



Rampion Offshore Wind Farm



ES Section 27 – Noise

RSK Environmental Ltd

Document 6.1.27

December 2012

APFP Regulation 5(2)(a)

Revision A

E.ON Climate & Renewables UK Rampion Offshore Wind Limited

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27 NOISE AND VIBRATION

27.1 Introduction

27.1.1 This section of the Environmental Statement (ES) assesses the potential noise and vibration impacts of the proposed Rampion Offshore Wind Farm (the Project) at onshore receptors. The assessment identifies, establishes and quantifies the expected noise emissions associated with the construction of the onshore cable route, and the construction and operation of the onshore substation. The assessment is based upon the results of baseline noise monitoring and predictive calculations of the noise impact. The potential for noise impacts at onshore receptors as a result of the operation of the offshore turbines is also addressed.

27.2 Legislation and Policy Context

27.2.1 National Policy Statements (NPS) provide the primary basis on which the Secretary of State is required to make its decisions. The specific assessment requirements for noise, as detailed within the NPSs are set out below.

27.2.2 EN-1 sets out NPS for energy infrastructure. In relation to noise and vibration, Sections 5.11.4 to 5.11.7 of the NPS state that, *"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 area; and*
- *Measures to be employed in mitigating noise".*

27.2.3 The NPS also states that:

27.2.4 *“The nature and extent of the noise assessment should be proportionate to the likely noise impact” and “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.*

“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 is 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.”

27.2.5 The National Planning Policy Framework (NPPF) (published March 2012) has replaced Planning Policy Guidance (including PPG 24: Planning and Noise) as the means by which noise is considered within the planning regime. The NPPF does not contain assessment criteria, instead providing a series of policies, giving local authorities the flexibility in meeting the needs of local communities. A summary of the pertinent paragraphs is presented in Section 4 (Planning Policy Context).

27.2.6 The use of various British Standard methodologies for noise assessments have been incorporated in this assessment as follows:

BS 7445: 2003 - Description and measurement of environmental noise - guide to quantities and procedures.

27.2.7 BS 7445 provides the framework within which environmental noise should be quantified. Part 1 provides a guide to quantities and procedures and Part 2, a guide to the acquisition of data pertinent to land use. Part 3 provides a guide to the application of noise limits. The standard also refers to BS EN 61672, which prescribes the equipment necessary for such measurements.

BS 5228-1: 2009 - Calculation for noise from open and construction sites - Part 1: Noise

27.2.8 Construction noise impacts arising from equipment, vehicular movements and processes related to the construction phase of a development are assessed by calculating the change in ambient noise level (LAeq,1hr) resulting from such processes with methods described in BS5228-1.

27.2.9 The assessment predicts noise emissions from various construction activities, which are then compared against background noise levels at residential receptors. Full details of the process are contained in Annex E of the standard.

- 27.2.10 Annex E of the standard also provides criteria for the assessment of significance. Exceedances of threshold levels trigger a responsibility on the developer to provide noise insulation or a scheme to facilitate temporary rehousing. The standard suggests that noise insulation should be provided if trigger levels are predicted to be exceeded for a period of ten or more days of working in any fifteen consecutive days, or for a total of days exceeding 40 in any 6 month period.

BS 5228-2:2009 - Calculation for noise from open and construction sites - Part 2: Vibration

- 27.2.11 BS 5228 describes methods of mitigation that can be employed for construction ground-borne vibration and provides historical library data of vibration levels measured during various activities on various ground types.
- 27.2.12 Table 27.1 (Table B.1 from BS 5228-2) gives the likely response to various Peak Particle Velocity (PPV) vibration levels.

Table 27.1: Typical human response to different PPV levels

Vibration Level	Effect
0.14 mms ⁻¹	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mms ⁻¹	Vibration might just be perceptible in residential environments.
1.0 mms ⁻¹	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10 mms ⁻¹	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

- 27.2.13 BS 5228-2 reiterates the transient vibration guide values in the 4 – 15Hz and 15Hz and above frequency bands that lead to cosmetic damage of BS 7385. BS 5228-2 also discusses the assessment of the vulnerability of ground-related structures and services concluding that a maximum PPV for intermittent or transient vibration of 30mms⁻¹ and a maximum PPV for continuous vibration of 15mms⁻¹. BS 5228 also discusses the vulnerability of building contents and activities within buildings to vibration, concluding that they too should be assessed on an individual basis.

Calculation of Road Traffic Noise (CRTN) & Design Manual for Roads and Bridges (DMRB)

27.2.14 The CRTN produced by the Department of Transport / Welsh Office provides a method for the prediction of noise from road traffic. The Highways Agency Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7 Had 213/11 Noise and Vibration, provides guidance on the assessment of noise impacts from roads and contains guidance for assessing the likely impact of noise generated by road traffic. The criteria from DMRB for short term effects have been used in the assessment of changes to traffic noise as a result of proposed construction Heavy Goods Vehicle (HGV) traffic.

BS 4142: 1997 - Method for rating industrial noise affecting mixed residential and industrial areas

27.2.15 BS 4142 provides a methodology for assessing industrial noise against ambient background noise levels. A 'rating penalty' of 5dB is added to the industrial noise if it contains characteristics that are likely to increase the potential for it to cause annoyance. Such characteristics could include impulses (e.g. bangs/crashes) or tonal components (e.g. hums/whistles etc). Noise from electricity infrastructure can contain tonal components (the "mains hum"). As such a rating penalty has been applied to noise levels assessed.

27.2.16 Comparison of the difference between the industrial noise level including any rating penalty (the rating level) and the background noise level indicates the likelihood of complaint. The greater the difference, the greater the likelihood of complaints arising.

- A difference of around +10dB or more indicates that complaints are likely.
- A difference of around +5dB is of marginal significance.
- A difference of -10dB indicates that complaints are unlikely.

27.2.17 BS 4142 is not suitable for use in situations where both the industrial noise and the background noise are very low (below 35 and 30dB(A) respectively). Where this occurs, a suitable alternative assessment method (such as criteria based on World Health Organisation (WHO) guidelines) should be utilised.

WHO Night Noise Guidelines for Europe (NNG)

27.2.18 Sleep is an essential part of healthy life and is recognised as a fundamental right under the European Convention on Human Rights. The report provides guidelines and recommendations for health protection. For the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than $L_{\text{night, outside}} = 40\text{dB}$ during the part of the night when most people are in bed.

- 27.2.19 For the purposes of assessing plant sound levels at receptor locations, as BS 4142 would be considered appropriate should plant rating noise levels at residential receptors be greater than 35dB(A) (including a tonal penalty) the effect of noise would be considered significant should plant noise at receptor be predicted to exceed 35dB(A). A level of 35dB(A) would also be within WHO recommended guidelines for night-time noise.

ETSU-R-97

- 27.2.20 ETSU-R-97 'The assessment and rating of noise from wind farms' is used for the assessment of onshore wind farms. However, it is also the most appropriate guidance for assessing noise from the offshore turbines at onshore receptors.
- 27.2.21 In general terms, ETSU-R-97 states that turbine noise levels should be limited to 5dB(A) above the prevailing background noise at each wind speed, subject to minimum limits of 35dB(A) and 43dB(A) during the day and night respectively.
- 27.2.22 Noise limit curves are derived based on background noise measurements taken under a variety of wind conditions. If it can be demonstrated that turbine noise levels will be below 35dB(A) at a wind speed of 10m/s, it can be concluded that there is no potential for noise from the turbines to give rise to impacts at onshore receptors.

