.

3.4.6 As background noise levels in the area are lowest during the night, and the converter station will operate continuously, 24-hours a day, it was deemed appropriate to use only the night time assessment period for residential receptors. The mean measured baseline noise level data at location P2: 46dB $L_{A90\ (16hr)}$, was used as a suitable daytime baseline level for assessment at non-residential receptors, e.g. those not occupied at night.

3.4.7 BS 4142 states that an exceedance of background noise levels by 5dBA is of "marginal significance" and an exceedance of 10dBA is "likely to cause complaints". Therefore the thresholds for medium and high impacts were set at 5dBA and 10dBA above the threshold level of 42dBA for residential receptors and 46dBA for non-residential receptors. Due to the tonality of converter station noise a 5dBA correction penalty was applied to all predicted rating levels at receptor locations.

Table 3.10 Converter stations noise impact magnitude criteria

Broadband converter stations noise level at residential receptor (dB $L_{Ar,5min}$)	Broadband converter stations noise level at non-residential receptor (dB $L_{Ar,5min}$)	Impact magnitude
<= 42dB	<= 46dB	Negligible
43 – 46dB	47 – 50dB	Low
47 – 52dB	51 – 56dB	Medium
> 52dB	> 56dB	High

3.4.8 The 42dBA threshold at residential receptors used in this assessment applies to noise levels outside of a property. BS 8233 states that a partly open window will offer 15dBA attenuation against external noise, therefore on this basis the 42dBA threshold at residential receptors would produce an internal noise level lower than the 35dB "reasonable" level inside bedrooms during the night, as defined in BS 8233.

3.4.9 The converter stations assessment is based upon predicted rated levels being equal to the measured background.

3.4.10 The noise impact magnitude criteria is based upon free field noise limits but the SoundPLAN predictive software produces resultant façade levels, therefore there is an additional 2-3dBA of contingency incorporated into the assessment.

Overall impact

3.4.11 The combination of receptor sensitivity and impact magnitude was used to derive the overall impact criteria, as shown in **Table 3.11**.

Table 3.11 Overall impact resulting from each combination of receptor sensitivity and the magnitude of the effect upon it

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible
	No effect	No impact	No impact	No impact	No impact

4 Existing Environment

4.1 Introduction

4.1.1 This section describes the existing environment in relation to baseline noise. The section is split into two parts, characterising the baseline levels at sensitive receptors surrounding the converter stations and those within the corridor containing the HVDC cable routes.

4.1.2 All measured survey data are deemed to be representative of the current daytime and night time baseline noise environment.

4.2 Converter stations study area

4.2.1 The noise environment around the proposed converter station area is largely governed by two main noise sources: the A174 and the Wilton Complex.

4.2.2 For locations P1, P2, P3 and the Wilton surrogate position (**Figure 3.1**), A174 road traffic and Wilton Complex site noise are the most significant noise sources. At all locations the Wilton Complex was audible at all times of day. During the night the noise environment was generally quiet, as road traffic reduced. **Table 4.1** - **Table 4.3** present a summary of the measured noise data from locations Surrogate P1, P2 and P3; the full noise dataset trace for Surrogate P1 (SP1) is appended separately in **Appendix 29A**. The data at P1 was acquired over a ten month period and therefore represents a long term measure of the existing noise environment, accounting for seasonal variations.

Table 4.1 Summary of surrogate baseline noise levels (2012) at Location Surrogate P1

Date	Period	L_{Aeq} (dB)*	L_{A90} (dB)*	L_{Amax} (dB)*
06/01/2012 to 17/11/2013	Night (23:00 – 05:00)	46	42	52

*Derived from averaging the measured daily 6 hour night time levels

Table 4.2 Summary of measured noise levels at Location P2

Date	Period	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	L_{Amax} (dB)
19/02/2013	Night (23:00 – 07:00)	39.4	40.9	37.1	46.0
20/02/2013	Day (07:00 – 23:00)	46.4	48.3	41.8	58.4
20/02/2013	Night (23:00 – 07:00)	36.8	38.2	34.4	44.9
21/02/2013	Day (07:00 – 23:00)	47.3	49.5	41.7	60.3

Date	Period	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	L_{Amax} (dB)
21/02/2013	Night (23:00 – 07:00)	38.9	40.3	36.8	45.5
22/02/2013	Day (07:00 – 23:00)	49.4	51.1	46.1	59.1
22/02/2013	Night (23:00 – 07:00)	43.7	44.9	41.8	50.1
23/02/2013	Day (07:00 – 23:00)	50.2	51.9	46.8	59.1
23/02/2013	Night (23:00 – 07:00)	46.1	47.5	44.2	53.0
24/02/2013	Day (07:00 – 23:00)	50.4	51.7	48.1	59.0
24/02/2013	Night (23:00 – 07:00)	48.0	49.4	46.5	53.4
25/02/2013	Day (07:00 – 23:00)	52.6	53.9	50.7	60.6
25/02/2013	Night (23:00 – 07:00)	46.2	47.5	44.2	52.5

Table 4.3 Summary of measured noise levels at Location P3*

Date	Start Time	Date	L_{Aeq} (dB)	L_{Amax} (dB)
18/02/2013	15:25	18/02/2013	61.8	77.6
18/02/2013	16:25	18/02/2013	56.7	61.1
18/02/2013	17:25	18/02/2013	55.5	60.5
18/02/2013	18:25	18/02/2013	56.2	62.0
18/02/2013	19:25	18/02/2013	55.2	64.9
18/02/2013	20:25	18/02/2013	53.4	61.1

*It was not possible to log the noise statistics on this SLM; therefore L_{A90} could not be reported at this location

4.3 Cable route study area

4.3.1 The noise environment at the monitoring locations along the cable corridor varied, with the largest determining factor of noise level being proximity to a main road. **Table 4.4** provides a brief description of the main noise sources at each monitoring location and each monitoring point is shown on **Figure 3.1**.

Table 4.4 Brief description of the main noise sources

Monitoring Location	Comments
M1	General urban noise, occasional squeaky wheelbarrow noise and allotment entrance gate impact noise
M2	Distant road traffic noise audible and plant noise from the sewage treatment works dominant
M3	Road traffic noise dominant and sewage treatment works audible
M4	Traffic noise from A174, occasional siren
M5	Traffic noise
M6	Traffic noise from Fishponds road
M7	Coast Road traffic noise dominant
M8	Broadband noise from Wilton Complex, traffic along A1042, birdsong, faint noise from substation, klaxon siren, and occasional noise from chainsaw operated at farm

4.3.2 **Table 4.5** presents a summary of the noise levels measured at each of the monitoring locations along the cable route.

Table 4.5 Summary of daytime survey results from the cable corridor

Location	Date and Start Time	Duration	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	L_{Amax} (dB)
M1	19/02/13 12:11	00:15:00	47.5	47.4	40.3	75.3
M1	19/02/13 12:26	00:15:00	45.2	48.4	40.3	63.2
M2	19/02/13 10:52	00:15:00	40.4	42.1	38.7	51.6
M2	19/02/13 11:07	00:15:00	41.4	42.8	39.7	58.4
M3	19/02/13 11:26	00:15:00	48.0	49.5	44.8	57.5
M3	19/02/13 11:41	00:15:00	46.3	47.5	43.1	59.6
M4	19/02/13 14:04	00:15:00	53.6	55.8	48.7	68.9
M4	19/02/13 14:22	00:15:00	55.1	56.7	48.3	74.8
M5	19/02/13 12:29	00:15:00	54.2	57.3	47.9	68.7
M5	19/02/13 12:46	00:15:00	53.2	56.4	47.8	62.1
M6	19/02/13 11:31	00:15:00	58.8	62.0	51.8	69.7

Location	Date and Start Time	Duration	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	L_{Amax} (dB)
M6	19/02/13 11:48	00:15:00	59.3	62.5	51.2	76.7
M7	19/02/13 10:05	00:15:00	62.0	66.8	44.5	76.7
M7	19/02/13 10:20	00:15:00	60.9	66.0	42.4	78.2
M8	19/02/13 09:37	00:15:00	66.1	63.2	53.3	85.9
M8	19/02/13 09:57	00:15:00	54.7	56.2	52.6	73.3

5 Assessment of Impact – Worst Case Definition

5.1 Introduction

5.1.1 This section establishes the realistic worst case scenario for each category of impact as a basis for the subsequent impact assessment. For this assessment this involves both a consideration of the construction scenarios (i.e. the manner in which Dogger Bank Teesside A & B will be built out), as well as the particular design parameters of each project (such as the maximum construction footprint at the landfall) that define the Rochdale Envelope[1].

5.1.2 Full details of the range of development options being considered by Forewind are provided within **Chapter 5 Project Description**. For the purpose of the noise impact assessment, the realistic worst case scenarios, taking these options into consideration, are set out in **Table 5.1**.

5.1.3 Only those design parameters with the potential to influence the level of impact are identified. Therefore, if the design parameter is not described, it is not considered to have a material bearing on the outcome of the assessment.

5.1.4 The realistic worst case scenarios identified here are also applied to the Cumulative Impact Assessment. When the worst case scenarios for the project in isolation do not result in the worst case for cumulative impacts, this is addressed within the cumulative section of this chapter (see Section 10) and summarised in **Chapter 33 Cumulative Impact Assessment**.

5.2 Construction scenarios

5.2.1 **Chapter 5** provides details of the three overarching construction scenarios associated with the onshore construction of Dogger Bank Teesside A & B.

5.2.2 The specific timing of construction of the two projects will be determined post consent and therefore a Rochdale Envelope approach has been undertaken for the EIA. There are four key principles that form the basis of the Rochdale Envelope, relating to how the projects will be built. These are:

- The two projects may be constructed at the same time, or at different times;
- If built at different times, either project could be built first;
- If built at different times, the duration of the gap between the end of the first project to be built, and the start of the second project to be built may vary from overlapping, to up to five years; and

[1] As described in **Chapter 5 Project Description** the term 'Rochdale Envelope' refers to case law (R.V. Rochdale MBC Ex Part C Tew 1999 "the Rochdale case"). The 'Rochdale Envelope' for a project outlines the realistic worst case scenario or option for each individual impact, so that it can be safely assumed that all lesser options will have less impact.

- Partial installation of elements of the second project may be completed during the construction of the first project, e.g. through the use of ducts to provide conduits for a later cable installation.

5.2.3 To determine which construction scenario is the realistic worst case for a given receptor two types of effect exist with the potential to cause a maximum level of impact on a given receptor:

- Maximum duration effects; and
- Maximum peak effects.

5.2.4 To ensure that the Rochdale Envelope incorporates all three overarching onshore construction scenarios (as outlined in **Chapter 5**), both the maximum duration effects and the maximum peak effects have been considered for each onshore receptor.

5.2.5 The three construction scenarios for Dogger Bank Teesside A & B considered within the onshore assessment for noise impacts are therefore:

i Build A in isolation;

ii Build B in isolation;

iii Build A and B concurrently – which provides the worst 'peak' impact and maximum working footprint; and

iv Build the first project, followed by a gap (of up to five years) before building the second project (sequential) – provides the worst 'duration' of impact.

5.2.6 For the noise assessment it has been assumed that construction noise could occur from any location within the converter stations site. As such, only one assessment for the single project scenario is presented and is considered representative for whichever project is built.

5.2.7 Furthermore an exercise was undertaken to identify which of the build out scenarios represents the realistic worst case for construction noise effects. This exercise identified that for all potential construction impacts the concurrent build scenario represents the worst case as the greater number of construction plant and wider spread activities represents the highest potential to elevate noise levels. As such, the scenarios assessed within this chapter are:

- Single project; and
- Concurrent build.

5.3 Operation scenarios

5.3.1 **Chapter 5** provides details of the operational scenarios for Dogger Bank Teesside A & B. Flexibility is required to allow for the following three scenarios; Dogger Bank Teesside A to operate on its own, Dogger Bank Teesside B to operate on its own, and for the two projects to operate concurrently. For the operational scenarios, the same approach to that outlined in Section 5.2.6 was used.

5.3.2 The two operation scenarios for Dogger Bank Teesside A & B considered within the onshore assessment for noise impacts are therefore:

- Single project; and
- Two projects (built and operating concurrently).

