East Anglia TWO Offshore Windfarm

Chapter 25

Noise and Vibration

Environmental Statement
Volume 1

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Glossary of Acronyms

AAWT	Annual Average Weekday Traffic
AIS	Air Insulated Switchgear
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CoCP	Code of Construction Practice
CRTN	Calculation of Road Traffic Noise
DMRB	Design Manual for Roads and Bridges
EPA	Environmental Protection Act
ETG	Expert Topic Group
eVDV	Estimated Vibration Dose Value
GIS	Gas Insulated Switchgear
HVAC	High Voltage Alternating Current
ISO	International Standards Organisation
LOAEL	Lowest Observed Adverse Effect Level
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPSE	Noise Policy Statement for England
NSR	Noise Sensitive Receptor
OAE	Observed Adverse Effect
PID	Public Information Days
PPG	Planning Practice Guidance
PPV	Peak Particle Velocity
SCDC	Suffolk Coastal District Council
SLM	Sound Level Meter
SOAEL	Significant Observed Adverse Effect Level
TMP	Traffic Management Plan
TRL	Transport Research Laboratory
TRRL	Transport and Road Research Laboratory
VDV	Vibration Dose Value
WHO	World Health Organisation

Glossary of Terminology

Applicant	East Anglia TWO Limited.
Cable sealing end compound	A compound which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Cable sealing end (with circuit breaker) compound	A compound (which includes a circuit breaker) which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Construction consolidation sites	Compounds associated with the onshore works which may include elements such as hard standings, lay down and storage areas for construction materials and equipment, areas for vehicular parking, welfare facilities, wheel washing facilities, workshop facilities and temporary fencing or other means of enclosure.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
dB(Z) (or previously Lleq)	Decibels measured on a sound level meter incorporating a flat frequency weighting (Z weighting) across the frequency range.
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
Development area	The area comprising the onshore development area and the offshore development area (described as the 'order limits' within the Development Consent Order).
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
National electricity grid	The high voltage electricity transmission network in England and Wales owned and maintained by National Grid Electricity Transmission
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Jointing bay	Underground structures constructed at intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
$L_{A10, T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise.

$L_{A90, T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142:2014+A1:2019 it is used to define the 'background' noise level.
$L_{Aeq, T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land and connect to the onshore cables.
Mitigation areas	Areas captured within the onshore development area specifically for mitigating expected or anticipated impacts.
National Grid infrastructure	A National Grid substation, cable sealing end compounds, cable sealing end (with circuit breaker) compound, underground cabling and National Grid overhead line realignment works to facilitate connection to the national electricity grid, all of which will be consented as part of the proposed East Anglia TWO project Development Consent Order but will be National Grid owned assets.
National Grid overhead line realignment works	Works required to upgrade the existing electricity pylons and overhead lines (including cable sealing end compounds and cable sealing end (with circuit breaker) compound) to transport electricity from the National Grid substation to the national electricity grid.
National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO project Development Consent Order.
Onshore cable corridor	The corridor within which the onshore cable route will be located.
Onshore cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
Onshore cables	The cables which would bring electricity from landfall to the onshore substation. The onshore cable is comprised of up to six power cables (which may be laid directly within a trench, or laid in cable ducts or protective covers), up to two fibre optic cables and up to two distributed temperature sensing cables.
Onshore development area	The area in which the landfall, onshore cable corridor, onshore substation, landscaping and ecological mitigation areas, temporary construction facilities (such as access roads and construction consolidation sites), and the National Grid Infrastructure will be located.
Onshore infrastructure	The combined name for all of the onshore infrastructure associated with the proposed East Anglia TWO project from landfall to the connection to the national electricity grid.
Onshore preparation works	Activities to be undertaken prior to formal commencement of onshore construction such as pre–planting of landscaping works, archaeological investigations, environmental and engineering surveys, diversion and laying of services, and highway alterations.
Onshore substation	The East Anglia TWO substation and all of the electrical equipment within the onshore substation and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia TWO project.