Local Policy Planning Framework

- 27.2.23 Local and Development Plans for the local authorities within the scope of this assessment include planning policies for the protection against noise effects. These policies are referenced in Section 4 (Planning Policy Context).

27.3 Assessment Methodology

Scoping

- 27.3.1 As part of the scoping phase of the Environmental Impact Assessment (EIA), a Scoping Report (E.ON/RSK, September 2010) was prepared to set out the proposed approach to EIA in respect of the proposed development, including the identification of assessment methodologies for each of the EIA topic areas to be assessed. The Scoping Report was submitted to the infrastructure Planning Commission (IPC) in September 2010. A Scoping Opinion (IPC, October 2010) was received from the IPC in October 2010 incorporating comments from a wide range of consultees. A copy of the Scoping Report and Scoping Opinion including consultee comments are included in Appendix 5.1 and 5.2.
- 27.3.2 The information and advice received during the scoping process with regard to noise and vibration issues is summarised in Table 27.2.

Table 27.2: Relevant scoping responses

Date	Consultee	Summary scoping response	Where addressed
11/10/2010 & 12/10/2010	Adur District Council	EIA to include assessment of noise on land from the wind turbines. Noise from offshore construction including construction of turbines and cabling to be assessed.	Turbine Noise: Paragraphs 27.5.34-27.5.38 Offshore construction noise: Paragraphs 27.5.20-27.5.22 Cable Route Construction: Paragraphs 27.5.5- 26.5.13
12/10/2010	Brighton and Hove City Council	There is evidence to suggest off shore wind farms create low frequency noise which is able to travel long distances. The potential for offshore noise should be considered using a variety of approaches including but not limited to: EN 61400-11:2003 BS 4142:1997 ETSU –R-97 Offshore noise from construction should also be considered. In the past the construction of other offshore wind farms has attracted complaints.	Turbine Noise: Paragraphs 27.5.34-27.5.38 Offshore construction noise: Paragraphs 27.5.20-27.5.22
October 2010	IPC	Refer to comments made by above councils. Request that following are considered: - Noise along public roads and Public Rights of Way; - Vibration caused by abnormal loads; - Noise disturbance at night and other unsocial times such as weekends and public holidays; - The monitoring of noise complaints; - Noise and vibration in terms of the offshore environment.	Paragraphs 27.5.23 – 27.5.27 Predicted Impacts Section 27.5 Mitigation Measures Section 27.6 Offshore construction noise: Paragraphs 27.5.20-27.5.22

27.3.3 The Environmental Health Officer (EHO) for Mid Sussex District Council was contacted with regard to the noise monitoring locations along the cable route and close to the substation in September 2011. An email confirming agreement of these locations was received from the EHO in October 2011.

- 27.3.4 The scope of the assessment was modified accordingly to take account of the above consultee responses and the opinions of the IPC, the findings of which were reported in the Draft ES.

Formal Pre-application Consultation

- 27.3.5 As detailed in Section 5 – EIA Methodology, an extensive programme of engagement has been undertaken with regard to the Project, details of which are provided in the Consultation Report (Document 5.1). This included publication of the Draft ES as part of the Section 42 and Section 48 consultation in June 2012.
- 27.3.6 Following review of consultee feedback on the Draft ES, discussions with consultees and updated technical information, the following modifications have been made to the Project and overall assessment scope:
- The 'Legislation and Policy Context' Section 27.2 has been updated to include the Design Manual For Roads and Bridges and the Calculation of Road Traffic Noise. In addition, the consideration of significance when noise levels are considered very low as described in BS 4142 has been clarified.
 - A criterion for the assessment of traffic noise changes taken from DMRB has been added to Section 27.3 'Assessment Methodology'.
 - Further description of the existing noise environment has been included within Section 27.4 'Environmental Baseline'.
 - Further discussion has been added to the assessment of offshore piling within Section 27.5 to explain that the piling would be inaudible at rural locations based on met mast piling noise measurements. An additional assessment has been added presenting a maximum sound power level for piling equipment to ensure onshore inaudibility of wind turbine piling.
 - An assessment of traffic noise based on CRTN predictions and short-term DMRB criterion has replaced the previous assessment in Section 27.5, previously based only on substation construction traffic.
 - Further to receiving additional information from project engineers, additional plant items (cooling radiators) have been used within predictions and Auxiliary Transformer noise has been increased to match Super Grid Transformers. The indicative spectrum data for the substation plant equipment has been included within the report. These changes have resulted in changed noise levels at receptor locations within Section 27.5. Noise contour plans have been amended with a smaller scale in order to include noise levels at all identified receptor points (Figure 27.4 and Figure 27.6).

- Several new options of offshore turbine layouts have been modelled and assessed within Section 27.5 including numerical predictions for residential and quiet leisure locations at the shoreline. A noise contour plan has been presented for the worst-case wind turbine layout Option B (Figure 27.5).
- A prediction and assessment for the offshore substation has been included within Section 27.5.
- Further discussion has been added to the Cumulative Assessment Section 27.8 incorporating noise from the construction and operation of additional plant at the existing Bolney substation.
- Appendix 27.2 has been updated to include co-ordinates for measurement points, condition of the sea during the noise survey, additional information on offshore piling noise measurements and clarification of Table 3.2.
- Computer noise modelling inputs have been presented in Appendix 27.3.

27.3.7 Full details of the consultation process and associated responses are documented in Document 5.1 (Consultation Report).

Establishment of Baseline Environment

27.3.8 A noise survey was undertaken at various locations along the proposed cable route and around the proposed substation site options between 29 February and 2 March 2012 during day and night-time periods.

27.3.9 Monitoring locations were selected to measure the ambient noise levels at sensitive human receptors that might be exposed to the noise from the construction of the onshore cabling work and the operation of the proposed onshore substation. Baseline methodology and monitoring locations were agreed with the Local Authority Environmental Health Department. Monitoring locations are presented on Figure 27.1 and Figure 27.2 and are listed in Table 27.3.

Table 27.3: Noise monitoring locations

Location	Town	Description
P 1	East Worthing	Between the east of the residential properties Seamill Park Crescent and Brooklands golf club, away from Brooklands Go Kart Circuit
P 2		At the end of St Pauls avenue (foot path)
P 3	Broadwater	At the end of Bramber Road (foot path)
P 4	Sompting	North of Titch Hill farm, at the entrance of Lychpole Farm
P 5	Coombes	Coombes Road, the west of the River Adur
P 6	Adburton	The top of Mill Hill, West Sussex
P 7	Small Dole	Oreham common, away from Horn lane
P 8	Woodmancote	To the west of Henfield Lodge
P 9	Blackstone	Twineham Lane

Location	Town	Description
P 10	Twineham	Wineham Lane, to the west of the existing Bolney substation
P 11		Further north on Wineham Lane
P 12		Bob Lane, to the east of the existing Bolney substation

27.3.10 Sound level measurements were made with the following equipment:

- Norsonic Nor-140 (serial number 1402810) with pre-amplifier and microphone protected by foam windshield; and
- Cirrus acoustic calibrator type 1251, serial number 037732.

27.3.11 Measurements were taken in free-field conditions, i.e. 1.5m above the ground and away from reflective building facades. The microphones were fitted with foam windshields to protect against extraneous wind noise. Weather conditions at the time of the survey were considered as suitable conditions for an environmental noise survey, being dry, sunny with light wind and clear sky.