5.4 Design criteria

5.4.1 The realistic worst case scenarios for the range of design criteria taken forward for assessment within this chapter are presented in **Table 5.1**. The identified worst case scenarios are also applied to the cumulative impact assessment. The general areas affected by the construction works and operational noise are highlighted in **Figure 6.1** by the location of the appropriate buffer zones.

Table 5.1 Realistic worst case scenario for the assessment of noise impact

Impact	Realistic worst case scenario	Rationale
Construction		
All impacts	*All scenarios* • All construction equipment will operate concurrently, at the closest point within each working area to a receptor; • Construction noise is assumed to be generated at the edge of the construction working area, rather than the centre; • No noise reduction from intervening barriers, terrain or soft ground; and • HDD equipment and equipment associated with adjacent cable trenching activities will be in operation at the same time.	To establish the maximum construction noise levels using the shortest distances and minimum attenuation, to indicate maximum noise levels
	Concurrent build • Assumes that twice the equipment described for a single project would operate simultaneously at the closest location to the receptor.	To represent the highest possible magnitude of noise
Operational		
	All scenarios • All noise emitting equipment modelled as point sources, at a height above ground level specified in **Table 3.6**; • All converter station equipment assumed to be operating concurrently, including all cooling/air handling units; and • The ground surrounding the converter station(s) assumed to be 'soft' (i.e. grassland) whereas within the converter stations a proportion of the ground is assumed to be hard and acoustically reflective, such as concrete.	To establish the maximum operational noise levels using the minimum attenuation, to indicate maximum noise levels

6 Assessment of Impacts During Construction

6.1 On-site construction noise

Single project

6.1.1 **Table 6.1** identifies the nearest receptors to the works. These locations are also shown in **Figure 6.1**.

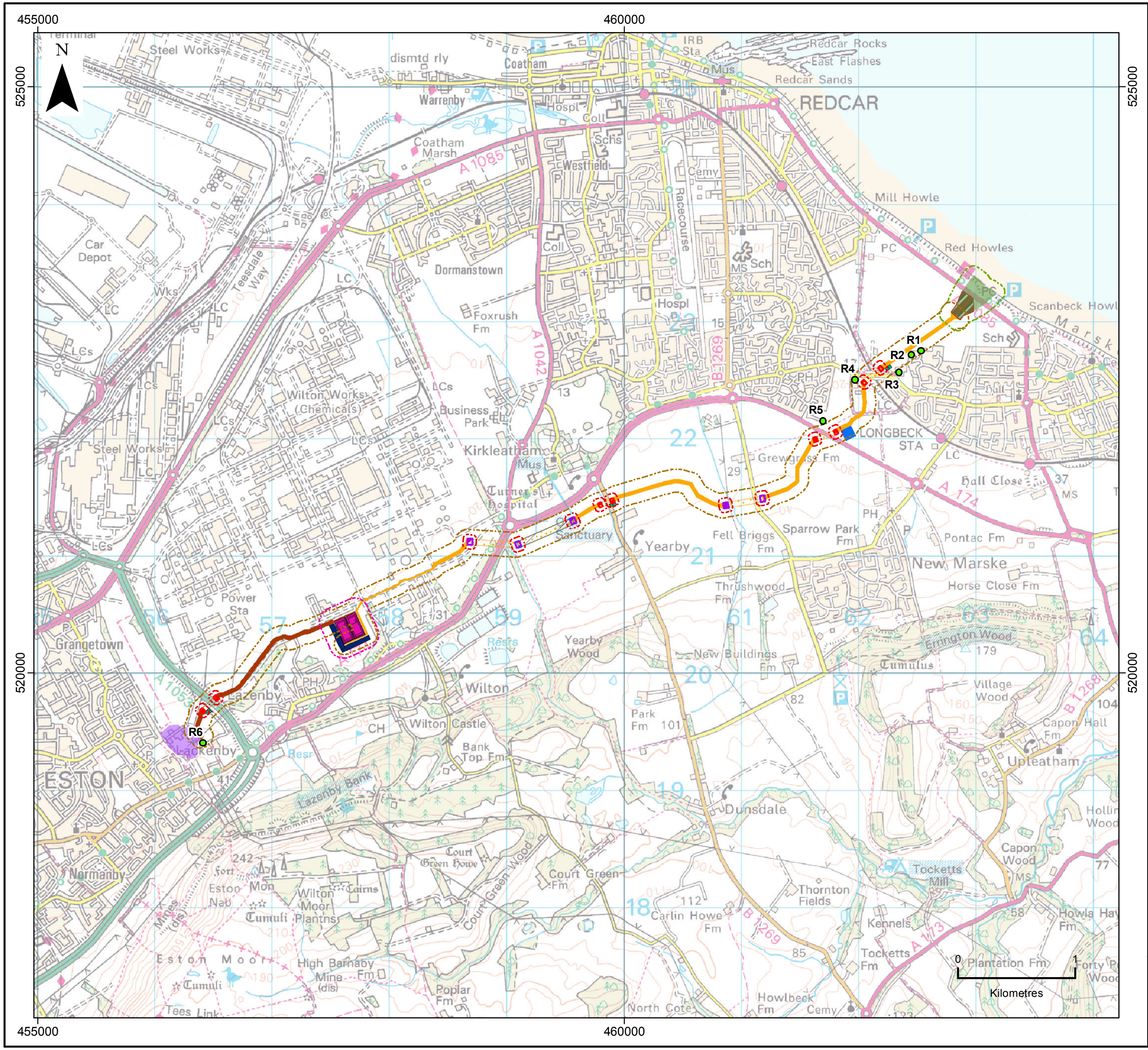
Table 6.1 Nearest receptors to the works

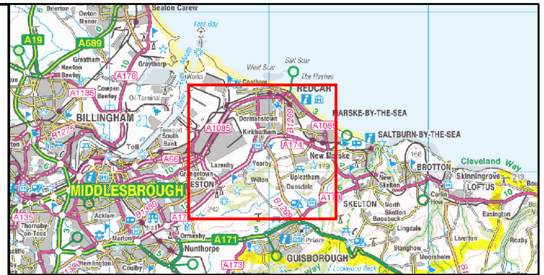
ID	Receptor	Distance to converter stations construction working area (m)	Distance to HVDC or HVAC cable route construction working area (m)	Distance to major HDD construction working area (m)
R1	Residential Properties on Vickers Close	N/A	74	320
R2	Residential Properties on De Havilland Drive	N/A	61	257
R3	Ryehills Farm	N/A	78	114
R4	Bridge Farm	N/A	43	61
R5	Residential Properties on Tunstall Gardens	N/A	68	61
R6	High Farm, Lackenby	N/A	60	348

6.1.2 A construction noise screening exercise was undertaken using a 65dB(A) impact buffer. An overview of the 65dB(A) construction noise buffer is shown in **Figure 6.1**.

6.1.3 There are no properties within the construction noise impact buffer around the converter stations site and HVAC route. Therefore on-site construction works associated with the converter stations are predicted to result in an effect of negligible magnitude and therefore a **negligible** impact.

6.1.4 The modelled noise level at each of the selected receptors is presented in **Table 6.2**.





LEGEND

- Teesside A&B cable landfall envelope
- Horizontal Directional Drilling (36m buffer)
- Cable Installation (80m buffer)
- Teesside A&B landfall construction envelope
- Teesside A&B HVDC, Open trench
- Teesside A&B HVDC, HDD
- Teesside A&B HVAC, Open trench
- Teesside A&B HVAC, HDD
- Teesside A&B major horizontal directional drill entry or exit locations (2,000m²)
- Teesside A&B minor horizontal directional drill entry or exit locations (1,200m²)
- HDD or open trench to be confirmed
- Teesside A&B cable route primary construction compound (10,000m²)
- Teesside A&B intermediate construction compound (784m²)
- Teesside A&B converter stations
- Teesside A&B converter stations construction compounds (10,000m² per project)
- Lackenby 400kV substation
- Noise Receptor Location (R = receptor)

Construction Noise Buffers

- Substation Construction (120m buffer)
- Cable Installation (80m buffer)
- Landfall Area (75m buffer)
- Horizontal Directional Drilling (36m buffer)

Data Source:
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PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 6.1: Construction noise buffers

VER	DATE	REMARKS	Drawn	Checked
3	04/09/2013	Draft	SEW	SW
4	14/10/2013	Submit for PEI3	SEW	SW
6	13/02/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-617**

SCALE	1:50,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

Table 6.2 Construction noise levels calculated at specific identified receptors

ID	Property	Noise from cable installation	Noise from major HDD	Total Noise	Magnitude of effect
		dB $L_{Aeq,11h}$	*dB $L_{Aeq,11h}$*	*dB $L_{Aeq,11h}$*	
R1	Residential Properties on Vickers Close	66	47	66	Low
R2	Residential Properties on De Havilland Drive	67	49	67	Low
R3	Ryehills Farm	65	56	66	Low
R4	Bridge Farm	70	61	71	Medium
R5	Residential Properties on Tunstall Gardens	66	61	67	Low
R6	High Farm, Lackenby	67	46	67	Low

6.1.5 **Table 6.2** shows that receptors at Bridge Farm may experience medium magnitude effects. This receptor is close to areas where both cable installation and HDD will occur.

6.1.6 For the properties identified in **Table 6.2** the construction noise levels were calculated using the same method defined in Section 4, however the noise level from both cable installation and HDD works were combined, to obtain the worst case noise level. Noise from the converter stations and landfall were not included in the calculation because none of the receptors identified in **Table 6.1** were within the noise buffer distances outlined within **Table 3.4**.

6.1.7 The results in **Table 6.2** show that a medium magnitude effect is predicted at Bridge Farm. This receptor is considered to be of medium sensitivity, as per **Table 3.7**.

6.1.8 **Table 6.2** demonstrates that at all other locations the magnitude of any effects is predicted to be low.

6.1.9 Various construction compounds will be established close to the landfall, along the cable route and for the converter stations. The compounds will generally be used for storage of materials, equipment and plant and will not be a source of significant construction activity. In addition, indicative locations of all compounds show that they are not in the immediate vicinity of residential properties. As such, it is deemed that they will not result in any significant construction noise affecting receptors and will therefore have a negligible effect.

6.1.10 Nevertheless a range of good practice mitigation measures is provided in **Table 6.3**.

Table 6.3 Potential mitigation measures (applicable to either Dogger Bank Teesside A or B) in relation to construction noise

Mitigation measures
To reduce potential construction noise impacts at receptors where the magnitude of impact is predicted to be greater than low, a solid site boundary hoarding fence, approximately 2.4m in height, could be erected prior to commencement of cable installation and remain in place until the works are complete in the relevant section of the cable route. Any fence would be located as close to the receptor as possible but still remaining within the easement.
A set of generic Best Practice working practices referred to as Best Practicable Means (BPM) are advised to be employed during the construction phase. Examples of typical BPM include: • Locating static noisy plant in use as far away from noise sensitive receptors as is feasible for the particular activity; • Ensuring that plant and equipment covers and hatches are properly secured and there are no loose fixings causing rattling; • Using the most modern equipment available and ensuring such equipment is properly maintained and operated by trained staff; • Using silenced equipment where possible, in particular silenced power generators if night time power generation is required for site security or lighting; • Ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate; • Ensuring plant machinery is turned off when not in use; • Imposition of vehicle speed limits for heavy goods vehicle traffic travelling on access roads close to receptors and ensuring that vehicles do not park or queue for long periods outside residential properties with engines running unnecessarily; • Ensuring, where practicable, that site access routes are in good condition with no pot-holes or other significant surface irregularities; • Maintaining good public relations with local residents that may be affected by noise from the construction works. Effective communication should be established prior to construction works, keeping local residents informed of the type and timing of works involved, paying particular attention to potential evening and night time works and activities which may occur in close proximity to receptors. Leaflet drops, posters and public meetings or exhibitions are an effective method of keeping local residents informed; • Provision of contact details for a site representative in the event that disturbance due to noise or vibration from the construction works occurs; ensuring that any complaints are dealt with promptly and that subsequent resolutions are communicated to the complainant; and • If night time works are envisaged then a Section 61 Prior Consent Notice should be sort from RCBC. This is a formal agreement that construction noise will be managed in accordance with 'best practicable means' (as outlined above).

6.1.11 BS 5228 states that where a barrier completely screens line-of-sight of a noise source, a reduction of around 10dB can be expected. Any barrier should be of a substantial construction, with no holes or gaps and be approximately 10kg/m^2 in density.