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25 Noise and Vibration

25.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential onshore airborne noise and vibration impacts of the proposed East Anglia TWO project. This chapter provides an overview of the baseline noise conditions where the onshore development area is proposed and identifies potentially sensitive receptors to noise and vibration. The chapter presents an assessment of the potential impacts and associated mitigation for the construction, operation and decommissioning of the proposed East Anglia TWO project.

2. The assessment also considers cumulative impacts of other proposed projects. The proposed methodology adhered to for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) is discussed in ***section 25.4.3*** and ***section 25.4.4*** respectively. The chapter was prepared by Royal HaskoningDHV.

3. It should be noted that the East Anglia ONE North offshore windfarm project (the proposed East Anglia ONE North project) is also in the application stage. The proposed East Anglia ONE North project has a separate Development Consent Order (DCO) process which has been submitted at the same time as the proposed East Anglia TWO project. This assessment considers the cumulative impact of the proposed East Anglia TWO project with the proposed East Anglia ONE North project (***Appendix 25.2***) and subsequently with other proposed developments (***section 25.7***).

4. This chapter is supported by ***Appendix 25.1***, ***Appendix 25.2, Appendix 25.3***, ***Appendix 25.4*** and ***Appendix 25.5***. Figures which accompany this chapter are provided in ***Volume 2 Figures***.

5. Potential impacts in relation to noise and vibration inter-relate with other technical topics as presented within other chapters of the ES. These are referenced within this chapter and consist of:

   - ***Chapter 22 Onshore Ecology***;
   - ***Chapter 23 Onshore Ornithology***;
   - ***Chapter 24 Archaeology and Cultural Heritage***;
   - ***Chapter 26 Traffic and Transport***;
   - ***Chapter 27 Human Health***; and
   - ***Chapter 30 Tourism Recreation and Socio-Economics***.

25.2 Consultation

6. Consultation is a key feature of the EIA process, and continues throughout the lifecycle of a project, from its initial stages through to consent and post-consent.

7. To date, consultation with regards to noise and vibration has been undertaken via Expert Topic Group (ETG) meetings, described within ***Chapter 5 EIA Methodology***, with meetings held in April 2018, January 2019 and May 2019, the East Anglia TWO Scoping Report (SPR 2017) and the Preliminary Environmental Information Report (PEIR) (SPR 2019). Feedback received through this process has been considered in preparing the ES where appropriate and this chapter has been updated for the final assessment submitted with the DCO application.

8. The responses received from stakeholders with regards to the Scoping Report, PEIR, as well as feedback to date from the Onshore Noise and Vibration ETG, are summarised in ***Appendix 25.1***, including details of how these have been taken account of within this chapter.

9. Ongoing public consultation has been conducted through a series of Public Information Days (PIDs) and Public Meetings. PIDs have been held throughout Suffolk in November 2017, March 2018, June / July 2018 and February / March 2019. A series of stakeholder engagement events were also undertaken in October 2018 as part of phase 3.5 consultation. Details of the consultation phases are discussed further in ***Chapter 5 EIA Methodology***.

10. ***Table 25.1*** shows public consultation feedback pertaining to noise and vibration. Full details of the proposed East Anglia TWO project consultation process are presented in the Consultation Report (document reference 5.1), which is provided as part of the DCO application.

Table 25.1 Public Consultation Responses relevant to Noise and Vibration

Topic	Response / where addressed in the ES
Phase 1	
• Concerns over noise and vibration	Noise and vibration impacts are assessed in ***section 25.6***
Phase 2	
• Substation noise levels during operation and switching • Noise levels in Friston • Noise impacts at Snape Maltings • Proximity to housing	Noise and vibration impacts are assessed in ***section 25.6*** Embedded mitigation is listed in ***section 25.3.3***