27.3.12 Calibration checks for the sound level meters were made before and after each measurement using the acoustic calibrator. No significant calibration drift was noted.

27.3.13 The sound level meters used conform to the requirements of BS EN 61672-1: 2003 Electroacoustics, Sound level meters, Specifications. The calibrator used conforms to the requirements of BS EN 60942: 2003 Electroacoustics, Sound calibrators. The equipment used has a calibration history that is traceable to a certified calibration institution. Calibration certification for equipment used in the survey can be found in Appendix 27.1.

Prediction of construction and decommissioning noise impacts

27.3.14 Construction phase noise impacts arising from equipment, vehicular movements and processes have the potential for a short-term impact on noise sensitive receptors in the vicinity of the construction site. The impact is assessed by calculating the change in ambient noise level (LAeq,1hr) as a result of construction works. An example method for assessing the criteria of noise from construction activities is provided within Annex E of BS 5228-1 and described with small amendments as below. Minor changes have been made to the start of the evening Saturday period (from 13:00 to 14:00) and start of the night period (from 23:00 to 22:00) of the threshold values within the associated table of BS 5228-1 to be in line with the trigger levels as presented in Table 27.5.

27.3.15 A significant effect has been deemed to occur if the total LAeq noise level, including construction, exceeds the threshold levels presented in Table 27.4 for the category appropriate to the ambient noise level. It is considered that a significant effect would occur if the increase in total noise levels is more than 3dB above the ambient noise, should this resultant level be above threshold values.

Table 27.4: Example threshold of significant effect at dwellings

Assessment category and threshold value period (LAeq)	Threshold value, in decibels (dB)		
	Category A _{A)}	Category B _{B)}	Category C _{C)}
Night-time (22.00–07.00)	45	50	55
Evenings and weekends _{D)}	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–14.00)	65	70	75

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

D) 19.00–22.00 weekdays, 14.00–22.00 Saturdays and 07.00–22.00 Sundays.

27.3.16 Annex E of BS 5228-1 continues by providing criteria for the assessment of significance. Exceedances of noise levels presented in Table 27.5 below trigger a responsibility to provide noise insulation or temporary rehousing if levels are exceeded for a period of ten or more days of working in any fifteen consecutive days or for a total of days exceeding 40 in any 6 month period.

Table 27.5: Noise levels applicable to eligibility for noise insulation

Time	Relevant Time Period	Averaging time, <i>T</i>	Noise trigger level dB <i>L</i> _{Aeq, <i>T</i>} ¹⁾
Monday to Friday	07.00 – 08.00	1 h	70
	08.00 – 18.00	10 h	75
	18.00 – 19.00	1 h	70
	19.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Saturday	07.00 – 08.00	1 h	70
	08.00 – 13.00	5 h	75
	13.00 – 14.00	1 h	70
	14.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Sunday & Public Holidays	07.00 – 21.00	1 h	65
	21.00 – 07.00	1 h	55

Time	Relevant Time Period	Averaging time, T	Noise trigger level dB $L_{Aeq, T}^{1)}$
Note 1) Equivalent continuous A-weighted noise level predicted or measured at a point 1m in front of the most exposed windows or doors leading directly to a habitable room (living room or bedroom) in an eligible dwelling.			

Prediction of operation noise impacts

27.3.17 Noise levels from the proposed substation site have been assessed at the locations shown on Figure 27.2 and set out below. Baseline noise measurements have been used to establish background levels in these locations. Where these receptor locations are also very close to monitoring points, these are shown in brackets.

- R1 Twineham Court Farm;
- R2 The Coach House;
- R3 Coombe Farm (P12);
- R4 Coombe House;
- R5 Dawe's Farm;
- R6 Eastridge Lodge (P11);
- R7 Westridge Place; and
- R8 Residence to west (P10); and
- R9 Woodpeckers / Downsview (P12).

27.3.18 Predictions for the substation have been undertaken using CadnaA computer noise modeling software, which incorporates prediction methodology in ISO 9613:1996 '*Acoustics - Attenuation of sound during propagation outdoors*'.

27.3.19 CadnaA noise software has been used to predict noise levels from the offshore wind turbine options at wind speeds of 10m/s. Predictions have been calculated at receptors across the shoreline including urban and rural locations. An assessment has been undertaken based on the absolute level of 35dB(A) as considered appropriate protection of amenity by ETSU-R-97.

27.3.20 A conservative calculation has been made of offshore substation noise with reference to distance attenuation, downwind conditions, a conservative assumption of air absorption attenuation and taking into account sound reflection from the water. Predicted noise from the offshore substations has been assessed at the closest onshore location.

Identification and Assessment of Impacts and Mitigation Measures

27.3.21 The magnitude of a noise impact has been assessed using the criteria set out in Table 27.6.

Table 27.6: Impact magnitude

Potential Impact	Negligible	Minor	Moderate	Major
Noise from construction	Less than BS 5228 significance criteria	Above the BS 5228 significance criteria for less than one month	Noise levels and duration exceed BS 5228 significance criteria for more than 1 month	Noise levels and duration exceed 'noise mitigation eligibility' criteria of BS 5228
Noise from construction traffic	0.1-0.9dB Short-term change in traffic noise level $L_{A10,18hr}$	1-2.9dB Short-term change in traffic noise level $L_{A10,18hr}$	3-4.9dB Short-term change in traffic noise level $L_{A10,18hr}$	>5dB Short-term change in traffic noise level $L_{A10,18hr}$
Vibration from construction	Vibration undetectable by humans (as defined by BS 5228)	Vibration just detectable but not intrusive (as defined by BS 5228)	Vibration levels likely to lead to complaint (as defined by BS 5228)	Vibration levels intolerable (as defined by BS 5228)
Noise from operation of substations	Noise level more than 10dB(A) below existing background	Noise level less than 'Marginal significance' as defined by BS 4142 or no more than 35dB(A) if background noise levels considered 'very low'	Noise level between 'Marginal Significance' and 'complaints likely' as defined by BS 4142 or > 35dB(A) if background noise levels considered 'very low'	Noise level exceeds 'complaints likely' criteria as defined by BS 4142
Onshore noise from turbines	Turbine noise imperceptible	Turbine noise level below 35dB(A)	Turbine noise level between 35dB(A) and 43dB(A).	Turbine noise level above 43dB(A)

27.3.22 While other types of receptor are considered, such as users of beaches and green spaces, this assessment focuses on residential receptors, considered to be the most sensitive receptor type, and therefore the sensitivity for all receptors identified are considered equal. As a result the significance of effect is only related to magnitude and not cross-referenced with sensitivity.

27.3.23 The significance of a noise impact has been assessed using the criteria set out in Table 27.7.

Table 27.7: Significance of Effect

Potential Impact	Not Significant	Significant
Noise from construction	Negligible or minor effect	Moderate or major effect
Noise from construction traffic	Negligible or minor effect	Moderate or major effect
Noise from operation of substation components	Negligible or minor effect	Moderate or major effect
Vibration from construction	Negligible or minor effect	Moderate or major effect
Onshore noise from turbines	Negligible or minor effect	Moderate or major effect

Uncertainty and Technical Difficulties Encountered

- 27.3.24 The noise emission levels, both for the construction and operational phases, are based on assumptions, as a detailed design of the scheme is not yet available. Where uncertainties exist, worst-case assumptions have been made, and as a result impacts may be slightly overstated.

27.4 Environmental Baseline

27.4.1 Attended measurements were undertaken at selected monitoring locations during day and night time periods and the results of measurements are summarised in Table 27.8.