6.1.12 **Table 6.4** presents the residual impacts providing the measures outlined in **Table 6.3** are fully implemented.

Table 6.4 Residual impacts from on-site construction works

ID	Property	Noise from cable installation dB $L_{Aeq,11h}$	Noise from major HDD dB $L_{Aeq,11h}$	Total Noise dB $L_{Aeq,11h}$	Residual impact
R1	Residential Properties on Vickers Close	66	47	66	Minor
R2	Residential Properties on De Havilland Drive	67	49	67	Minor
R3	Ryehills Farm	65	56	66	Minor
R4	Bridge Farm	60	61	64	Negligible
R5	Residential Properties on Tunstall Gardens	66	61	67	Minor
R6	High Farm, Lackenby	67	46	67	Minor

6.1.13 **Table 6.4** demonstrates that **minor** residual impacts are predicted for the construction of either Dogger Bank Teesside A or B, at the majority of properties, with negligible impacts at one receptor close to the cable route.

6.1.14 It is not deemed that other site or off-site mitigation is required for receptors expected to experience minor impacts, due to the small exceedance of the construction noise 'limit' and the relatively short duration of the impact.

Two projects - concurrent

6.1.15 The modelled noise level for a concurrent build at each of the identified receptors is presented in **Table 6.5**.

Table 6.5 Construction noise levels calculated at specific identified receptors

ID	Property	Noise from cable installation dB $L_{Aeq,11h}$	Noise from major HDD dB $L_{Aeq,11h}$	Total Noise dB $L_{Aeq,11h}$	Magnitude of effect
R1	Residential Properties on Vickers Close	69	47	69	Low
R2	Residential Properties on De Havilland Drive	70	49	70	Medium
R3	Ryehills Farm	68	56	68	Low
R4	Bridge Farm	73	61	73	Medium
R5	Residential Properties on Tunstall Gardens	69	61	70	Medium
R6	High Farm, Lackenby	70	46	70	Medium

6.1.16 **Table 6.6** presents the residual impacts of a concurrent build providing the measures outlined in **Table 6.3** are fully implemented.

Table 6.6 Residual impacts from on-site construction works

ID	Property	Noise from cable installation	Noise from major HDD	Total noise	Residual impact
		dB $L_{Aeq,11h}$	dB $L_{Aeq,11h}$	dB $L_{Aeq,11h}$	
R1	Residential Properties on Vickers Close	69	47	69	Minor
R2	Residential Properties on De Havilland Drive	60	49	60	Negligible
R3	Ryehills Farm	68	56	68	Minor
R4	Bridge Farm	63	61	65	Minor
R5	Residential Properties on Tunstall Gardens	59	61	63	Negligible
R6	High Farm, Lackenby	60	46	60	Negligible

6.1.17 **Table 6.6** demonstrates that **minor** and **negligible** residual impacts are predicted for the construction of Dogger Bank Teesside A & B.

6.1.18 It is not deemed that other site or off-site mitigation is required for receptors expected to experience minor impacts, due to the small exceedance of the construction noise 'limit' and the relatively short duration of the impact. Contractors should aim to select the quietest equipment possible when working close to the identified receptors.

6.2 Off-site construction traffic noise

Single project

6.2.1 **Table 6.7** shows the calculated increase in traffic flow on the road links identified by the transport assessment as carrying construction traffic (refer to **Chapter 28**).

Table 6.7 Construction traffic impacts assuming traffic for one converter station

Road number	Road name/description	Background 2015 flows AAWT		Baseline + Dogger Bank Teesside A or B in isolation	Increase
		Total vehicles	Total HGVs	Total vehicles	%
A1085	A1085 (Trunk Road)	21675	497	21675	0.0
A66	A66 (Tees Dock Road)	25339	2028	25566	0.9
A1053	A1053 (Greystone Road)	17485	1418	17712	1.3
B1380*	B1380 (High Street)	9921	457	10044	1.2
A174	A174	28582	1611	28788	0.7
A174	A174 (south of Wilton)	44151	1525	44540	0.9
A1042	A1042 (Kirkleatham Lane)	16679	383	16727	0.3
A174	A174 (south of Redcar)	30683	1678	30821	0.4

Road number	Road name/description	Background 2015 flows AAWT		Baseline + Dogger Bank Teesside A or B in isolation	Increase
		Total vehicles	Total HGVs	Total vehicles	%
B1269	B1269 (Fishponds Road)	6269	254	6301	0.5
Unclassified	Grewgrass Lane	4862	18	4869	0.1
Unclassified	Redcar Road	9490	161	9496	0.1
A1085	A1085 (Coast Road)	12652	128	12699	0.4
A174	A174 (south of Marske)	13221	274	13260	0.3
A174	A174 (south of Redcar)	30683	1678	30781	0.3

*Denotes construction vehicles related to the upgrade of existing NGET substation at Lackenby; upgrade works will be required only once.

6.2.2 **Table 6.5** shows that, assuming the cable for each project is installed at different times there will be a less than 25% increase in traffic flow along the affected road links. This equates to a noise increase of less than 1dB, which is regarded as an imperceptible change in noise level according to the criteria from DMRB. Therefore the impact of road traffic is considered to be **negligible** if Dogger Bank Teesside A or B are built in isolation and the enabling works at existing NGET substation at Lackenby is undertaken concurrently.

Two projects - concurrent

6.2.3 **Table 6.8** shows the calculated noise increases adjacent to the roads previously identified, should both Dogger Bank Teesside A & B be constructed concurrently.

Table 6.8 Construction traffic impacts for two converter stations built concurrently

Road number	Road name/description	Background 2015 flows AAWT		Baseline + Dogger Bank Teesside A & B concurrently	Increase
		Total vehicles	Total HGVs	Total vehicles	%
A1085	A1085 (Trunk Road)	21675	497	21675	0.0
A66	A66 (Tees Dock Road)	25339	2028	25754	1.6
A1053	A1053 (Greystone Road)	17485	1418	17900	2.3
B1380*	B1380 (High Street)	9921	457	10050	1.3
A174	A174	28582	1611	28954	1.3
A174	A174 (south of Wilton)	44151	1525	44890	1.6
A1042	A1042 (Kirkleatham Lane)	16679	383	16760	0.5
A174	A174 (south of Redcar)	30683	1678	30935	0.8

Road number	Road name/description	Background 2015 flows AAWT		Baseline + Dogger Bank Teesside A & B concurrently	Increase
		Total vehicles	Total HGVs	Total vehicles	%
B1269	B1269 (Fishponds Road)	6269	254	6333	1.0
Unclassified	Grewgrass Lane	4862	18	4876	0.3
Unclassified	Redcar Road	9490	161	9501	0.1
A1085	A1085 (Coast Road)	12652	128	12735	0.6
A174	A174 (south of Marske)	13221	274	13288	0.5
A174	A174 (south of Redcar)	30683	1678	30855	0.6

*Denotes construction vehicles related to the upgrade of existing NGET substation at Lackenby; upgrade works will be required only once.

6.2.4 Whilst there would be a marginal increase in noise compared to a single project being constructed, the magnitude of the road traffic flow increases remains less than 25% on each link. As such, if both projects are constructed concurrently (including the enabling works at existing NGET substation at Lackenby), there will be a **negligible** impact associated with increased traffic noise at roadside receptors.

7 Assessment of Impacts During Operation

7.1 Operational noise from the converter stations

Single build

7.1.1 The predicted noise levels at the nearest receptors, from the operation of one converter station, are presented in **Table 7.1**. The receptor locations are also shown in **Figure 7.1**.

7.1.2 Whilst the distances between the source and the receptor differ slightly between Dogger Bank Teesside A & B, the assessment is representative of either converter station in operation.

7.1.3 It should be noted that the results do not account for any noise attenuation measures at this stage.

Table 7.1 Operational noise from one converter station (pre mitigation)

Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Rating level above background	Magnitude of effect
			dB L_{Ar}	*dB L_{A90}*	*dB*	
C1	7 Grange Estate	G.Fl	35.7	42	-6.3	**Negligible**
C1	7 Grange Estate	1.Fl	37.0	42	-5.0	**Negligible**
C2	10 Grange Estate	G.Fl	33.4	42	-8.6	**Negligible**
C2	10 Grange Estate	1.Fl	34.8	42	-7.2	**Negligible**
C3	20 Grange Estate	G.Fl	38.4	42	-3.6	**Negligible**
C3	20 Grange Estate	1.Fl	39.5	42	-2.5	**Negligible**
C4	Lazenby Grange Farmhouse	G.Fl	41.1	42	-0.9	**Negligible**
C4	Lazenby Grange Farmhouse	1.Fl	42.2	42	0.2	**Low**
C4	Lazenby Grange Farmhouse	2.Fl	43.4	42	1.4	**Low**
C5	Wilton Golf Club+	G.Fl	40.3	41***	-0.7	**Negligible**
C6	Wilton Office Block**	G.Fl	49.7	46	3.7	**Low**
C6	Wilton Office	1.Fl	49.8	46	3.8	**Low**

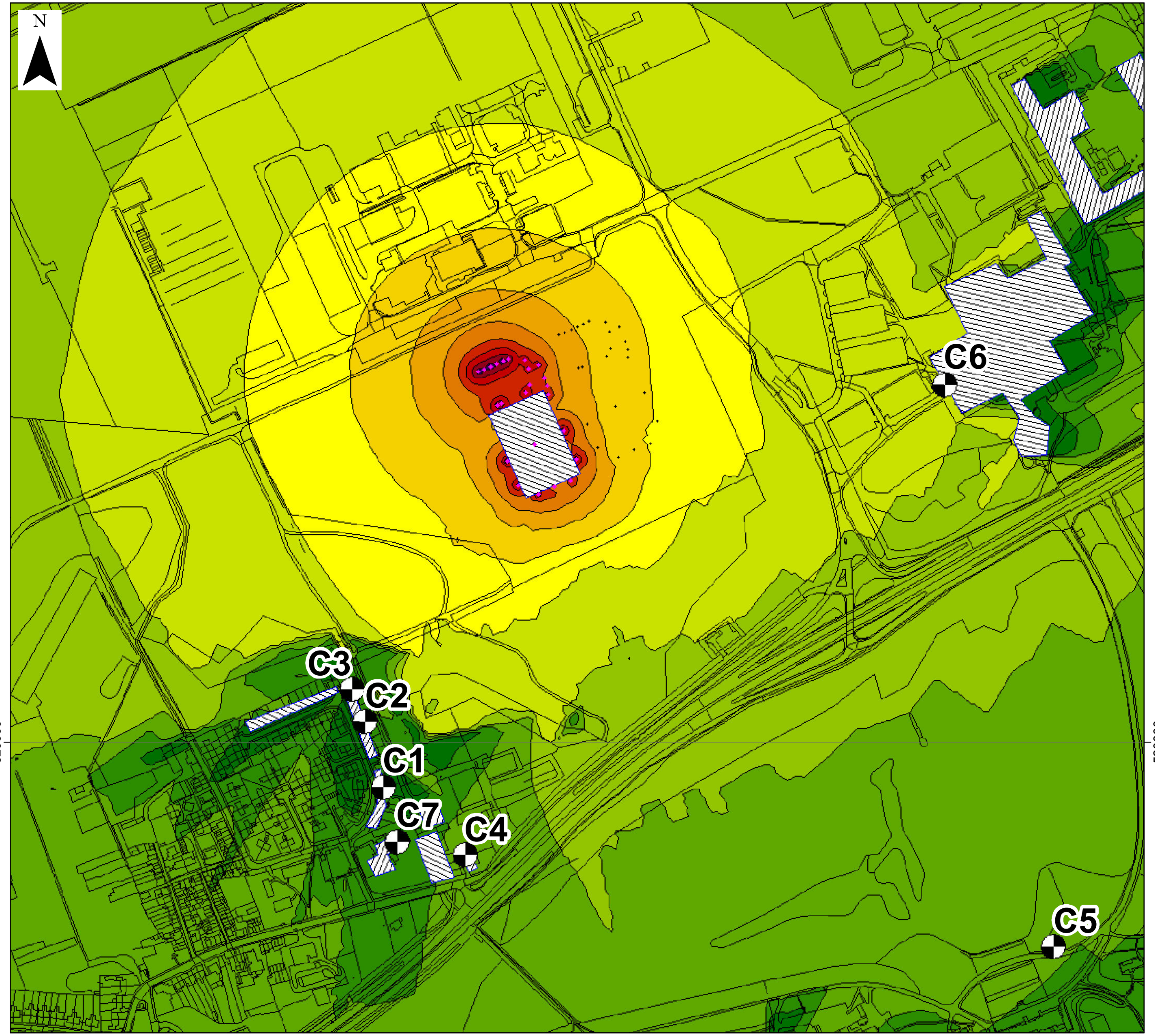
Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Rating level above background	Magnitude of effect
			dB L_{Ar}	*dB L_{A90}*	*dB*	
	Block**					
C6	Wilton Office Block**	2.Fl	49.9	46	3.9	**Low**
C7	Wilton Primary School**	G.Fl	36.3	46	-9.7	**Negligible**

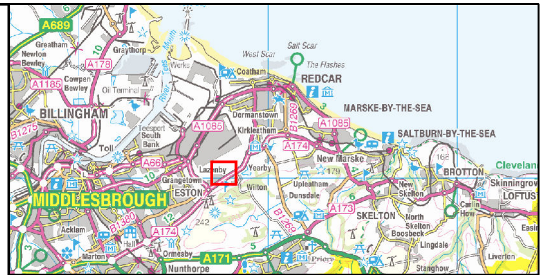
*Noise level modelled at the receptor – external façade
**Non-residential receptor
***Measured background noise level

7.1.4 **Figure 7.1** shows the noise contour plot for the operation of a single converter station. It should be noted that any building drawn into the noise model is simply referred to as a 'main building' in the *SoundPLAN* contour plot legend.