Topic	Response / where addressed in the ES
• Adequate screening and noise reduction measures in place	
Phase 3	
• Noise impacts from substation • Assessment methodology • Construction noise at substation, onshore cable corridor, landfall, compounds etc, including construction traffic • Use gas cooled substations to reduce noise • Topography of land contributing to noise impacts • Cumulative impact of noise with all equipment • Efficiency of trees to mitigate noise • Vibration impacts	Noise and vibration impacts are assessed in ***section 25.6*** Embedded mitigation is listed in ***section 25.3.3*** Noise and vibration assessment methodology is addressed in ***section 25.4***
Phase 3.5	
• Noise impacts from construction and operation • Construction noise impacting Thorpeness residents (including piling) • Minimal background noise at Friston	Noise impacts are assessed in ***section 25.6.1*** (construction phase) and ***section 25.6.2*** (operation phase). The assessment of background noise levels is detailed in ***section 25.5***.
Phase 4	
• Impacts of construction vibration • Concerns over construction noise • Low background noise in a rural area • Friston is a quiet area • Noise limits during the construction phase	Potential construction impacts are assessed in ***section 25.6.1.3*** Noise impacts are assessed in ***section 25.6.1*** (construction phase) and ***section 25.6.2*** (operation phase). The assessment of background noise levels is detailed in ***section 25.5***.

25.3 Scope

25.3.1 Study Area

11. The noise and vibration study area, defined as the extent of the onshore development area, is shown on ***Figure 25.1***. The noise and vibration study area includes the following elements:

- Landfall;
- Onshore cable corridor;
- Onshore substation; and
- National Grid infrastructure.

12. The spatial scope of the construction noise assessment included the following geographic coverage:

- Along the onshore development area where significant activities could affect Noise Sensitive Receptors (NSRs); and
- Traffic routes and routes subject to significant changes in traffic flows (and / or percentage HGV) associated with construction.

13. The extent of the noise and vibration study area for the construction phase road traffic noise and vibration assessment was based on details provided in ***Chapter 26 Traffic and Transport*** and agreed through traffic-specific consultation.

14. The noise and vibration assessment draws on the information provided within ***Chapter 6 Project Description*** in order to define a worst case scenario, which is subsequently assessed in this chapter.

25.3.1.1 Offsite Highway Improvements

15. Offsite highway improvements may take place at three locations; the A1094 / B1069 junction, the A12 / A1094 junction and Marlesford Bridge. These works are part of the onshore preparation works which may take place prior to the commencement of main construction. Therefore, detailed assessment of these works does not form part of the assessment of construction impacts presented in ***section 25.6.*** These works are to allow larger construction vehicles to access and navigate certain parts of the public road network. Any modifications to roads would be undertaken in consultation with and in accordance with the requirements of the local Highways Authority in accordance with the requirements of the draft DCO. Further details of the works required are presented in ***Chapter 6 Project Description.***

16. The offsite highway improvements at the A1094 / B1069 and A12 / A1094 junctions would involve the temporary moving of street furniture and temporary local widening of the highway (or creation of overrun areas). Offsite highway improvements at Marlesford Bridge would additionally require temporary laydown areas for structural works to accommodate abnormal indivisible loads.

17. The offsite highway improvements will not require a large quantity of plant and equipment and the works will have a small footprint, mostly within the existing highway boundary. All offsite highway improvements will be undertaken in compliance with construction noise limits defined in BS 5228-1:2009+A1:2014 which specifies a construction noise limit based on the existing ambient noise level and for different periods of the day as presented in ***Table 25.9.*** The limits described in BS 5228-1:2009+A1:2014 establish that there is no impact below the three thresholds presented in ***Table 25.9.*** Offsite highway improvements will be undertaken between the hours of 07:00 to 19:00 Monday to Friday and 07:00

to 13:00 on Saturday unless otherwise agreed with the Local Highway Authority. Therefore, it is considered that these works will not have the potential to generate levels of construction noise that will have a potential impact on NSRs.

18. In addition, the offsite highway improvement locations fall within the assessed road network study area as shown in ***Table 25.25.*** Therefore, noise impacts on receptors in proximity to the offsite highway improvement locations from the worst case construction vehicle movements are assessed and mitigated in ***section 25.6.1.2***. The offsite highway improvement works will not generate vehicle movements that have the potential to impact receptors along the assessed road network greater than that already assessed as the worst case during construction.