Table 27.8: Summary of measurements

Period	Location	Date	Time	Duration	L _{Aeq, T} dB	L _{A90, T} dB	Dominant noise source
Day	P 1	01/03/12	11:19	00:15:02	50.6	45.5	Distant road traffic noise
	P 2	01/03/12	11:45	00:15:00	50.8	41.0	Road traffic noise, bird song, dogs barking
	P 3	01/03/12	12:17	00:15:00	46.4	42.6	Road traffic noise, bird song, dogs barking
	P 4	01/03/12	12:49	00:15:00	60.6	35.7	Distant farming noise and road traffic noise
	P 5	01/03/12	15:11	00:15:00	55.7	40.3	Livestock
	P 6	01/03/12	15:53	00:15:00	47.3	34.7	Bird song
	P 7	01/03/12	16:43	00:16:03	46.2	40.0	Distant farming noise and road traffic noise
	P 8	01/03/12	17:26	00:15:00	43.5	35.8	Distant road traffic noise and bird song
	P 9	29/02/12	17:41	00:15:00	62.1	41.8	Road traffic noise
	P 10	29/02/12	15:50	00:15:00	63.7	43.8	Bird song and construction noise from the existing site just audible
	P 11	29/02/12	16:28	00:15:00	64.2	41.7	Road traffic noise and bird song
	P 12	29/02/12	16:58	00:15:00	54.8	37.6	Road traffic noise and bird song
Night	P 1	02/03/12	02:04	00:15:00	43.0	41.3	Distant road traffic noise
	P 2	02/03/12	02:27	00:15:00	39.5	37.3	Distant road traffic noise
	P 3	02/03/12	02:52	00:15:00	48.2	37.5	Distant road traffic noise
	P 4	-	-	-	-	-	-
	P 5	02/03/12	03:21	00:15:00	42.6	34.2	Distant road traffic noise
	P 6	-	-	-	-	-	-
	P 7	29/02/12	23:42	00:12:32	35.3	30.5	Distanced Road traffic noise
	P 8	01/03/12	00:31	00:15:00	52.8	30.5	Road traffic noise
	P 9	01/03/12	01:13	00:15:00	34.2	28.6	Distanced Road traffic noise and bird song
	P 10	01/03/12	02:14	00:15:00	34.2	31.9	Noise from electric cable (pylon)
	P 11	01/03/12	01:48	00:13:17	33.5	30.4	Operational noise from the existing site just audible
	P 12	01/03/12	02:37	00:15:00	34.9	29.3	Distant road noise

- 27.4.2 The general noise climate at sensitive receptors along the proposed cable route and around the proposed substation are affected by road traffic noise and animal noise (bird song, dogs barking and livestock).
- 27.4.3 The ambient noise levels (LAeq) in the area along the proposed cable route are in the range of 44dB(A) to 65dB(A) during day time.
- 27.4.4 The ambient noise levels in the area along the proposed cable route are in the range of 34dB(A) to 53dB(A) during night time.
- 27.4.5 The dominant noise sources affecting the monitoring locations are the noise from the adjacent roads, house stock and nature (i.e. bird song).
- 27.4.6 For the purpose of the BS 5228 assessment the lowest ambient noise levels, LAeq, measured at monitoring locations are 44dB(A) and 35dB(A) for day and night time periods at sensitive receptors along the cable route, and 55dB(A) and 34dB(A) for day and night time periods at sensitive receptors around the proposed substation. The lowest target threshold levels of 65dB(A) and 45dB(A) for day and night time (from Table 27.4 Category A) have been used for the assessment as a 'worst-case' for both cable trenching works and the construction of the substation. Target threshold values for the purposes of assessing HDD works are identified on a site specific basis.
- 27.4.7 The background noise levels in the area surrounding the substation site are in the range of 29dB(A) to 32dB(A) during the night time.

27.5 Predicted Impacts

Rochdale Envelope Principles

- 27.5.1 In line with the use of the "Rochdale Envelope" (see Section 5 – EIA Methodology), the assessment in this section has been based on a development scenario, which is considered to be the worst case in terms of noise emissions. Rochdale Envelope principles relating to noise relate to the noise emissions associated with the entire Project.

Onshore Cable Route & Onshore Substation

- 27.5.2 Worst-case construction noise levels have been assumed for each aspect of cabling construction works as detailed in Section 27.5.7. For substation construction, it has been assumed that all of the plant is operating on the closest part of the site to the receptor as a worst case.
- 27.5.3 For substation operation, maximum sound power levels for major equipment within the proposed substation have been assumed as a worst case as detailed in Table 27.17. In addition, the assessment has assumed that all plant is operating continuously.

Onshore Wind Farm

- 27.5.4 For turbine operation, eight indicative turbine layouts have been assessed as part of the Rochdale Envelope for the Project and these are presented in Section 2a: Project Description (Offshore). Turbine layout option B has been adopted as the worst case scenario in terms of noise at onshore receptors.

Construction

Construction noise – Cable Route

- 27.5.5 Equipment likely to be used during cabling construction work has been assumed for activities based on information provided as set out in Table 27.9. The noise level data has been taken from Annex C of BS 5228-1: 2009. All sound pressure levels are given at a distance of 10m from the measured plant.

Table 27.9: Noise levels of construction equipment - cabling

Activity	Plant	No#	BS 5228 ref.	Operational hours	A-weighted SPL dB(A) at 10m
Topsoil strip	Tracked excavator (22t)	2	C.2.3	90 %	73
	Dozer	3	C.2.1	90 %	75
Construction of temporary site access road	Wheeled backhoe loader (8t)	1	C. 2.8	90 %	68
	Dumper (5t)	2	C. 4.7	90 %	78
	Vibratory roller (3t)	1	C. 2.40	90 %	73
Trench excavation	Tracked excavator (16t)	1	C. 2.5	90 %	76
	Tracked mobile crane	1	C.3.29	90 %	70
	Sheet Piling – Hydraulic jacking	1	C.3.9	90 %	63
	Power Pack	1	C.3.10	90 %	68
Duct work	Side boom (Use tracked mobile crane data)	3	C.3.28	90 %	67
	Water pump	1	C. 4.88	90 %	68
	Wheeled backhoe loader (8t)	1	C. 2.8	90 %	68
Backfilling trench	Wheeled backhoe loader (8t)	1	C. 2.8	90 %	68
	Tracked excavator (16t).	1	C. 2.5	90 %	76
	Dumper (5t)	2	C. 4.7	90 %	78
	Vibratory roller (3t)	2	C. 2.40	90 %	73
Reinstatement	Dumper (5t)	2	C. 4.7	90 %	78
	Wheeled backhoe loader (8t)	1	C. 2.8	90 %	68
Cable pulling	Conveyor drive unit	1	C.10.20	90 %	77
	Field conveyor (rollers)	2	C.10.23	90 %	53
Horizontal Directional Drilling	Power Auger (Crawler Mounted Rig)	1	C.3.21	100 %	79

27.5.6 Noise levels at the sensitive receptors have been calculated according to the method presented within BS 5228. Noise propagation is affected by distance between the source and receiver, any noise screening and the duration of activity. For the purposes of predicting noise from cable construction work the following have been considered:

- Soft ground condition between source and receiver;
- No screening;
- The likely nearest distance from the sources to receptor; and
- Operational hours of equipment have been assumed as maximum uses.