7.1.5 The results show that, with one converter station in operation a low magnitude effect is predicted at Lazenby Grange Farmhouse (second floor level), and Wilton Office Block (non-residential receptor). A negligible magnitude effect is predicted at all other residential and non-residential receptors.

7.1.6 **Table 7.2** provides a breakdown of the contribution from each noise source, at the worst affected residential receptor, Lazenby Grange Farmhouse, second floor level. This was calculated in order to determine the equipment that was giving rise to the most significant contribution to receptor noise levels and, therefore, which equipment would be the focus for any noise control or mitigation.





LEGEND

Noise level
Leq
in dB(A)

Noise level	
	<= 20
20 <	<= 25
25 <	<= 30
30 <	<= 35
35 <	<= 40
40 <	<= 45
45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	<= 80
80 <	<= 85
85 <	<= 90
90 <	

× Point source

Main building

Point receptor

0 250

Metres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 7.1: Noise contours from unmitigated converter station operating in isolation

VER	DATE	REMARKS	Drawn	Checked
2	03/06/2013	Draft	SEW	SW
3	19/07/2013	Draft	SEW	SW
5	13/02/2014	Pre-DCO submission review	SEW	SW

DRAWING NUMBER: **F-ONL-MA-618**

SCALE	1:7,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

Table 7.2 Converter station equipment pre mitigation noise contributions at Lazenby Grange Farmhouse – 2nd floor level (one converter station)

Equipment *(Number relates to equipment presented in Figure 3.2)*	Source sound power level	Combined rating level at receptor
	dB L_{WA}	dB $L_{Ar,5min}$
Aux Transformer (18)	75	-4
Aux Transformer (19)	75	-4
Control Building HVAC AHU (10)	88	10
Control Building Pump Skid (11)	85	6
Converter Cooler Area (21)	90	12
Converter Cooler Area (22)	90	11
Converter Hall (23)	80	6
Converter Hall AHU (4)	93	15
Converter Hall AHU (5)	93	15
Converter Hall AHU (6)	93	15
Converter Hall AHU (12)	93	15
Converter Hall AHU (13)	93	16
Converter Hall AHU (14)	93	34
Converter Hall AHU (15)	93	34
Converter Hall AHU (16)	93	33
Converter Transformer (1)	100	22
Converter Transformer (2)	100	38
Converter Transformer (3)	100	38
DC Equipment (17)	89	30
DC Equipment (24)	89	30
Diesel Generator (20)	90	11
Transformer Cooler (7)	93	15
Transformer Cooler (8)	93	15
Transformer Cooler (9)	93	31

7.1.7 The results clearly show that the main noise sources leading to the off-site impacts are the converter transformers, DC equipment and eastern/southern/western converter hall Air Handling Unit. Standard acoustic enclosures can provide a noise reduction of up to 20dB. If a greater degree of mitigation is required, bespoke enclosures can be designed.

7.1.8 Reducing the noise solely from the converter transformers is not sufficient to reduce the converter station noise to below the 42dB $L_{Ar,5min}$ threshold for residential receptors and 46dB $L_{Ar,5min}$ for non-residential receptors. Therefore a calculation was undertaken to determine the degree of source level reduction that is required for each piece of equipment, in order to limit the total noise to

42dB $L_{Ar,5min}$ and 46dB $L_{Ar,5min}$, at the respective receptor locations. The results of this calculation are presented in **Table 7.3**.

Table 7.3 Required noise reduction for one converter station Lazenby Grange Farmhouse – 2nd floor level

Equipment *(Number relates to equipment presented in Figure 3.2)*	Source sound power level	Required reduction	Mitigated rating level*	Mitigated source level**
	dB L_{WA}	*dB*	*dB $L_{Ar,5min}$*	*dB L_{WA}*
Aux Transformer (18)	75	0	-4	75
Aux Transformer (19)	75	0	-4	75
Control Building HVAC AHU (10)	88	0	10	88
Control Building Pump Skid (11)	85	0	6	85
Converter Cooler Area (21)	90	0	12	90
Converter Cooler Area (22)	90	0	11	90
Converter Hall (23)	80	0	6	80
Converter Hall AHU (4)	93	0	15	93
Converter Hall AHU (5)	93	0	15	93
Converter Hall AHU (6)	93	0	15	93
Converter Hall AHU (12)	93	10	5	83
Converter Hall AHU (13)	93	10	6	83
Converter Hall AHU (14)	93	10	24	83
Converter Hall AHU (15)	93	10	24	83
Converter Hall AHU (16)	93	10	23	83
Converter Transformer (1)	100	10	12	90
Converter Transformer (2)	100	10	28	90
Converter Transformer (3)	100	10	28	90
DC Equipment (17)	89	10	20	79
DC Equipment (24)	89	10	20	79
Diesel Generator (20)	90	0	11	90
Transformer Cooler (7)	93	0	15	93
Transformer Cooler (8)	93	0	15	93
Transformer Cooler (9)	93	0	31	93
Combined Rating Level			**35**	

*Mitigated rating level is the amount of noise at receptor location including tonal corrections.
**Mitigated source level is the amount of noise generated from the equipment.

7.1.9 **Table 7.3** indicates that a noise reduction of approximately 10dB(A) is required for the converter transformers, DC equipment and eastern/southern/western converter hall AHUs in order to limit the total night time noise to 42dB $L_{Ar,5min}$ at the nearest residential receptors. This mitigation provides a combined rating level of 7dBA below the measured background level at residential receptors. Mitigation measures are outlined in **Table 7.4**.

Table 7.4 Mitigation measures in relation to operational noise

Mitigation measures
The converter station operational noise levels (at the nearest receptor) will be reduced to below the 42dB(A) threshold for residential receptors and 46dB(A) for non-residential receptors. The precise nature of mitigation will be determined during detailed design of the converter station. Typical measures will include: • Selection of quieter equipment; • Installation of acoustic enclosures (a minimum 10dB reduction is required for the transformers); • Installation of acoustic barriers[2]; • Possibility to screen converter stations further by the construction of a landform/embankment around the site, which will protect against flooding and may also provide up to 10dB attenuation; • Silencing of exhausts/outlets for air handling/cooling units; and • Locating equipment to take advantage of screening inherent in the design, i.e. from the converter hall or control room buildings. These measures are all good practice industry standard approaches to noise reduction.

7.1.10 The measures outlined are designed to reduce operational noise levels, at the nearest receptors, to equal or be lower than the impact threshold of 42dB $L_{Ar,5min}$ for residential receptors and 46dB $L_{Ar,5min}$ for non-residential receptors. With this reduction in place the operational noise levels at each of the nearest receptors were calculated and are presented in **Table 7.5**. In addition, a noise contour chart is presented in **Figure 7.2**.

Table 7.5 Residual impacts from mitigated converter station noise (one converter station)

Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Rating level above background	Magnitude of effect	Residual impact
			dB $L_{Ar,5min}$	*dB L_{A90}*	*dB*		
C1	7 Grange Estate	G.Fl	29.2	42	-12.8	Negligible	**Negligible**
C1	7 Grange Estate	1.Fl	30.3	42	-11.7	Negligible	**Negligible**
C2	10 Grange Estate	G.Fl	27.8	42	-14.2	Negligible	**Negligible**
C2	10 Grange Estate	1.Fl	28.7	42	-13.3	Negligible	**Negligible**
C3	20 Grange Estate	G.Fl	31.9	42	-10.1	Negligible	**Negligible**
C3	20 Grange Estate	1.Fl	32.9	42	-9.1	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	G.Fl	33.2	42	-8.8	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	1.Fl	34.2	42	-7.8	Negligible	**Negligible**
C4	Lazenby Grange	2.Fl	35.4	42	-6.6	Negligible	**Negligible**

[2] 'Fire walls' may be required around the Converter Transformers, which may provide some acoustic benefit; however these were not accounted for in the assessment.

Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Rating level above background	Magnitude of effect	Residual impact
			dB $L_{Ar,5min}$	dB L_{A90}	dB		
	Farmhouse						
C5	Wilton Golf Club**	G.Fl	34.6	41	-6.4	Negligible	**Negligible**
C6	Wilton Office Block**	G.Fl	44.1	46	-1.9	Negligible	**Negligible**
C6	Wilton Office Block**	1.Fl	44.4	46	-1.6	Negligible	**Negligible**
C6	Wilton Office Block**	2.Fl	44.5	46	-1.5	Negligible	**Negligible**
C7	Wilton Primary School**	G.Fl	29.5	46	-16.5	Negligible	**Negligible**

*Noise level modelled at the receptor – external façade
** Non-residential receptor
*** Measured background noise level

7.1.11 The results in **Table 7.5** show that, with mitigation in place to reduce the operational noise at the nearest receptor to below 42dB $L_{Ar,5min}$ for residential receptors and 46dB $L_{Ar,5min}$ for non-residential receptors the magnitude of the effect is reduced to **negligible** for all residential and non-residential receptors. As such, a **negligible** residual impact is expected for the operational noise of either Dogger Bank Teesside A or B operating in isolation.

Two projects - concurrent

7.1.12 **Table 7.6** presents the noise levels from both converter stations operating concurrently. These results do not account for any noise attenuation measures at this stage.