25.3.1.2 Offshore Airborne Noise

19. Offshore airborne noise was suggested to be scoped out by the Applicant (SPR 2017). Onshore receptors for offshore noise sources were scoped out, however the Planning Inspectorate (Planning Inspectorate 2017a) requested more information on the potential offshore receptors before this could be agreed. Offshore airborne noise was therefore considered in ***Chapter 12 Offshore Ornithology*** (***sections 12.6.1.1*** and ***12.6.3.1***) as part of the disturbance impacts to birds caused by the presence of plant, vessels and infrastructure. No other offshore ecological receptors have a source-pathway-receptor relationship to airborne noise.

20. With regard to offshore human environment receptors, these would be other sea users (i.e. commercial fishermen, aggregates workers and recreational or commercial sailors only) (see ***Chapter 13 Commercial Fisheries, Chapter 14 Shipping and Navigation*** and ***Chapter 17 Infrastructure and Other Users***). These users would have a limited exposure to noise during construction if within range (i.e. due to the duration of noisy activities (temporary and episodic) and due to the receptors themselves being mobile) and would potentially be within a noisy environment themselves (e.g. with generators, engines and winches on their own vessels).

21. During operation potential receptors would, as per construction, either only be within range of noise for limited periods (as transiting the area) and/or within noisy operational environments themselves.

22. It is therefore considered that all impacts on human receptors from offshore airborne noise during construction and operation would be negligible for the limited period of exposure and are not considered further in this assessment.

23. This approach is consistent with the conclusions for other projects and the agreement of the Planning Inspectorate to scope out offshore airborne noise impacts for recent offshore windfarm projects such as Norfolk Vanguard (Planning Inspectorate 2016a), Norfolk Boreas (Planning Inspectorate 2017b) and Hornsea Project 3 (Planning Inspectorate 2016b).

25.3.2 Worst Case Scenarios

24. This section identifies the realistic worst case parameters associated with the proposed East Anglia TWO project alone. This includes all onshore infrastructure for the proposed East Anglia TWO project and the National Grid infrastructure that the proposed East Anglia TWO project will require for ultimate connection to national electricity grid.

25. The worst case assumptions for noise and vibration impacts are presented in ***Table 25.2***. For the construction noise assessment, the worst case phase is considered to be represented by months 1 to 24. This is therefore presented in the assessment within this chapter. Impact magnitude and significance are determined for sensitive receptors which fall within the noise and vibration study area.

26. Details of the construction plant and equipment to be used, and considered in this assessment, can be found in ***section 25.4.3.1.2*** and details of the modelled operational equipment at the onshore substation can be found in ***section 25.6.2.1***.

27. As described in ***Chapter 5 EIA Methodology***, there are two co-located onshore substation locations for either the proposed East Anglia TWO project or the proposed East Anglia ONE North project. It should be noted that the draft DCOs for both the proposed East Anglia TWO and East Anglia ONE North projects have the flexibility for either project to use either onshore substation location.

28. In this chapter, the project alone assessment in ***section 25.6*** is based on the intended development strategy of the proposed East Anglia TWO project using the eastern onshore substation location. However, ***Appendix 25.4*** and ***Appendix 25.5*** present the project alone impacts in the eventuality that the onshore substation for the proposed East Anglia TWO project used the alternative onshore substation location, as allowed for in the draft DCO. A summary of this is provided in ***section 25.6.4.***

Table 25.2 Realistic Worst Case Scenarios

Impact	Parameter	Notes
Construction		
Construction duration	The minimum realistic duration that the onshore works can be completed in is 36 months (three years). For the construction noise assessment, the worst case phase is considered to be represented by months 1 to 24.	
Construction date	Earliest start of construction is mid 2023	
Working hours	Construction activities must only take place between 0700 hours and 1900 hours Monday to Friday and 0700 hours and 1300 hours on Saturdays, with no activity on Sundays or bank holidays, except as specified in the draft DCO (e.g. HDD works will require 24 hour working).	
Operation		
Impacts related to the landfall	No above ground infrastructure	
Impacts related to the onshore cable route	No above ground infrastructure	
Impacts related to the onshore substation	Presence of onshore substation. Refer to ***section 25.6.2*** for further details regarding sound power levels from various elements of onshore substation infrastructure	
Impacts related to the National Grid Infrastructure	The equipment required at the National Grid substation for operation does not include components which would contribute any significant noise contributions in the area. Normal operational noise levels are expected to be minimal as there are no transformers on the site. Diesel generators and circuit breakers would be activated only during maintenance or during a system fault.	Details provided below in ***section 25.3.2.1.***
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As		

Impact	Parameter	Notes
such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

25.3.2.1 National Grid Infrastructure – Operational Noise

29. The National Grid infrastructure does not contain plant such as high voltage transformers or shunt reactors, or rotating plant such as transformer coolers, that would usually be the dominant noise sources from a substation during operation.