27.5.7 Based upon the predicted plant type, number and percentage 'on-time' Table 27.10 to Table 27.12 provides calculated 'worst-case' construction noise levels for each aspect of cabling construction works in terms of distance from the works at distances of 20m, 50m, and 100m from the works respectively.

Table 27.10: Assessment of cable construction work – distance at 20m

Time period	Construction aspect	Predicted construction noise level dB(A)	Ambient noise level dB(A)	Combined noise level dB(A)	Target threshold level dB(A)	Increases over threshold dB
Day time	Topsoil strip	74.1	44	74.1	65	9
	Construction of temporary site access road	76.5		76.5		12
	Trench excavation	74.7		74.7		10
	Duct work	69.5		69.5		4
	Backfilling trench	78.1		78.1		13
	Reinstatement	75.4		75.4		10
	Cable pulling	74.0		74.0		9

Table 27.11: Assessment of cable construction work – distance at 50m

Time period	Construction aspect	Predicted construction noise level dB(A)	Ambient noise level dB(A)	Combined noise level dB(A)	Target threshold level dB(A)	Increases over threshold dB
Day time	Topsoil strip	64.2	44	64.2	65	-1
	Construction of temporary site access road	66.6		66.6		2
	Trench excavation	64.7		64.7		0
	Duct work	59.5		59.7		-5
	Backfilling trench	68.2		68.2		3
	Reinstatement	65.5		65.5		1

Time period	Construction aspect	Predicted construction noise level dB(A)	Ambient noise level dB(A)	Combined noise level dB(A)	Target threshold level dB(A)	Increases over threshold dB
	Cable pulling	64.1		64.1		-1

Table 27.12: Assessment of cable construction work – distance at 100m

Time period	Construction aspect	Predicted construction noise level dB(A)	Ambient noise level dB(A)	Combined noise level dB(A)	Target threshold level dB(A)	Increases over threshold dB
Day time	Topsoil strip	56.7	44	56.9	65	-8
	Construction of temporary site access road	59.1		59.2		-6
	Trench excavation	57.2		57.4		-8
	Duct work	52.0		52.6		-12
	Backfilling trench	60.7		60.7		-4
	Reinstatement	58.0		58.1		-7
	Cable pulling	56.6		56.8		-8

27.5.8 The results show that for the majority of receptors noise levels have the potential to exceed the target threshold levels when works are within 50m of a property, which accounts for 21 properties along the cable route, but the noise levels would not exceed the target threshold levels when works were 100m from the property.

27.5.9 However, it should be noted that, as the works are transient and individual items of plant or machinery assigned to complete different tasks will move along the cable route as works progress, the time over which these worst-case noise levels would be experienced at an individual receptor is likely to be less than ten days of working in any fifteen consecutive days or for a total of days not exceeding 40 in any 6 month period.

27.5.10 Worst-case noise levels from trenching of the cable route would result in a minor impact, which is not significant.

27.5.11 Noise from the Horizontal Directional Drilling (HDD) has been assessed based on a duration of works between 7.5 to 13.5 weeks and a worst case scenario that drilling would be required 24 hours a day. Table 27.13 presents the results of HDD noise predictions at the nearest residential receptor to the anticipated drill end of the HDD transit. Where the project description is uncertain as to which end that the drill rig will be operational, a worst-case approach based on proximity to residences has been assumed. The location of the HDD has been taken as the centre point of the working width.

Table 27.13: Assessment of HDD works

HDD location	Approximate Distance to nearest receptor (m)	LAeq Noise Levels (dB(A))					
		Ambient Measured	Target Threshold	Predicted HDD	Combined Ambient + HDD	Increase over target	Increase over Trigger Threshold (55 dBA)
Landfall	200	43	50	51	52	+2	-3
Railway	100	40	45	59	59	+14	+4
Sompting Bypass	75	48	55	62	62	+7	+7
River Adur	375	43	50	44	47	-3	-8
A281	100	53	56	59	60	+4	+5
B2116	100	34	45	59	59	+14	+4

27.5.12 The results show a predicted negligible impact from HDD noise at the River Adur site, which would not be significant. The results show a moderate impact from HDD noise at the landfall and a major impact from HDD at the railway, Sompting Bypass, A281 and B2116, which would be considered significant.

Construction vibration – Cable Route

27.5.13 The construction equipment that is anticipated to be used for the cable route is not considered to generate significant levels of vibration more than 10m from the equipment. All construction works would occur significantly more than 10m from buildings. Effects of vibration would therefore be considered negligible and not significant.

Construction noise – Substation

27.5.14 The noise levels of equipment likely to be used for the construction of the substation have been provided and are shown in Table 27.14.

Table 27.14: Noise level of construction equipment – substation

Plant	No# of vehicles	Operational hours	A-weighted SPL (dB(A) at 10m
Front end loaders (wheeled)	1	90 %	82
Tracked excavator	1	90 %	77
Wheeled backhoe loader	1	90 %	68
Wheeled loader	1	90 %	79
Dozer	1	90 %	80
Articulated dump truck	1	90 %	74
Road roller	1	90 %	80
Graders	1	90 %	75
Material Handling	1	90 %	86
Cement mixer truck	1	90 %	75

Plant	No# of vehicles	Operational hours	A-weighted SPL (dB(A) at 10m
Truck mounted concrete pump and boom arm	1	90 %	80
Wheeled mobile telescopic crane	1	90 %	78
Diesel generator for site cabins	1	100 %	65

27.5.15 Noise emission levels at the nearest residential receptor from the construction work of the substation have been calculated according to the method presented within BS 5228.

27.5.16 The closest receptor to the substation site is 130m from the substation boundary. Resultant worst-case noise levels would be 64dB(A). This is below the BS 5228 target threshold of 65dB(A), and as such would result in a negligible impact which is not significant.

27.5.17 The results show that the predicted construction noise would exceed the target threshold level during daytime within 100m from the site boundary. It should be noted that the predicted levels are worst-case, as it is assumed that all of the plant is operating on the closest part of the site to the receptor. Actual noise levels are likely to be lower, as in reality some of the plant is likely to operate further away from the receptor.

Construction vibration – Substation

27.5.18 The large distances (in vibration terms) between the site and sensitive receptors means that there is no potential for vibration from these works to affect sensitive receptors. The impact of vibration will therefore be negligible and not significant.

Construction noise – Offshore Piling

27.5.19 Noise from piling offshore was assessed during piling of the offshore meteorological (met) mast monopile foundation at the Project site on 13 April 2012. Similar offshore piling equipment will be used for installation of the turbine bases, it can be concluded that the piling of turbine bases offshore does not have the potential to disturb receptors onshore as piling was inaudible onshore during the met mast piling, 13.5km from the shoreline.

27.5.20 The findings of the met mast noise assessment are provided in Appendix 27.2. The measurement locations were undertaken in the towns of Shoreham, Worthing and Littlehampton. In rural areas, such as Peacehaven, it is possible that the background noise levels will be less than measured. However, noise levels from piling would be inaudible, regardless of the existing background noise level. This is because predicted piling noise was, at most, 13dB(A) at the shoreline. This is below the threshold of normal human hearing (around 20dB(A)).