Table 7.6 Pre-mitigated operational noise from two converter stations

Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Exceedance	Magnitude of effect
			dB $L_{Ar,5min}$	dB L_{A90}	dB	
C1	7 Grange Estate	G.Fl	38.0	42	-4.0	**Negligible**
C1	7 Grange Estate	1.Fl	39.3	42	-2.7	**Negligible**
C2	10 Grange Estate	G.Fl	35.5	42	-6.5	**Negligible**
C2	10 Grange Estate	1.Fl	36.6	42	-5.4	**Negligible**
C3	20 Grange Estate	G.Fl	39.6	42	-2.4	**Negligible**
C3	20 Grange Estate	1.Fl	40.6	42	-1.4	**Negligible**
C4	Lazenby Grange Farmhouse	G.Fl	42.5	42	0.5	**Low**

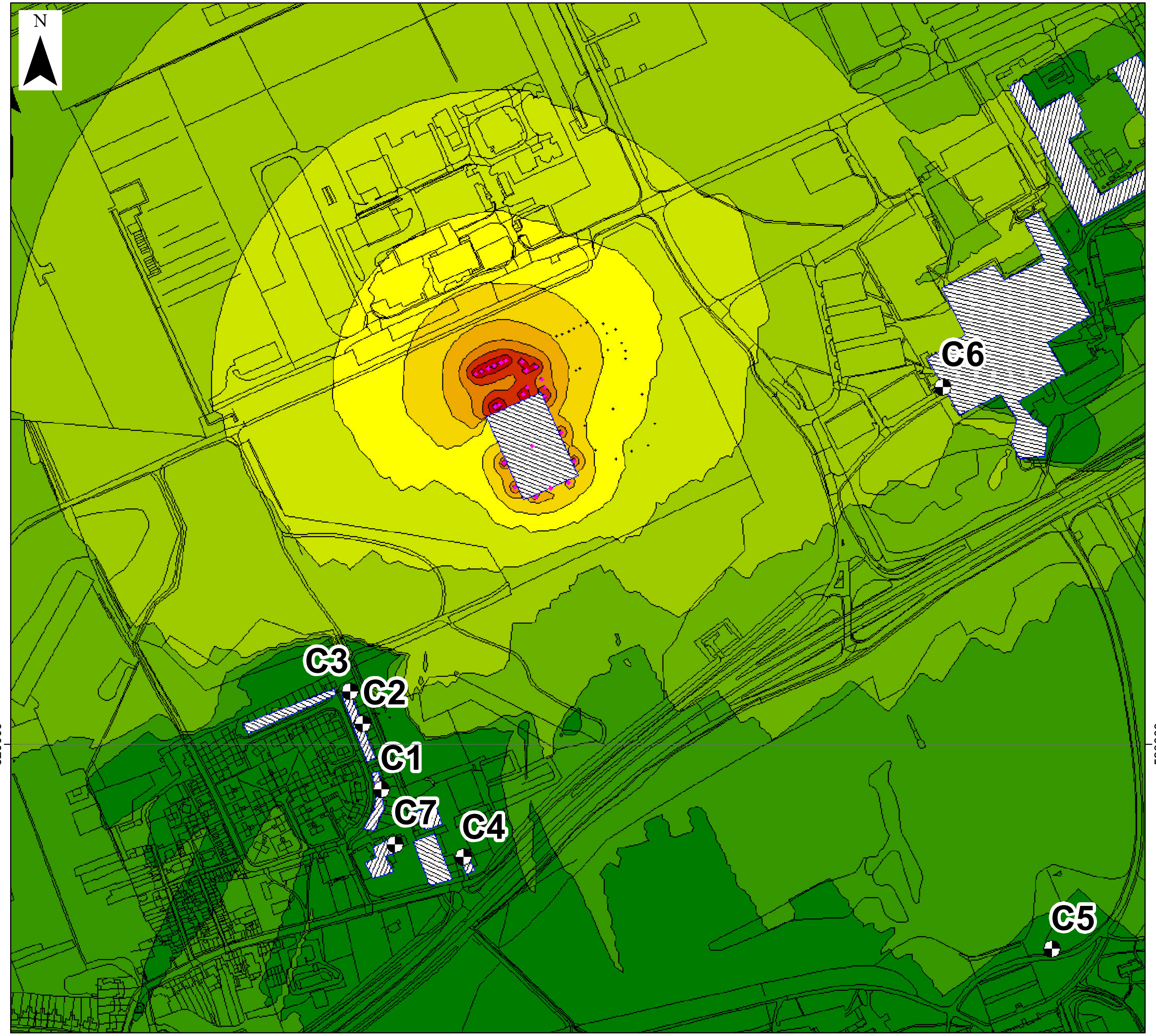
Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Exceedance	Magnitude of effect
			dB $L_{Ar,5min}$	*dB L_{A90}*	*dB*	
C4	Lazenby Grange Farmhouse	1.Fl	43.6	42	1.6	**Low**
C4	Lazenby Grange Farmhouse	2.Fl	44.8	42	2.8	**Low**
C5	Wilton Golf Club**	G.Fl	43.3	41	2.3	**Low**
C6	Wilton Office Block**	G.Fl	52.2	46	6.2	**Medium**
C6	Wilton Office Block**	1.Fl	52.3	46	6.3	**Medium**
C6	Wilton Office Block**	2.Fl	52.5	46	6.5	**Medium**
C7	Wilton Primary School**	G.Fl	38.3	46	-7.7	**Negligible**

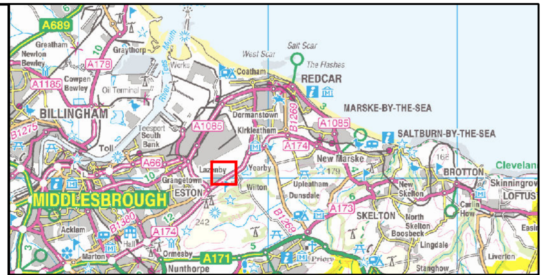
*Noise level modelled at the receptor – external façade
**Non-residential receptor
***Measured background noise level

7.1.13 **Figure 7.3** shows the noise isopleth for both Dogger Bank Teesside A & B converter stations operating concurrently.

7.1.14 The results show that, with two converter stations operating concurrently a negligible to medium magnitude effect is predicted at all receptors with the worst residential location affected being Lazenby Grange Farmhouse (second floor level), and Wilton Office Block (non-residential receptor).

7.1.15 On the basis that Wilton Office Block is classified as having a low sensitivity and is not a residential receptor (nor occupied throughout the night), **Table 7.7** provides a breakdown of the contribution from each post mitigated noise source, only at the worst affected residential receptor, Lazenby Grange Farmhouse, second floor level.





LEGEND

Noise level Leq in dB(A)

<= 20
20 < <= 25
25 < <= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

- Point source
- Main building
- Point receptor

0 250

Metres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

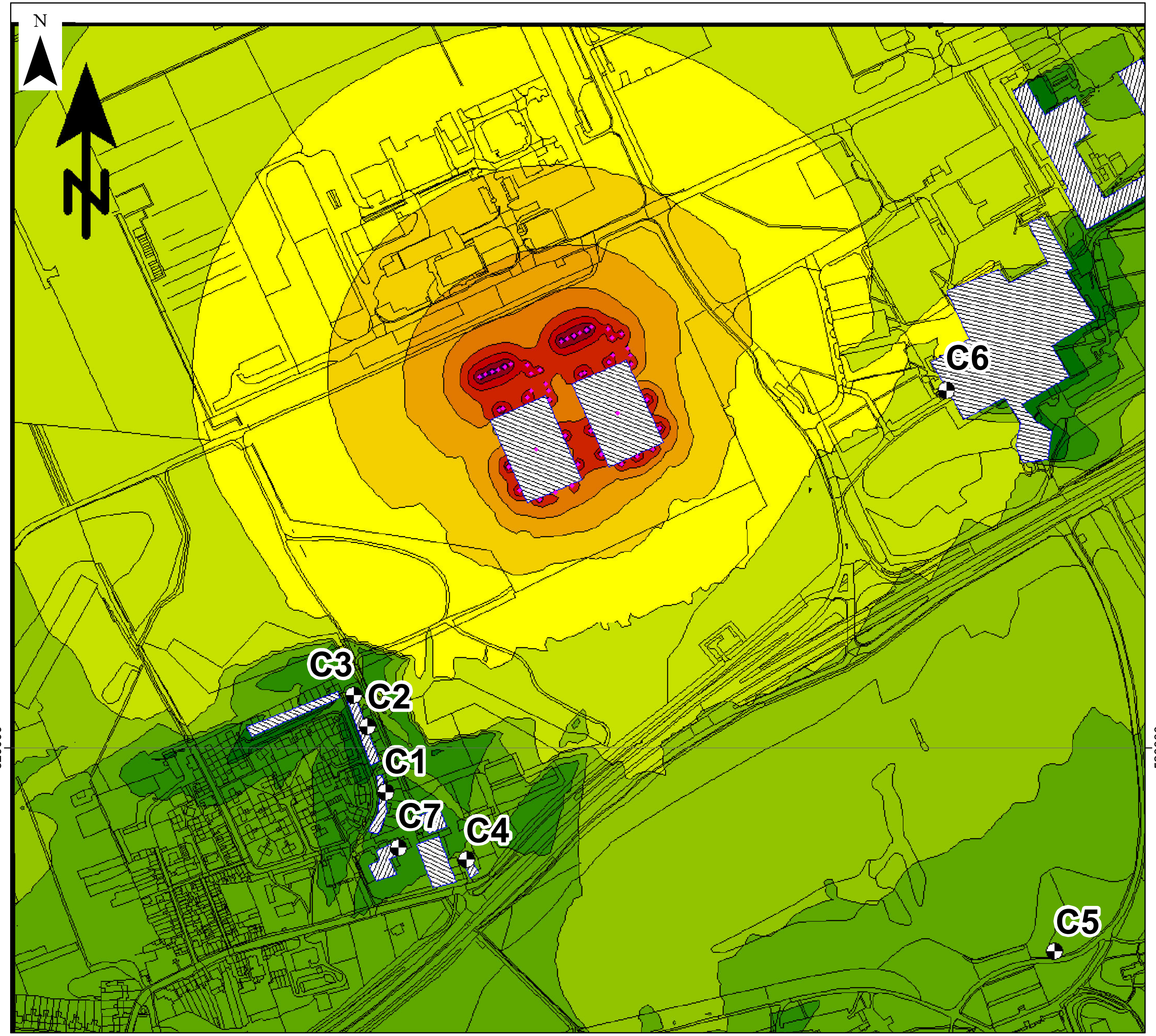
Figure 7.2: Noise contours from mitigated converter station operating in isolation

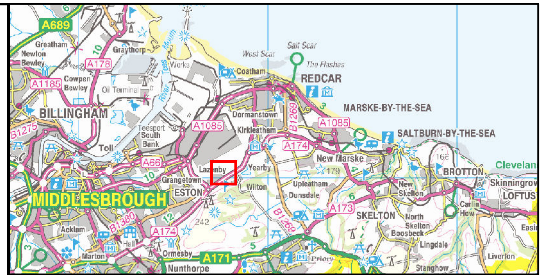
VER	DATE	REMARKS	Drawn	Checked
2	29/07/2013	Draft	SEW	SW
3	04/09/2013	Submit for PEI3	SEW	SW
5	13/02/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-619**

SCALE	1:7,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND





LEGEND

Noise level Leq in dB(A)

<= 20
20 < <= 25
25 < <= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

- Point source
- Main building
- Point receptor

0 — 250 Metres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 7.3: Noise contours from unmitigated converter stations operating concurrently

VER	DATE	REMARKS	Drawn	Checked
2	29/07/2013	Draft	SEW	SW
3	04/09/2013	Submit for PEI3	SEW	SW
5	21/01/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-620**

SCALE	1:7,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

Table 7.7 Converter station equipment noise contributions post mitigation at Lazenby Grange Farmhouse – 2nd floor level (two converter stations)

Equipment* *(Number relates to equipment presented in Figure 3.2)*	**Source sound power level**	**Combined rating level at receptor**
	dB L_{WA}	***dB $L_{Ar,5min}$***
Aux Transformer (18) CS A	75	-5
Aux Transformer (18) CS B	75	-4
Aux Transformer (19) CS A	75	-5
Aux Transformer (19) CS B	75	-4
Control Building HVAC AHU (10) CS A	88	8
Control Building HVAC AHU (10) CS B	88	10
Control Building Pump Skid (11) CS A	85	5
Control Building Pump Skid (11) CS B	85	6
Converter Cooler Area (21) CS A	90	11
Converter Cooler Area (21) CS B	90	12
Converter Cooler Area (22) CS A	90	10
Converter Cooler Area (22) CS B	90	11
Converter Hall (23) CS A	80	4
Converter Hall (23) CS B	80	6
Converter Hall AHU (4) CS A	93	14
Converter Hall AHU (4) CS B	93	15
Converter Hall AHU (5) CS A	93	14
Converter Hall AHU (5) CS B	93	15
Converter Hall AHU (6) CS A	93	14
Converter Hall AHU (6) CS B	93	15
Converter Hall AHU (12) CS A	83	4
Converter Hall AHU (12) CS B	83	5
Converter Hall AHU (13) CS A	83	4
Converter Hall AHU (13) CS B	83	6
Converter Hall AHU (14) CS A	83	24
Converter Hall AHU (14) CS B	83	24
Converter Hall AHU (15) CS A	83	24
Converter Hall AHU (15) CS B	83	24
Converter Hall AHU (16) CS A	83	10
Converter Hall AHU (16) CS B	83	23
Converter Transformer (1) CS A	90	12
Converter Transformer (1) CS B	90	12
Converter Transformer (2) CS A	90	16
Converter Transformer (2) CS B	90	28

Equipment* *(Number relates to equipment presented in Figure 3.2)*	Source sound power level	Combined rating level at receptor
	dB L_{WA}	*dB $L_{Ar,5min}$*
Converter Transformer (3) CS A	90	14
Converter Transformer (3) CS B	90	28
DC Equipment (17) CS A	79	18
DC Equipment (17) CS B	79	20
DC Equipment (24) CS A	79	20
DC Equipment (24) CS B	79	20
Diesel Generator (20) CS A	90	10
Diesel Generator (20) CS B	90	11
Transformer Cooler (7) CS A	93	15
Transformer Cooler (7) CS B	93	15
Transformer Cooler (8) CS A	93	19
Transformer Cooler (8) CS B	93	15
Transformer Cooler (9) CS A	93	18
Transformer Cooler (9) CS B	93	31
Combined Rating Level		**37**

*CS A and CS B refer to the two potential converter stations

7.1.16 Whilst the distances between the source and the receptor differ slightly between converter stations A and B, the earlier principles of equipment mitigation (**Table 7.3**) for a single station are also deemed applicable to the scenario of two projects operating concurrently. The assessment determined the source level mitigation required for each piece of equipment for a single station or concurrent operation, in order to limit the total noise to 42dB $L_{Ar,5min}$ and 46dB $L_{Ar,5min}$ for residential and non-residential receptors respectively. This mitigation provides a combined rating level of 5dBA below the measured background level at residential receptors.