30. Any noise during the operational phase from National Grid infrastructure would be due to switchgear (circuit breakers & isolators), and if present, auxiliary plant such as control systems or an emergency generator. For an Air Insulated Switchgear (AIS) National Grid substation, switchgear equipment will be external of any buildings. For a Gas Insulated Switchgear (GIS) National Grid substation, some or all of the switchgear would typically be located within a building subject to detailed design. Noise from switchgear is impulsive in character (i.e. of very short duration – measured in milliseconds). However, these items of plant are designed to be inherently quiet in operation, and do not make operational noise or vibration at a level that would be perceptible at NSRs.

31. The design of the overhead line (L6 quad Zebra line) is one of the quietest designs available on the 400 kV transmission system[1]. The permanent overhead line realignment would comply with all relevant National Grid specification standards and is considered to be consistent with the existing overhead line design in vicinity of the onshore development area.

32. Using SoundPLAN, an illustrative sound power level was assigned to each overhead line source at a height of 25m based on the existing overhead line alignment and the proposed National Grid permanent overhead line realignment. Other than the proposed realignment, an assumption was made that all other parameters would remain equal between the baseline (existing alignment) and proposed (future alignment).

33. The highest change in noise level from the permanent realignment was predicted as +1.3dBA at SSR3 (details of NSR are provided in ***section 25.5)***, +1.1dBA at SSR9; with all other NSRs in the predicted to be <1.0dBA relative change. A reduction in the operational overhead line noise level was predicted at SSR2, SSR5 NEW, SSR6. A 3dBA change in environmental noise level is accepted to be the lowest perceptible level. Therefore, the relative change in noise level from the permanent OHL realignment is not considered further in this chapter as the

[1] The conductor surface electrical stress gradient on the quad Zebra bundle is approximately 12.4 kV/cm Emax, which is significantly below the corona inception level of 17 to 20 kV/cm.

change is imperceptible and would not alter the operational noise assessment presented in ***section 25.6.2.***

34. For the reasons stated above, operational noise from the National Grid infrastructure is not assessed further in this chapter.

25.3.3 Embedded Mitigation and Best Practice

35. Embedded mitigation relating to noise and vibration is summarised in ***Table 25.3***. The final details of the construction mitigation would be developed once the exact plant types and locations are confirmed, this will be subject to procurement and contracting. The table first presents general mitigation measures (which would apply to all parts of the onshore infrastructure), and mitigation measures which would apply specifically to the landfall, onshore cable route and onshore substation are described separately.

36. The operational noise emissions from the onshore substation will be governed by a noise restriction secured through the requirements of the draft DCO which states that operational rating noise level from the onshore substation (in accordance with BS4142:2014+A1:2019) will be no greater than 34dB $L_{Aeq\ (5\ minutes)}$ at any time at the NSRs (SSR2 and SSR5 NEW). The effect of this requirement will be such that noise emissions from the onshore substation will not exceed the prescribed limit at any receptors.

Table 25.3 Embedded Mitigation and Best Practice Relating to Noise and Vibration

Parameter	Mitigation Measures Embedded into the proposed East Anglia TWO Project Design
General	
Construction	A Construction Phase Noise and Vibration Management Plan will be submitted to, and approved by, the relevant regulators to discharge a requirement of the draft DCO and form part of the Code of Construction Practice (CoCP). An Outline CoCP (OCoCP) has been submitted as part of this DCO application. Best practice noise mitigation measures, to be implemented and controlled through the Construction Phase Noise and Vibration Management Plan, will typically include: • Management of construction operating hours; • Implementation of traffic management measures such as agreed routes for construction traffic. • Use of screens and noise barriers / acoustic screens. • Construction site layout to minimise or avoid reversing with use of banksmen where appropriate. Output noise from reversing alarms set at levels for health and safety compliance. • Use of modern, fit for purpose, well maintained plant and equipment to minimise noise generation. Plant and vehicles will be fitted with mufflers /