27.5.21 The pile size for the turbines would be up to a maximum diameter of 6.5m in comparison with the 2.5m pile used for the met mast. Potentially this could result in higher noise level during the turbine piling than that measured for the met mast. However, there would not necessarily be an increase in noise level as a different pile technique or equipment could result in lower noise levels despite the increased size of pile. The maximum sound power level of the piling in order that noise levels would be inaudible onshore (20dB(A)) has been calculated at 148dB(A). This is based on distance attenuation, reflections from water (+3dB), favourable wind conditions (+3dB) and air absorption (-3dB per 1,000m). As a comparison, the average sound power level from the piling calculated from the noise measurements was 130dB(A). A level of 148dB(A) is considered achievable with existing piling types.

Construction noise and vibration - Traffic

27.5.22 The changes in noise levels along road links for construction traffic is presented in Table 17.15. The 'Without Construction' scenario consists of baseline traffic in addition to predicted traffic changes as a result of committed development. Speeds have been based on guidance within CRTN as follows (it is assumed that construction traffic is limited to 80km/h):

- 50km/h for single carriage roads subject to a speed limit of less than 50mph;
- 70km/h for single carriage roads subject to a speed limit of 50mph); and
- 80km/h for dual carriage roads subject to a speed limit of 50mph.

Table 27.15: Construction traffic noise results

Road	Without Construction		With Construction		Speed (km/hr)	L _{A10, 18 Hr} Result		
	Total flows	% HGV	Total flows	% HGV		Without Construction (dBA)	With Construction (dBA)	Increase (dBA)
A272	16132	8	16256	8	80	73.4	73.6	0.2
Wineham Lane	1014	7	1411	14	50	58.8	61.6	2.8
B2116	3808	8	3877	9	50	64.5	64.9	0.3
A2037	8059	0	8355	0	50	65.4	65.5	0.2
Edburton Road	1760	7	1853	10	50	61.2	62.1	0.9
A283	21811	7	22277	8	70	73.8	74.0	0.2
A27 (East of A283)	69157	15	69471	16	80	80.9	81.0	0.1
A27 (between A2025 and A283)	57622	15	58115	15	80	80.1	80.1	0.0
Western Rd	11815	8	11880	8	50	69.5	69.6	0.1
A259	35599	7	35650	7	50	74.1	74.1	0.0

27.5.23 The results show that short-term changes to traffic noise levels on the road system affected by construction would be negligible (<0.9dBA) to minor (1-2.9dBA) magnitude of impact and not significant.

27.5.24 CRTN states that the prediction methodology is not suitable for traffic flows less than 50 per hour. Both predicted baseline traffic and construction traffic on St Paul's Avenue would be lower than 50 vehicular trips per hour. Therefore, the methodology and criteria within BS 5228 has been utilised for construction traffic movements along St Paul's Avenue, assuming an HGV traffic flow of 34 vehicles (worst case flow estimated to only occur at most for 2 days during construction) averaged over an 8 hour day and based on a sound power level for a wheeled loader (BS 5228, Annex C, Table C.2, Ref # 27).

Table 27.16: Construction traffic noise on St Paul's Avenue

Sound power level L _{Aw} dB(A)	Hourly flows*	Distance to receptor, m	Speed (km/h)	Sound pressure level, dB(A)
111	4	10	48	57

27.5.25 The results (see Table 27.16) show that noise levels would be below the BS 5228 threshold for daytime and therefore the noise impact would be considered negligible.

27.5.26 In the majority of circumstances HGV traffic is not considered a significant source of vibration. However, higher peaks of vibration can be caused by HGV driving over cracks and holes within the road. HGV traffic will largely be using A and B classified roads that are likely to be well maintained. Where it is planned that HGV traffic uses unclassified roads or newly constructed access routes (the two side accesses shown on Figure 2b.1), residences are at sufficient distances (>10m) from these routes so that vibration caused by HGV would not result in a significant impact. Some routes to access the cable route corridor are yet to be determined and will be assessed for potential vibration impacts when identified.

Operation

Operational Noise - Substation

27.5.27 The proposed onshore substation has been modelled using CadnaA noise software. The detailed design for the substation has not yet been completed, so an indicative design has been used to assess potential noise impact. The key components consist of the noise sources set out in Table 27.17. The location of the noise sources as modelled is presented in Figure 27.3.

Table 27.17: Sound power levels of major equipment within the onshore substation

Equipment	Number of Plant	Point Source Height (m)	Sound Power Level, dB(A)	Mitigation Sound Reduction Levels, dB(A)
Super Grid Transformer	4	3.5	90	25
Auxiliary Transformer	4	3.5	90	25
Reactor ¹	12	3.0	78	15
STATCOM unit	4	4.0	84	15
Harmonic Filter Compound	4	4.0	91	20
Cooling Unit (Transformers and STATCOM)	12	6.0	75	0
Note 1: includes reactive compensation equipment				
Note 2: assumes that noise levels from capacitors do not significantly contribute to noise levels from the substation				

27.5.28 Given the distance between sources and receptors, it was considered appropriate to model the various plant as point sources, with the height of point relating to 2/3 of the height of plant. Indicative spectrum data for the plant has been used (based on a reasonable worst-case assumption of low frequency dominance within the 125Hz Octave Band). Details of computer noise modeling are presented in Appendix 27.3.

27.5.29 Resultant noise levels from the substation site during operation without mitigation are presented as a noise contour map in Figure 27.4, and noise levels at each receptor are presented in Table 27.18. Table 27.18 also shows the BS 4142 assessment noise level, and is based on night time background noise levels as worst-case. A 5dB 'rating penalty' has been applied to the modelled noise levels to take account of the potential for the substation to generate noise containing tonal components.

Table 27.18: Substation BS 4142 assessment (without mitigation)

Receptor			Plant		Assessment		
ID	Name	L _{A90} (dB)	SPL (dBA)	Rating Level (dBA)	BS 4142 Applicable	Rating Level Over L _{A90}	Impact Magnitude
R1	Twineham Court Farm	30	45	50	Yes	20	Major
R2	The Coach House	30	40	45	Yes	15	Major
R3	Coombe Farm	30	39	44	Yes	14	Major
R4	Coombe Farm	30	38	43	Yes	13	Major
R5	Receptor to North	30	37	42	Yes	12	Major
R6	Eastridge Lodge	30	34	39	Yes	9	Moderate
R7	Farm to West	30	34	39	Yes	9	Moderate
R8	Residence to west	32	35	40	Yes	8	Moderate
R9	Woodpeckers / Downsview	30	39	44	Yes	14	Major

27.5.30 The results in Table 27.18 show that at all locations, the rating level without mitigation applied is more than 5-10dB(A) above the existing background noise level. This would result in a moderate to major impact, which would be significant.

27.5.31 However, it should be noted that the noise models assume all plant is operating continuously. This may not be the case, particularly at night, because it is generally cooler and the cooling plant is unlikely to be operating at its highest capacity.

Operational Vibration - Substation

27.5.32 There are no sources on site with the potential to generate vibration that is perceptible at the nearest receptors. Therefore the impact of vibration from the operation of the substation would be negligible and not significant.

Operational Noise - Turbines

27.5.33 Operational noise from the turbines has been predicted using CadnaA noise modelling software, incorporating ISO-9613 methodology. Wind farm layout options A - D have been modeled with a 7MW wind turbine and options E-H modelled with a 3MW wind turbine. Details of computer noise modeling are provided in Appendix 27.3. The predicted noise from the proposed wind turbines at 10m/s wind speed for each layout option is presented in Table 27.19. Receptor locations have been chosen at intervals along the nearest coastline to the proposed wind turbines.