7.1.17 Mitigation measures are outlined in **Table 7.4**, to enable a 10dB reduction by the installation of enclosures/screens, which is standard industry practice for reducing noise. The other measures proposed in **Table 7.4** are also tried and tested methods for noise reduction

7.1.18 The concurrent converter stations operational noise levels (at the nearest residential receptor) will be reduced to or below the 42dB $L_{Ar,5min}$ and 46dB $L_{Ar,5min}$ threshold for residential and non-residential receptors respectively. A combination of mitigation measures outlined in **Table 7.4** will be implemented should both Dogger Bank Teesside A & B operate concurrently. The precise nature of mitigation will be determined during detailed design of the converter stations. An assessment of tonal noise propagation and subsequent mitigation will be undertaken during post consent detailed design of the converter stations.

7.1.19 The measures outlined are designed to reduce operational noise levels, at the worst affected receptor, to equal or be lower than the impact threshold of 42dB $L_{Ar,5min}$ for residential receptors and 46dB $L_{Ar,5min}$ for non-residential receptors. With this reduction in place the operational noise levels at each of the nearest receptors were calculated and are presented in **Table 7.8**. In addition, a noise contour chart is presented on **Figure 7.4**.

7.1.20 The results in **Table 7.8** show that, with mitigation in place to reduce the operational noise at the nearest residential receptor to 42dB $L_{Ar,5min}$ and nearest non-residential receptor to 46dB $L_{Ar,5min}$, the magnitude of the effect is reduced to negligible for all residential and minor for some non-residential receptors. As such, a **negligible** residual impact is expected at residential receptors for the operational noise of both Dogger Bank Teesside A & B operating concurrently. The Wilton Office Block is classified as having a low sensitivity as it is not a residential receptor nor is it occupied throughout the night, and the worst-case predicted impact is less than 1dB above threshold.

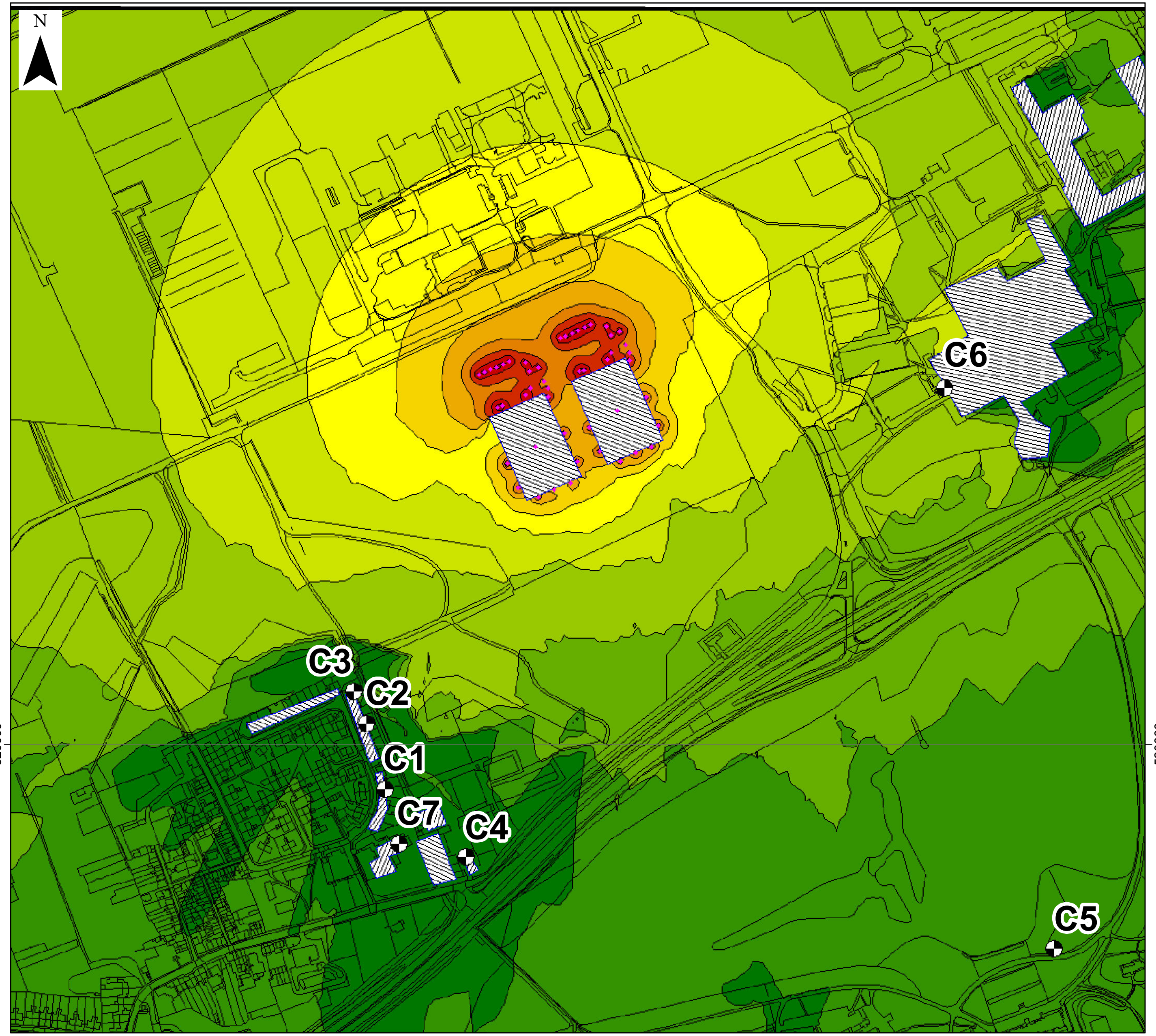
7.2 Operational noise from the enabling works at existing NGET substation at Lackenby

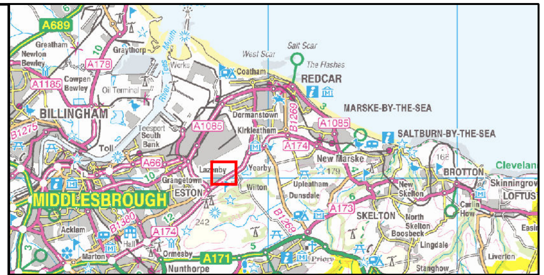
7.2.1 Noise emissions from the existing NGET substation at Lackenby are not expected to change in level or character due to the development of Dogger Bank Teesside A & B. A **negligible** impact is predicted and no further assessment is required.

Table 7.8 Residual impacts from mitigated converter station noise (two converter stations)

Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Exceedance	Magnitude of effect	Residual impacts
			dB $L_{Ar,5min}$	dB L_{A90}	dB		
C1	7 Grange Estate	G.Fl	31.1	42	-10.9	Negligible	**Negligible**
C1	7 Grange Estate	1.Fl	32.1	42	-9.9	Negligible	**Negligible**
C2	10 Grange Estate	G.Fl	29.9	42	-12.1	Negligible	**Negligible**
C2	10 Grange Estate	1.Fl	30.6	42	-11.4	Negligible	**Negligible**
C3	20 Grange Estate	G.Fl	33.1	42	-8.9	Negligible	**Negligible**
C3	20 Grange Estate	1.Fl	34.0	42	-8.0	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	G.Fl	34.5	42	-7.5	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	1.Fl	35.5	42	-6.5	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	2.Fl	36.6	42	-5.4	Negligible	**Negligible**
C5	Wilton Golf Club**	G.Fl	37.2	41	-3.8	Negligible	**Negligible**
C6	Wilton Office Block**	G.Fl	46.3	46	0.3	Low	**Minor**
C6	Wilton Office Block**	1.Fl	46.3	46	0.3	Low	**Minor**
C6	Wilton Office Block**	2.Fl	46.4	46	0.4	Low	**Minor**
C7	Wilton Primary School**	G.Fl	31.3	46	-14.7	Negligible	**Negligible**

*Noise level modelled at the receptor – external façade
**Non-residential receptor
***Measured background noise level





LEGEND

Noise level
Leq
in dB(A)

<= 20
20 < <= 25
25 < <= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

× Point source

Main building

Point receptor

0 250

Metres

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 7.4: Noise contours from mitigated converter stations operating concurrently

VER	DATE	REMARKS	Drawn	Checked
2	29/07/2013	Draft	SEW	SW
3	04/09/2013	Submit for PEI3	SEW	SW
5	13/02/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-621**

SCALE	1:7,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

8 Assessment of Impact During Decommissioning

8.1 Assessment of impacts during decommissioning

8.1.1 The decommissioning of the onshore electrical connection, including the cable route and converter stations at Dogger Bank Teesside A & B, will form part of an overall Decommissioning Plan. A full EIA will be carried out ahead of any decommissioning works being undertaken.

8.1.2 In relation to the converter stations the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology will be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of electrical equipment;
- Removal of cabling from site;
- Removal of any building services equipment;
- Demolition of the buildings and removal of fences; and
- Landscaping and reinstatement of the site.

8.1.3 At the time of decommissioning, it will be evaluated whether the buried cable systems could be used for another purpose. If this is not feasible, the above ground features will be removed to a sufficient depth to allow agricultural (or other) practices to occur unhindered. The buried cable systems will be isolated and left in place unless otherwise specified by the local planning authority. It is possible that some cabling at the landfall will require removal to avoid exposure as a result of future coastal erosion.

8.1.4 Noise impacts associated with the decommissioning of both the cable route and converter stations will be similar to those identified for the construction of both elements.

8.1.5 The mitigation measures outlined for the construction of the cable route and converter stations, for the control of noise, would therefore also be expected to be adopted for the decommissioning phase.

9 Inter-Relationships

9.1 Inter-relationships

9.1.1 In order to address the environmental impact of the proposed development as a whole, this section summarises the inter-relationships between noise receptors and other physical, environmental and human receptors (**Table 9.1**). The objective is to identify where the accumulation of effects on a single receptor, and the relationship between those effects, may give rise to more significant impact than those effects in isolation which may, in turn, result in a need for additional mitigation.

9.1.2 **Chapter 31 Inter-relationships** provides a more detailed holistic overview of the potential effects that may manifest themselves on the same receptors as well as noise impacts.

Table 9.1 Inter-relationships relevant to the assessment of noise impacts

Inter-relationship	Section where addressed	Linked chapter
Influence of local footpath closures during construction on local amenity	Section 23.6	**Chapter 23 Tourism and Recreation**
Influence of construction traffic on local amenity	Section 28.6	**Chapter 28 Traffic and Access**

10 Cumulative Impacts

10.1 Cumulative impacts

10.1.1 This section describes the cumulative impact assessment for noise, taking into consideration other plans, projects and activities. A summary for the cumulative assessment is presented in **Chapter 33**.

10.1.2 Forewind has developed a strategy for the assessment of cumulative impacts in consultation with statutory stakeholders including the Marine Management Organisation (MMO), the Joint Nature Conservation Committee (JNCC), Natural England and the Centre for the Environment, Fisheries and Aquaculture Science (Cefas) and the Local Authority. Details of the approach to cumulative impact assessment adopted for this ES are provided in **Chapter 4 EIA Process**. In its simplest form, the cumulative impact assessment strategy involves consideration of whether impacts on a receptor can occur on a cumulative basis between Dogger Bank Teesside and other activities, projects and plans for which sufficient information regarding location and scale exist.