Parameter	Mitigation Measures Embedded into the proposed East Anglia TWO Project Design
General	
	silencers maintained in good working order. Use of silenced equipment, as far as possible and low impact type compressors and generators fitted with lined and sealed acoustic covers. Doors and covers housing noise emitting plant will be kept closed when machines are in use. • No audible music or radios to be played outdoors on site. • Ensuring engines are switched off when machines are idle. • Regular communication with site neighbours to inform them of the construction schedule, and when noisy activities are likely to occur. • Use of pre-construction survey to identify road surface irregularities which require remediation in order to mitigate vibration impacts. A Construction Traffic Management Plan (CTMP) will also be submitted to and approved by the relevant regulators which will outline measures to manage impacts of construction vehicles, secured under a requirement of the draft DCO. An Outline CTMP (OCTMP) has been submitted with this DCO application. Jointing bays will not be constructed within 55m of a residential dwelling as detailed in the OCoCP submitted with this DCO application.
Substation	
Operation	The operational noise emissions from the onshore substation will be governed by a noise restriction of a rating level (in accordance with BS4142:2014+A1:2019) no greater than 34dBA $L_{Aeq\ (5\ minutes)}$ at any time at the NSRs (SSR2 and SSR5 NEW). Industry standard noise mitigation schemes (including consideration of design) around the substation will ensure that noise emissions from the onshore substation does not exceed the levels stated in the noise requirement.

25.3.4 Monitoring

37. Post-consent, the final detailed design of the proposed East Anglia TWO project will refine the worst-case parameters assessed in this ES. It is recognised that monitoring is an important element in the management and verification of the actual impacts based on the final detailed design. Where monitoring is proposed for noise and vibration, this is described in the OCoCP submitted with this DCO application (document reference 8.1). Final details of monitoring will be agreed post-consent with the Local Planning Authority and relevant stakeholders.

25.4 Assessment Methodology

38. Potential noise and vibration impacts associated with onshore construction will be assessed using the guidance contained in BS 5228:2009+A1:2014 (*Code of Practice for Noise and Vibration Control on Construction and Open Sites*), which defines the accepted prediction methods and source data for various construction plant and activities.

39. Construction noise and vibration impacts will be based on the identified construction programme and associated activities and plant, including earthworks, piling (if required), directional drilling, cable trenching and associated construction traffic.

40. Operational impacts will include noise generation associated with the onshore substation. The guidance and methodology contained in BS 4142:2014+A1:2019 (*Rating and Assessing Industrial and Commercial Sound*) will be used to assess potential noise impacts.

41. Following the identification of the onshore development area, liaison with the Noise and Vibration ETG in April 2018, including the East Suffolk Council (ESC) Environmental Health Officer (formerly Suffolk Coastal District Council (SCDC)), was undertaken to agree the approach and methodology to baseline noise surveys and the criteria to be used for the noise and vibration assessment.

25.4.1 Guidance

25.4.1.1 Legislation

42. This section provides details on key pieces of legislation which are relevant to this assessment.

25.4.1.1.1 Environmental Protection Act 1990

43. Section 79 of the Environmental Protection Act 1990 (the EPA 1990) defines statutory nuisance with regard to noise and determines that Local Planning Authorities have a duty to detect such nuisances in their area.

44. The EPA 1990 also defines the concept of 'Best Practicable Means' (BPM) as:

- *"Practicable" means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;*
- *The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;*
- *The test is to apply only so far as compatible with any duty imposed by law;* and
- *The test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances."*

45. Section 80 of the EPA 1990 provides Local Planning Authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

25.4.1.1.2 The Control of Pollution Act 1974

46. Section 60 of the Control of Pollution Act 1974 provides powers to Local Planning Authority officers to serve an abatement notice in respect of noise nuisance from construction works.