Table 27.19: Wind farm noise levels at receptor locations

Receptor	Predicted Noise Levels (L _{A90}) at Receptor Locations from Wind Turbine Options							
	A	B	C	D	E	F	G	H
Worthing	27	27	28	28	24	24	24	25
Littlehampton	23	23	23	24	20	20	20	20
Brighton	27	27	27	27	24	24	24	24
Peacehaven	26	26	25	25	23	23	22	22
Newhaven	25	25	24	24	22	22	21	21
Sleaford	23	23	22	22	20	20	19	19

27.5.34 Turbine layout option B is considered the worst case overall and the predicted noise contours are presented in Figure 27.5. For all wind farm layout options, the results show that noise levels at the coastline are not predicted to exceed an LA90 of 35dB(A). The ETSU R-97 methodology states that background noise monitoring is not required for a wind farm development if turbine noise levels are predicted to be less than 35dB(A) at all receptors for a wind speed of 10m/s.

- 27.5.35 It is unlikely that the wind farm would be audible, even at very quiet coastal locations, as at 10m/s the background noise at onshore locations would be raised by wind conditions. At lower wind speeds, the predicted noise level from the wind farm would be lower or, as on calm days, not operational. It is therefore considered that noise from the wind turbines would not result in a disturbance to residential amenity, would be of negligible impact and therefore not significant.
- 27.5.36 The predictions will need to be revised should testing of the 7MW turbine (the V164-7MW) in accordance with EN 61400-11:2003 show that the sound spectrum or sound power levels for the wind turbines is significantly different from that used in predictions.
- 27.5.37 Should revised predictions at onshore receptors be in excess of 35dB(A), a full ETSU R-97 assessment (including background noise monitoring) will be required for the onshore receptors.

Operational Noise - Offshore Substations

- 27.5.38 It is expected that there will be two offshore substations installed at the northern boundary of the Project site to serve the development. It is anticipated that each substation will consist of 2 transformers, considered to be the dominant noise source on each substation. Noise levels from the two substations have been predicted assuming a likely maximum sound power level of 105dB(A) for each transformer and the nearest residential receptor along the shoreline at 13km from the northern boundary of the site. Predictions have taken into account distance attenuation, atmospheric absorption (estimated at 3dB per 1,000m), reflection from the water (+3dB) and a tonal penalty of 5dB. The resulting calculated noise level, including a tonal penalty, is 10dB(A).
- 27.5.39 The resulting noise level predicted from the two substations would not be audible and therefore a negligible impact and not significant.

Decommissioning

- 27.5.40 At decommissioning it is anticipated that the onshore cables will be left buried in situ, unless lifted to be replaced by new cables to be run along the same route as part of future developments or wind farm repowering. It is likely that ducting will remain in place; however, the cables may be pulled out of the ducts via the jointing bays. Decommissioning would be quieter than construction as there would be no trenching and HDD operations undertaken.

- 27.5.41 No decision has been made regarding the final decommissioning policy for the proposed substation, as it is recognised that industry best practice, rules and legislation change over time. The onshore substation may continue to be used as a substation site after the Project has been decommissioned. It is quite possible that the substation will be upgraded for use by future offshore renewable developments. The decommissioning methodology cannot be finalised until immediately prior to decommissioning; the substation will be decommissioned in line with relevant policy at that time.
- 27.5.42 Decommissioning for offshore elements of the project would be quieter than construction as there would be no piling operations undertaken.

27.6 Mitigation Measures

During Construction

- 27.6.1 Best practice construction noise methods will be used to minimise noise generated throughout the construction of the cable route and the substation. Methods will include the following:
- Consideration of noise levels when selecting construction methods and equipment used;
 - Training of construction workers on site to ensure noise is considered through all stages of the construction works;
 - Careful timing of any particularly noisy activities;
 - Development area layouts to minimise or avoid vehicle reversing;
 - Locating highest noise emitting plant and activities farthest away from residences;
 - Use of modern, quiet equipment to minimise noise generation;
 - Ensuring engines are switched off when machines are idle;
 - Registration with the 'Considerate Constructors Scheme', which includes independent inspection of the environmental performance of development areas;
 - Use of a construction management plan detailing the mitigation to be used throughout each stage of construction;
 - Regular communication with residents close to the cable route and substation, particularly where the route is close to houses. The communication will include details of expected work schedules and activities taking place, and contact details in case of query or complaint; and

- Noise measurements will be undertaken in the event of complaints in order to assess the level of disturbance and requirements for further mitigation.

27.6.2 In addition to the above general construction management measures, in order to reduce noise from HDD, screening should be provided to block line of sight between the notable noise emitting element of the HDD rig and associated plant and effected residential receptors.

27.6.3 It is planned that the construction mitigation measures will be incorporated into a noise management scheme.

During Operation - Substation

27.6.4 Without mitigation, there is potential for the operation of the onshore substation to give rise to disturbance at night to neighbouring properties. To reduce noise levels to 'less than marginal', mitigation will be incorporated into the design of the substation to ensure that 'rating levels' are less than 35dB(A) at the closest properties. An example mitigation package is set out below; however it may be possible to mitigate noise using an alternative package of mitigation. Other mitigation measures that could be used include modifying the site layout, construction of noise barriers or enclosures, or selection of quieter equipment.

27.6.5 The example mitigation package assessed comprises:

- Applying noise mitigation to all transformers (SGT and Auxiliary) to reduce noise levels by 25dB(A);
- Applying noise mitigation to all reactors to reduce noise levels by 15dB(A);
- Applying noise mitigation to all filters to reduce noise levels by 20dB(A); and
- Applying noise mitigation to all STATCOM units to reduce noise levels by 15dB(A).

27.6.6 It is considered that the required sound level reductions can be achieved with appropriate enclosures over the identified equipment.

27.6.7 In addition to the above, noise measurements will be undertaken in the event of complaints in order to assess the level of disturbance and requirements for further mitigation.

27.6.8 It is planned that the substation operation mitigation measures will be incorporated into a noise management scheme.

During Operation - Wind Turbines

- 27.6.9 As assessed, the wind turbines are predicted to be inaudible at the shoreline. Prior to the construction of wind turbines, a review of noise predictions would be undertaken with guaranteed sound power levels (as calculated in accordance with EN 61400-11:2003) for the chosen wind turbine type. Construction of the wind farm would not take place unless the predicted noise levels satisfied the requirements within ETSU R-97. Although all of the predictions indicate that noise from the turbines will not be audible onshore, if justified complaints due to potential noise from the turbines are made, noise measurements will be undertaken in order to assess the level of disturbance and any requirements for mitigation.

During Decommissioning

- 27.6.10 Mitigation during decommissioning would utilise best practice methods as described for construction.

27.7 Significance of Residual Effects

During Construction

- 27.7.1 Construction noise and vibration effects for trenching works and the construction of the substation remain negligible to minor and not significant.
- 27.7.2 It is considered that with appropriate screening at the HDD sites in addition to the use of low noise machinery and good construction practice, noise levels could be reduced such that BS 5228 threshold values were not exceeded. The residual noise from HDD sites would be considered a minor effect on the nearest residential receptors and not significant.

During Operation

- 27.7.3 Residual noise levels from the substation site are presented as a noise contour map in Figures 27.6 and noise levels at each receptor are presented in Table 27.20 shows the BS4142 assessment noise level and is based on night time background noise levels as worst-case. A 5dB 'rating penalty' has been applied to the modelled noise levels to take account of the potential for the substation to generate noise containing tonal components.