10.1.3 **Table 10.1** provides details of the other projects and plans considered relevant to the noise impact assessment.

Table 10.1 Projects considered within the cumulative impact assessment

Development number	Title	Distance to nearest point	Impact on this project?	Taken forward for cumulative impact assessment?
1	Tees Renewable Energy Plant	3640 (m)	HVAC Cable route	No, given relative size of development and distance separation
2	Tees Renewable Energy Plant underground cable	0 (m) (intersects project)	Substation; HVAC Cable route	Yes
3	York Potash Project	0 (m) (intersects project)	HVDC Cable route	Yes
4	Anemometry Mast at The Wilton Centre	30 (m)	HVDC Cable route	No, given small size of development
5	Northern Gateway Terminal	2680 (m)	HVAC Cable route	No, given relative size of development and distance separation
6	Breagh Pipeline	2890 (m)	HVDC Cable route	No, given small size of development
7	Two storey 2, 3 and 4 bedroom dwelling houses and garages	2320 (m)	HVDC Cable route	No, given small size of development
8	Installation of single pole to house transformer unit	3420 (m)	HVDC Cable route	No, given small size of development

Development number	Title	Distance to nearest point	Impact on this project?	Taken forward for cumulative impact assessment?
	(application submitted under section 37 of the electricity act 1989)			
9	Redevelopment comprising the erection of 288 dwellings and ancillary works (amended scheme)	1920 (m)	HVDC Cable route	No, given small size of development
10	Demolition of various buildings	415 (m)	HVDC Cable route	No, given small size of development
11	Erection of 6 dwellings	770 (m)	HVDC Cable route	No, given small size of development
12	Teesside Power Station	350 (m)	HVAC Cable route	No, given relative size of development and distance separation
13	Three storey 72 bedroom care home	3300 (m)	HVDC Cable route	No, given small size of development
14	Screening opinion request for new biomass import facility	3140 (m)	HVAC Cable route	No, given relative size of development and distance separation
15	Screening opinion for proposed potash processing plant	1850 (m)	HVAC Cable route	No, given relative size of development and distance separation
16	Two storey management block with associated 92 space car park	600 (m)	HVDC Cable route	No, given small size of development
17	Dogger Bank Teesside Projects C & D	0 (m) (intersects project)	HVDC Cable route & Operation of converter stations	Yes
18	Scoping request for 2 wind turbines (140m max height to tip) including compound; equipment; buildings; new vehicular access onto A174 and associated infrastructure	0 (m) (intersects project)	HVDC Cable route	No, given small size of development and construction traffic is included within the background + committed development flows 2015, shown in Table 3.5.
19	Waste Treatment Facility for bioremediation and treatment of hazardous wastes. The WTF will be located within the footprint of the Teesport Landfill Site.	4200 (m)	HVAC Cable route	No, given relative size of development and distance separation

Development number	Title	Distance to nearest point	Impact on this project?	Taken forward for cumulative impact assessment?
20	Extension to existing factory building with ancillary new access roads	800 (m)	HVDC Cable route	No, given small size of development
21	Prior notification for demolition of a power station and associated structures and equipment	265 (m)	HVAC Cable route	No, given relative size of development and distance separation
22	Proposed anaerobic digestion and combined heat and power plant	2530 (m)	HVAC Cable route	No, given relative size of development and distance separation
23	Erection of single wind turbine (max height 80m to tip) and associated infrastructure including access tracks, hardstandings, control buildings and cabling	1290 (m)	HVAC Cable route	No, given small size of development
24	Installation of above ground effluent main pipeline to replace underground corrosive pipeline	3000 (m)	HVDC Cable route	No, given small size of development
25	Wind farm including 5 No. wind turbines, control building and associated access.	3240 (m)	HVAC Cable route	No, given relative size of development and distance separation
26	Installation of a single wind turbine (max height to tip 51m), associated infrastructure, including external company housing with underground cabling, turbine foundation and access tracks.	2400 (m)	HVAC Cable route	Application withdrawn
27	Substitution of 30 approved house types of planning permission with 28 new house types, boundary treatments and associated landscaping.	2000 (m)	HVAC Cable route	No, given small size of development
28	3x four bedroomed special needs bungalows and day care centre including new vehicular and pedestrian accesses	1500 (m)	HVAC Cable route	No, given small size of development

Development number	Title	Distance to nearest point	Impact on this project?	Taken forward for cumulative impact assessment?
	and associated landscaping			
29	Outline application for up to 1000 dwellings together with ancillary uses including a park-and- ride car park, petrol filling station, drive-through, public house/ restaurant and 60 bed hotel with details of access	770 (m)	HVAC Cable route	No, given relative size of development and distance separation
30	Resubmission	0 (m) (intersects project)	HVAC Cable route	No, given small size of development
31	Residential development comprising of 14 two storey detached dwellings with new access and landscaping	1200 (m)	HVAC Cable route	No, given small size of development

Construction of Dogger Bank Teesside A & B

10.1.4 Minor adverse residual impacts have been identified at various points along the HVDC cable route. As shown in **Figure 6.1**, the 65dB(A) buffer associated with construction of the HVDC cable route is limited to the immediate area (less than 100m from construction). Development numbers 2, 3, 17 and 18 intersect this 65dB(A) noise buffer and therefore cumulative impact needs consideration.

10.1.5 Cumulative impacts predicted for Dogger Bank Teesside A & B and developments 2, 3 and 18 have been considered in Section 6.2 as the associated construction traffic is incorporated within the background plus committed development flows (2015).

10.1.6 No residual noise impacts have been identified for the construction of the Dogger Bank Teesside A & B converter stations and HVAC cable route.

10.1.7 Cumulative impacts are predicted as a result of the construction of the onshore elements of Dogger Bank Teesside A & B in combination with the projects listed above in **Table 10.1**.

10.1.8 If the construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D cable routes occurred concurrently, the estimated combined construction noise receptor levels are shown in **Table 10.2**. These are based on the methodology outlined in Section 3.3 and can be compared to the concurrent Dogger Bank Teesside A & B estimated levels presented in **Table 6.2**. It should be noted that receptors R1, R2 and R3 were not assessed due to the cable route of Dogger Bank Teesside C & D being diverted away from these particular receptors.

Table 10.2 Construction noise levels calculated at specific identified receptors for concurrent construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D

ID	Property	Noise from cable installation (*dB* $L_{Aeq,11h}$)	Noise from major HDD (*dB* $L_{Aeq,11h}$)	Total noise (*dB* $L_{Aeq,11h}$)	Magnitude of effect
R4	Bridge Farm	73	64	74	Medium
R5	Residential Properties on Tunstall Gardens	69	64	70	Medium

10.1.9 **Table 10.2** shows that receptors at Bridge Farm and residential properties on Tunstall Gardens may experience medium magnitude effects. Both receptors are close to areas where cable installation and HDD will occur.

10.1.10 A range of mitigation measures are provided in **Table 6.3**, which are consistent with an approach for the concurrent contribution of the Dogger Bank Teesside A & B and Dogger Bank Teesside C & D projects.

10.1.11 BS5228 states that where a barrier completely screens line-of-sight of a noise source, a reduction of around 10dB can be expected. Any barrier should be of a substantial construction, with no holes or gaps and of a density of approximately $10kg/m^2$.

10.1.12 **Table 10.3** presents the residual impacts providing the measures outlined in **Table 6.3** are fully implemented.

Table 10.3 Construction noise levels post mitigation calculated at specific identified receptors for concurrent construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D

ID	Property	Noise from cable installation (*dB* $L_{Aeq,11h}$)	Noise from major HDD (*dB* $L_{Aeq,11h}$)	Total noise (*dB* $L_{Aeq,11h}$)	Magnitude of effect
R4	Bridge Farm	63	64	67	Low
R5	Residential Properties on Tunstall Gardens	59	64	65	Low

10.1.13 **Table 10.3** demonstrates that **low** residual impacts are predicted for the concurrent construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D, at the assessed receptors.

10.1.14 As a result, the cumulative impact on noise during the concurrent construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D is anticipated to be no greater than **low**, with mitigation in place (close-boarded fencing).In relation to the concurrent construction of Dogger Bank Teesside A & B and Dogger Bank Teesside C & D, there are no properties within the construction noise impact buffer around the converter stations site. Therefore on-site construction works associated with the concurrent converter stations builds are predicted to result in an effect of negligible magnitude and therefore a **negligible** impact. No cumulative impacts are predicted.

10.1.15 The use of piling during the construction of all converter stations has not been discounted; however there is a large separation distance present between the construction works and receptors. It is therefore considered that vibration will not adversely affect receptors and has not been assessed in detail. No cumulative impacts are predicted.

10.1.16 There are no residential properties close to or within the construction noise buffer zones in the area where development numbers 2 or 3 will intersect the Dogger Bank Teesside A & B project. Therefore, no additional mitigation measures are proposed and the residual impacts will remain as shown in **Table 6.4**.

Operation of Dogger Bank Teesside A & B converter station

10.1.17 Provided the mitigation measures identified in **Table 7.4** and paragraph 7.1.9 are fully implemented on each converter station there are predicted to be no residual noise impacts on residential and non-residential receptors associated with the operation of the converter station. As such, no cumulative impacts are predicted associated with the projects identified within **Table 10.1**.

Operation of Dogger Bank Teesside A & B, and Dogger Bank Teesside C & D converter stations concurrently

10.1.18 The noise emissions associated with the Dogger Bank Teesside C & D converter station operating concurrently with Dogger Bank Teesside A & B were modelled and the resultant levels and impact assessments are shown in **Table 10.4** (with a methodology identical to that employed in Section 7).

10.1.19 **Figure 10.1** shows the noise level isopleth (contour plot) for both Dogger Bank Teesside A & B, and Dogger Bank Teesside C & D when operating concurrently.

Table 10.4 Residual impacts from mitigated converter station noise (Dogger Bank Teesside A & B, and Dogger Bank Teesside C & D operating concurrently)