47. Section 61 provides a method by which a contractor can apply for 'prior consent' for construction activities before commencement of works. The 'prior consent' is agreed between the Local Planning Authority and the contractor and may contain a range of agreed working conditions, noise limits and control measures designed to minimise or prevent the occurrence of noise nuisance from construction activities. Application for a 'prior consent' is a commonly used control measure in respect of potential noise impacts from major construction works.

25.4.1.1.3 The Environmental Noise (England) (Amendment) Regulations 2018

48. The Environmental Noise directive is transposed into UK Law by The Environmental Noise (England) Regulations 2006, as amended 2018.

25.4.1.2 National Planning Policy

25.4.1.2.1 National Policy Statements (NPS)

49. The assessment of potential impacts upon onshore noise and vibration receptors has been made with specific reference to the relevant NPS. These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to the proposed East Anglia TWO project are:

- 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).

50. The specific assessment requirements for noise and vibration, as detailed in the NPSs, are summarised in ***Table 25.4***, together with an indication of where each is addressed within the ES.

Table 25.4 Summary of NPS Requirements

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 ***section 25.4.3.1*** for the assessment methodology for assessing potential noise and vibration impacts, ***section 25.5*** for details on the existing noise environment including the identification of NSRs and ***section 25.6*** where any changes in noise levels as a result of the proposed East Anglia TWO project are assessed, and any potential impacts and potential mitigation measures are identified.
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 25.6.1.2*** where any changes in noise levels as a result of the proposed East Anglia TWO project from ancillary works, for example vehicle movements, are assessed and any potential impacts and potential mitigation measures are identified.
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)	EN-1, paragraph 5.11.6	Any changes in noise levels as a result of the proposed East Anglia TWO project are assessed in ***section 25.6***, and any potential impacts and

NPS Requirement	NPS Reference	ES Reference
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.		potential mitigation measures are identified. Noise assessment described within EN-3 and EN-5 relates to the offshore environment. Those potential noise impacts are considered separately within ***Chapter 10 Fish and Shellfish Ecology*** and ***Chapter 11 Marine Mammals.*** The current relevant British Standards (BS) have been used within this assessment detailed within ***section 25.4.***
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 ***22 Onshore Ecology*** and ***Chapter 23 Onshore Ornithology.***
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 IPC [now the Planning Inspectorate and the Secretary of State] 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	Further operational assessment of rain-induced noise is not considered necessary. BS 4142:1997 was superseded and fully revised in 2014. Further amendments were incorporated in a 2019 version. Where BS 4142 is referred to in this document, the 2014 revision with 2019 amendments has been applied which is in accordance with current best practice. See ***Chapter 6 Project Description*** for more information on works related to overhead lines.

25.4.1.2.2 National Planning Policy Framework

51. The National Planning Policy Framework (NPPF) (as revised in 2019) forms the basis of the Government's planning policies for England and how these should be applied. Paragraph 170 of the NPPF states planning policies and decisions should contribute to and enhance the natural and local environment by:

- "……*preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution……"*

52. Furthermore, Paragraph 180 states:

- "*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
  - *mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
  - *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
  - *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

53. The NPPF also refers to the Noise Policy Statement for England (NPSE) (Defra 2010).

25.4.1.2.3 Noise Policy Statement for England, 2010

54. The NPSE document was published by Defra in 2010 and paragraph 1.7 states three policy aims:

- *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
  - Avoid significant adverse impacts on health and quality of life;
  - Mitigate and minimise adverse impacts on health and quality of life; and
  - Where possible, contribute to the improvement of health and quality of life."

55. The first two points require that significant adverse impacts should not occur and that, where a noise level falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect (OAE):

- *"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the*

guiding principles of sustainable development. This does not mean that such effects cannot occur." (Paragraph 2.24, NPSE, March 2010).

56. Section 2.20 of the NPSE introduces key phrases including 'significant adverse' and 'adverse' and two established concepts from toxicology that are being applied to noise impacts:

- *"NOEL – No Observed Effect Level; this is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise";* and
- *"LOAEL – Lowest Observed Adverse Effect Level; this is the level above which adverse effects on health and quality of life can be detected".*

57. Paragraph 2.21 of the NPSE extends the concepts described above and leads to a significant observed adverse effect level (SOAEL), which is defined as the level above which significant effects on health and quality of life occur.