Table 27.20: Residual substation BS 4142 assessment (with mitigation)

Receptor			Plant		Assessment		
ID	Name	L _{A90} (dB)	SPL (dBA)	Rating Level (dBA)	BS4142 Applicable	Rating Level Over L _{A90}	Impact Magnitude
R1	Twineham Court Farm	30	29	34	No	4	Minor
R2	The Coach House	30	24	29	No	-1	Minor
R3	Coombe Farm	30	24	29	No	-1	Minor
R4	Coombe Farm	30	23	28	No	-2	Minor
R5	Receptor to North	30	22	27	No	-3	Minor
R6	Eastridge Lodge	30	19	24	No	-6	Minor
R7	Farm to West	30	19	24	No	-6	Minor
R8	Residence to west	32	21	26	Yes	-6	Minor
R9	Woodpeckers / Downsview	30	24	29	No	-1	Minor

27.7.4 The results in Table 27.20 show that at all locations, the rating level is either below the background noise level where BS 4142 would be considered applicable or below 35dB(A) (and therefore below WHO night-time guideline limits) where BS 4142 would not be considered applicable. The predicted noise levels would result in a minor effect, which would not be significant.

27.7.5 Impacts from the operation noise from the offshore wind farm and offshore substations remain negligible and not significant.

27.7.6 Operational vibration effects remain negligible and not significant.

During Decommissioning

27.7.7 Construction noise and vibration effects remain negligible to minor and not significant.

Table 27.21: Summary of residual effects and mitigation measures

Aspect	Impact	Magnitude of Impact	Proposed Mitigation Measures	Residual Effect
Construction Phase				
Noise	Disturbance to receptors from trenching works	Negligible to minor	Good practice construction management	Negligible to minor
	Disturbance to receptors from HDD works	Negligible to major	Good practice construction management / screening	Negligible to minor
	Disturbance to receptors from traffic noise increases	Negligible to minor	None required	Negligible to minor
Vibration	Disturbance / structural damage	Negligible	Good practice construction management	Negligible
Operational Phase				
Noise from substation	Disturbance to receptors	Moderate to major	Incorporation of noise control measures into detailed design of substation	Minor
Noise from offshore substations	Disturbance to receptors	Negligible	None required	Negligible
Noise from turbines	Disturbance to receptors	Negligible	None required	Negligible
Decommissioning Phase				
Noise	Disturbance to receptors	Negligible to minor	Good practice construction management	Negligible to minor
Vibration	Disturbance/ structural damage	Negligible	Good practice construction management	Negligible

27.8 Cumulative Impacts

- 27.8.1 If the works associated with the Teville Stream restoration coincide with cable route construction works in similar locations, there is potential for noise levels to be generated over and above those predicted for the cable route construction works alone. At this stage, there is insufficient information to enable the resultant noise levels to be calculated, but any periods of high noise levels at any one location would be likely to be short as the cable route works are transient. As such, the durations of construction in any one location would not exceed the BS 5228 time thresholds and the cumulative impact is therefore likely to be limited to negligible to minor and not significant.
- 27.8.2 The following planned developments are noted in the vicinity of the proposed substation:
- Modifications to the existing National Grid Bolney substation (associated with Rampion connection).
 - Modifications to the existing National Grid Bolney substation (not associated with Rampion).
- 27.8.3 Four 400kV feeder bays are required within the NGET substation compound at Bolney to connect the new Rampion substation to the existing NGET Bolney substation. Recent discussions between National Grid and E.ON have indicated that these works would fall outside NGET's permitted development rights and therefore planning consent would be required, E.ON intends to apply for planning permission from Mid Sussex District Council.
- 27.8.4 Detailed environmental assessment reports have not yet been completed for the National Grid Bolney modifications.
- 27.8.5 The construction works at the existing Bolney substation are likely to include earthworks, foundations and installation. The nearest residential receptor to the construction works for the existing substation is 110m from the anticipated site boundary. This residence is 580m from the site boundary for the proposed Rampion substation. If a worst case scenario occurs (all construction equipment operational at the same time for both sites as assessed in Section 27.5), the contribution of the Project construction noise would be at least 15dB(A) below the construction noise from the existing Bolney substation works. The overall noise levels would therefore be the same as the existing Bolney substation works alone, and there would not be a cumulative effect.

- 27.8.6 The nearest residence to the proposed Rampion substation works at 130m is 330m from the anticipated nearest works at the existing substation site. If a worst case scenario occurs (all equipment operational at the same time for both sites as assessed in Section 27.5), the contribution of the Bolney equipment would be 8dB(A) below the predicted noise from the proposed Project substation works. This would increase the predicted noise level in Section 27.5 of 64dB(A) by 1dB. The resultant noise level would still be below the threshold for significant effect as described within BS 5228.
- 27.8.7 The cumulative noise effect of construction works at both the existing Bolney substation and proposed Rampion substation would be considered negligible and not significant.
- 27.8.8 The notable noise emitting plant to be proposed at the existing Bolney substation site (works not associated with Rampion) includes a Mechanically Switched Capacitor (MSC) compound (including reactors) and Static VAR Compensator (SVC) Compound (including reactors, cooling fans, filters and transformer with radiator). It is understood that National Grid (the site developer) will mitigate noise levels for new plant at the existing Bolney substation, if required, such that background noise levels will not be exceeded (inclusive of appropriate tonal penalties). A noise level from the existing Bolney substation equaling the background noise level at residential receptors would result in the following cumulative noise levels with the proposed Rampion substation.

Table 27.22: Cumulative substation BS 4142 assessment (with mitigation)

Receptor			Rating Level (dBA)			Assessment		
ID	Name	L _{A90} (dB)	Existing Substation - New Plant	Proposed Substation	Cumulative Effect	BS 4142 Applicable	Rating Level Over L _{A90}	Impact Magnitude
R1	Twineham Court Farm	30	30	34	35	No	5	Minor
R2	The Coach House	30	30	29	33	No	3	Minor
R3	Coombe Farm	30	30	29	33	No	3	Minor
R4	Coombe Farm	30	30	28	32	No	2	Minor
R5	Receptor to North	30	30	27	32	No	2	Minor
R6	Eastridge Lodge	30	30	24	31	No	1	Minor
R7	Farm to West	30	30	24	31	No	1	Minor
R8	Residence to west	32	32	26	33	Yes	1	Minor
R9	Woodpeckers / Downsview	30	30	29	33	No	3	Minor

- 27.8.9 The results show that cumulative noise levels would constitute a minor impact and not significant.

27.9 References

BS 4142: 1997 - Method for rating industrial noise affecting mixed residential and industrial areas

BS 5228-1: 2009 - Calculation for noise from open and construction sites - Part 1: Noise

BS 5228-2:2009 - Calculation for noise from open and construction sites - Part 2: Vibration

BS 7385-1:1990 Evaluation and measurement for vibration in buildings - Guide for measurement of vibrations and evaluation of their effects on buildings

BS 7445: 2003 - Description and measurement of environmental noise - guide to quantities and procedures

BS 60942: 2003 Electroacoustics Sound Calibrators – Specifications

BS 61672: 2003 Electroacoustics. Sound Level Meters – Specifications

Calculation of Road Traffic Noise (DTI & Welsh Office, 1988)

Design Manual For Roads and Bridges Volume 11, Section 3, part 7 HD213/11 (Highways Agency, Updated 2011)

EN 61400-11: 2003 Wind turbine generator systems - Acoustic noise measurement techniques

National Planning Policy Framework

World Health Organisation (WHO) Night Noise Guidelines for Europe (NNG)