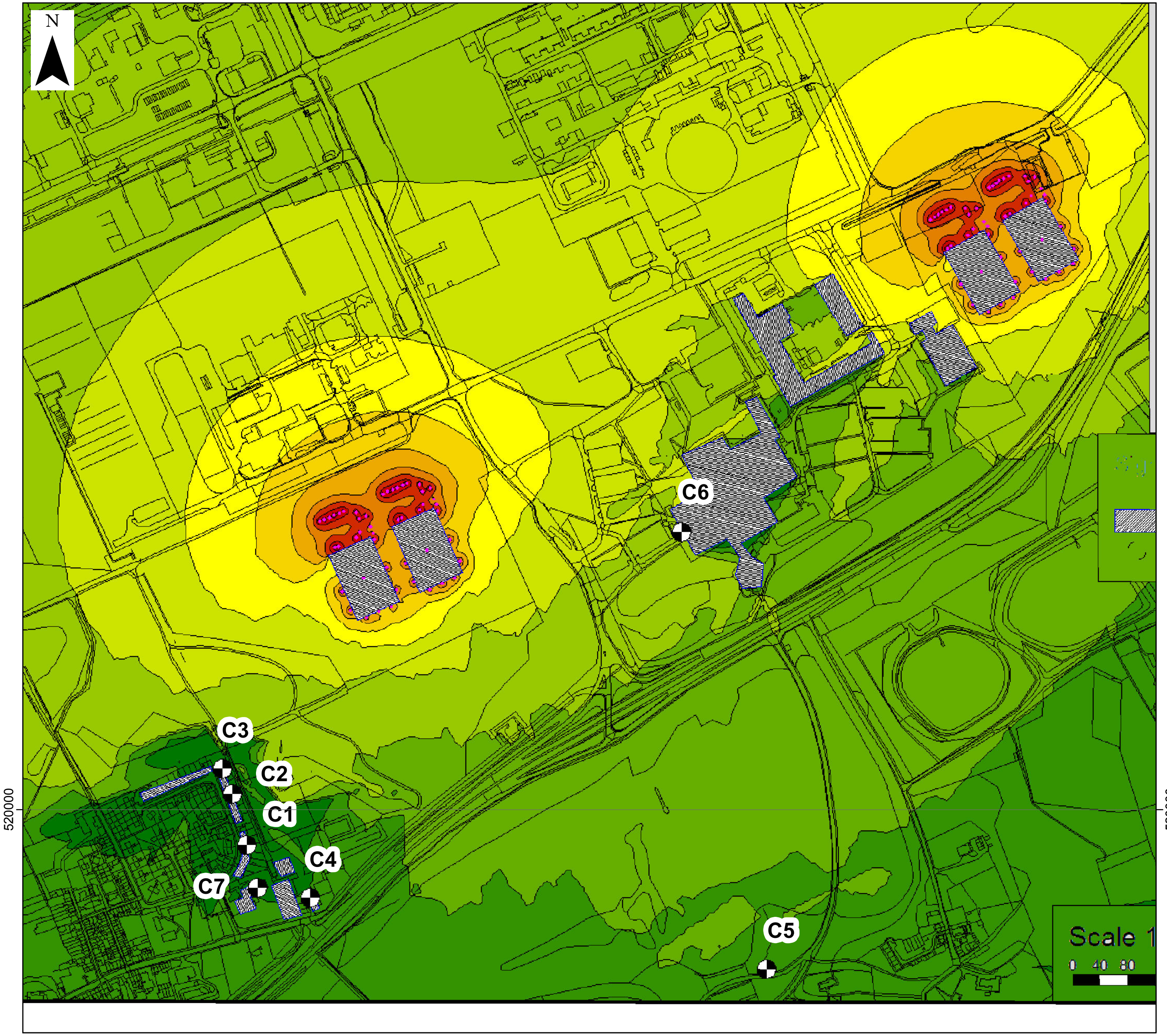
Reference number	Receptor	Floor level	Noise rating level*	Measured background noise	Exceedance	Magnitude of effect	Residual impacts
			dB $L_{Ar,5min}$	dB $L_{Ar,5min}$	dB		
C1	7 Grange Estate	G.Fl	32.2	42	-9.8	Negligible	**Negligible**
C1	7 Grange Estate	1.Fl	33.4	42	-8.6	Negligible	**Negligible**
C2	10 Grange Estate	G.Fl	30.6	42	-11.4	Negligible	**Negligible**
C2	10 Grange Estate	1.Fl	31.5	42	-10.5	Negligible	**Negligible**
C3	20 Grange Estate	G.Fl	33.4	42	-8.6	Negligible	**Negligible**
C3	20 Grange Estate	1.Fl	34.4	42	-7.6	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	G.Fl	37.9	42	-4.1	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	1.Fl	38.6	42	-3.4	Negligible	**Negligible**
C4	Lazenby Grange Farmhouse	2.Fl	39.3	42	-2.7	Negligible	**Negligible**
C5	Wilton Golf Club**	G.Fl	39.6	41	-1.4	Negligible	**Negligible**
C6	Wilton Office Block**	G.Fl	46.3	46	0.3	Low	**Minor**
C6	Wilton Office Block**	1.Fl	46.6	46	0.6	Low	**Minor**
C6	Wilton Office Block**	2.Fl	46.7	46	0.7	Low	**Minor**
C7	Wilton Primary School**	G.Fl	35.5	46	-10.5	Negligible	**Negligible**

*Noise level modelled at the receptor – external façade
**Non-residential receptor
***Measured background noise level

10.1.20 The results in **Table 10.4** demonstrate that, with mitigation installed in converter stations A, B, C and D to reduce the operational noise at the nearest residential receptor to 42dB $L_{Ar,5min}$ and nearest non-residential receptor to 46dB $L_{Ar,5min}$, the magnitude of the effect is negligible for all residential and minor for some non-residential receptors. As such, a **negligible** residual impact is expected for the concurrent operational noise of Dogger Bank Teesside A & B, and Dogger Bank Teesside C & D at residential receptors.

10.1.21 The predicted noise impact of Dogger Bank Teesside A & B (mitigated) and Dogger Bank Teesside C & D (mitigated) operating concurrently will not exceed the existing background levels at all residential receptor locations. No cumulative impacts are predicted.

10.1.22 The Wilton Office Block is classified as having a low sensitivity as it is not a residential receptor nor is it occupied throughout the night, and the worst-case predicted impact is less than 1dB above threshold. Any further mitigation can be applied during the detailed design phase of Dogger Bank Teesside C & D, and any marginal improvement on this worst-case assessment would ensure that the magnitude of the effect is reduced to negligible at all non-residential receptors.



LEGEND

Noise level Leq in dB(A)

<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

× Point source

Main building

Point receptor

0 180 360 Meters

Data Source:
Ordnance Survey data © Crown copyright and database right, 2014

PROJECT TITLE

DOGGER BANK TEESSIDE A & B

DRAWING TITLE

Figure 10.1: Noise contours from mitigated converter stations Teesside A & B and Teesside C & D operating concurrently

VER	DATE	REMARKS	Drawn	Checked
4	29/07/2013	Draft	SEW	SW
5	04/09/2013	Submit for PEI3	SEW	SW
7	13/02/2014	Pre-DCO submission review	SEW	RH

DRAWING NUMBER: **F-ONL-MA-622**

SCALE	1:9,000	PLOT SIZE	A4	DATUM	OSGB36	PROJECTION	BNG

FOREWIND

11 Transboundary Effects

11.1 Transboundary

11.1.1 The proposed development is not located close to any international boundaries and there will be no transboundary effects in relation to noise and vibration.

12 Summary

12.1 Summary

12.1.1 This chapter of the ES has assessed the potential noise impacts the onshore elements of Dogger Bank Teesside A & B may have on surrounding noise sensitive receptors.

12.1.2 A baseline noise survey was conducted, comprising measurements of the existing noise climate around residential receptors within the converter station study area and within the cable corridor. The survey demonstrated that noise levels within the converter station study area were typical of a heavy industrial area; being variable during the day but generally steady and also relatively high during the night. The noise environment is largely governed by two main noise sources: the A174 and the Wilton Complex. Noise levels within the cable corridor varied significantly, depending on location, the main influencing factor being a location's proximity to a main road; sewage treatment works noise and the Wilton Complex.

12.1.3 Construction noise impacts arising from onsite works, within the working areas of the landfall, cable corridor and converter stations were assessed. Receptors that will experience negligible impacts (noise levels of 65dB(A) or less) were eliminated from the assessment through a screening process, which identified six receptors that may experience a **minor** impact or greater. Of those six receptors, only one for a single build and four for a concurrent build scenario were predicted to experience a **medium** impact magnitude. Mitigation was recommended to reduce construction noise at this location, which comprised the installation of site perimeter fencing to screen the construction works from residential properties. The residual impacts following the application of mitigation were **negligible** to **minor** at all affected receptors, taking account of the temporary nature of the construction phase.

12.1.4 Noise generated by construction-related traffic was assessed considering the increase in traffic flow on surrounding roads used during the construction period. A less than 25% increase in traffic flow along the affected road links is predicted. This equates to a noise increase of less than 1dB, which is regarded as an imperceptible change in noise level according to the criteria and is therefore considered as **negligible**.

12.1.5 The use of piling during the construction of the converter stations has not been discounted; however there is a large separation distance present between the construction works and receptors. It is therefore considered that vibration will not adversely affect receptors and has not been assessed in detail.

12.1.6 Ground borne vibration may potentially arise from the operation of electrical substations and associated plant. There is a very large separation distance between the converter stations and residential properties. Where properties are located outside of the 100m buffer zone, the distances are deemed large enough to protect receptors from operational related ground borne vibration. It is considered that vibration will not adversely affect receptors and has not been assessed in detail.

12.1.7 An assessment of operational noise for the converter stations was conducted using computer modelling software. The assessment used a level of 42dB $L_{A90\ (6hr)}$ (calculated mean background noise from measured data at Wilton Complex, Surrogate P1) as a threshold for night time disturbance at residential receptors, and 46dB $L_{A90\ (16hr)}$ (calculated mean background noise from measured data at Wilton Golf Club) for daytime at non-residential receptors. These values were assigned as thresholds between negligible and low magnitude of impact. The assessment took account of two scenarios: Converter Station A or B, and Converter Stations A & B operating concurrently. Noise predictions were made at four nearby residential receptors: 7 Grange Estate, 10 Grange Estate, 20 Grange Estate and Lazenby Grange Farmhouse, and at a further three non-residential receiver locations: Wilton Office Block, Wilton Golf Club and Wilton Primary School.

12.1.8 Until the converter stations are designed in detail, specific mitigation measures cannot be defined, however it was possible to determine the level of noise reduction for each piece of equipment such that a level of 42dB $L_{Ar,5min}$ would not be exceeded at any residential receptor and 46dB $L_{Ar,5min}$ would not be exceeded at any non-residential receptor. With mitigation in place to meet the specified reduction in equipment noise levels, residual impacts from the operation of the converter stations was assessed to be **negligible** at all residential and non-residential receptors.

12.1.9 An assessment of potential tonal noise propagation and subsequent mitigation schemes will be undertaken during the post consent detailed design of the converter stations.

12.1.10 Noise impacts relating to the decommissioning of the both the converter stations and cable system elements are predicted to reflect those identified for the construction phase, provided the appropriate mitigation measures are employed.

12.1.11 **Table 12.1** provides a summary of the potential impacts on noise receptors arising from the realistic worst case scenarios set out in Section 5 of the chapter.

Table 12.1 Summary of predicted impacts of Dogger Bank Teesside A & B on noise receptors

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
Construction phase		
On-site construction noise	• To reduce potential construction noise impacts at receptors where a medium magnitude of impact is predicted. A solid site boundary hoarding fence, approximately 2.4m in height, will be erected prior to commencement of cable installation and remain in place until the works are complete in the relevant section of the cable route. A set of generic Best Practice working practices referred to as Best Practicable Means (BPM) will be employed during the construction phase. Examples of typical BPM include: • Locating static noisy plant in use as far away from noise sensitive receptors as is feasible for the particular activity; • Ensuring that plant and equipment covers and hatches are properly secured and there are no loose fixings causing rattling; • Using the most modern equipment available and ensuring such equipment is properly maintained and operated by trained staff; • Using silenced equipment where possible, in particular silenced power generators if night time power generation is required for site security or lighting; • Ensuring that vehicles and mobile plant are well maintained such that loose body fittings or exhausts do not rattle or vibrate; • Ensuring plant machinery is turned off when not in use; • Imposition of vehicle speed limits for heavy goods vehicle traffic travelling on access roads close to receptors and ensuring that vehicles do not park or queue for long periods outside residential properties with engines running unnecessarily; • Ensuring, where practicable, that site access routes are in good condition with no pot-holes or other significant surface irregularities; • Maintaining good public relations with local residents that may be affected by noise from the construction works. Effective communication should be established prior to construction, keeping local residents informed of the type and timing of works involved, paying particular attention to potential evening and night time works and activities which may occur in close proximity to receptors. Leaflet drops, posters and public meetings or exhibitions are an effective method of keeping local residents informed; and • Provision of contact details for a site representative in the event that disturbance due to noise or vibration from the construction works occurs; ensuring that any complaints are dealt with promptly and that subsequent resolutions are communicated to the complainant.	**Minor** (for 5 residential properties close to the construction - single build scenario) **Minor** (for 3 residential properties close to the construction - concurrent build scenario) **Negligible** for all other receptors.

Description of impact	Key mitigation measures	Residual impact (worst case scenario)
Off-site construction traffic noise	None proposed	**Negligible**
Operational phase		
Converter stations	The converter station operational noise levels (at the nearest receptor) will be reduced to below the established indicator of 42dB(A) for residential receptors and 46dB(A) for non-residential receptors. The precise nature of mitigation will be determined during detailed design of the converter station. Typical measures will include: • Selection of quieter equipment; • Installation of acoustic enclosures (a minimum 10dB reduction is required); • Installation of acoustic barriers; • Possibility to screen converter stations further by the construction of a landform/embankment around the site, which will protect against flooding and may also provide up to 10dB attenuation; • Silencing of exhausts/outlets for air handling/cooling units; and • Locating equipment to take advantage of screening inherent in the design, i.e. from the converter hall or control room buildings. These measures are all good practice industry standard approaches to noise reduction.	**Negligible** for all residential receptors. **Minor** for some non-residential receptors
Decommissioning phase		
Decommissioning	Similar to those identified for construction	As per construction

13 References

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