58. The NPSE states:

- *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations". (Paragraph 2.22, NPSE, March 2010).*

59. Furthermore, paragraph 2.22 of the NPSE acknowledges that:

- *"Further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise".*

60. However not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

25.4.1.2.4 National Planning Practice Guidance for Noise (NPPG) 2014

61. The National Planning Practice Guidance for Noise (NPPG Noise, December 2014), issued under the NPPF, states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or making decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

25.4.1.3 Local Planning Policy

62. The onshore development area falls within the administrative area of East Suffolk Council Local Planning Authority. East Suffolk Council (ESC) is the merger of SCDC and Waveney District Council (WDC), which became effective from 1st April 2019.

63. ESC published their Suffolk Coastal Final Draft Local Plan for a final stage of consultation in January 2019 (ESC 2019). This plan sets out strategic planning policies within East Suffolk and how the Local Planning Authority addresses the NPPF on a local basis. ***Table 25.5*** provides details of local planning policy documents and the relevant policies in respect of onshore noise and vibration.

Table 25.5 Relevant Local Planning Policies

Document	Policy / guidance	Policy / guidance purpose
ESC (2019) Suffolk Coastal Final Draft Local Plan	Suffolk Coastal District Local Plan – July 2013 East Suffolk (SCDC and WDC) Council (2018) First draft Local Plan Development Management Policy DM23: Residential Amenity	When considering the impact of new development on residential amenity, the Council will have regard to the following: (a) privacy/overlooking; (b) outlook; (c) access to daylight and sunlight; (d) noise and disturbance; (e) the resulting physical relationship with other properties; (f) light spillage, air quality and other forms of pollution; and (g) safety and security. Development will be acceptable where it would not cause an unacceptable loss of amenity to adjoining or future occupiers of the development.

25.4.1.4 Guidance Documents

64. The guidance in ***Table 25-6*** has been applied to the noise and vibration assessment.

Table 25-6 Relevant Guidance

Document	Policy / guidance purpose
BS 4142:2014+A1:2019 – Method for Rating and Assessing Industrial and Commercial Sound	Describes a method for rating and assessing sound of an industrial and/or commercial nature. This method uses a Rating level to assess the likely effects from sound of an industrial or commercial nature on people using amenity space outside a dwelling or premises used for residential purposes upon which the sound is incident.
BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise	Part 1 provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. The legislative background to noise and vibration control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and Local Planning Authorities. This BS provides guidance on methods of predicting and measuring noise and assessing its impact on those exposed to it.
BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration	Part 2 gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels. The Standard includes tables of vibration levels measured during piling operations throughout the UK. It provides guidance concerning methods of mitigating vibration from construction, particularly with regard to percussive piling.
BS 6472-1:2008 – Guide to Evaluation of Human Exposure to Vibration in Buildings	Provides general guidance on human exposure to building vibration in the range of 1Hz to 80Hz and includes curves of equal annoyance for humans. It also outlines the measurement methodology to be employed. It introduces the concept of Vibration Dose Value (VDV) and estimated Vibration Dose Value (eVDV) for the basis of assessment of the severity of impulsive and intermittent vibration levels, such as those caused by a series of trains passing a given location.
BS 7445: Parts 1 and 2 – Description and Measurement of Environmental Noise	Provides details of the instrumentation and measurement techniques to be used when assessing environmental noise and defines the basic noise quantity as the continuous A-weighted sound pressure level (L_{Aeq}). Part 2 of BS 7445 replicates International Standards Organisation (ISO) 1996-2.
BS 8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings	Provides a methodology to calculate the noise levels entering a building through facades and facade elements and provides details of appropriate measures for sound insulation between dwellings. It includes recommended internal noise levels which are provided for a variety of situations, and are based on World Health Organisation (WHO) recommendations.
Calculation of Road Traffic Noise (CRTN) 1988	Provides a method for assessing noise from road traffic in the UK and a method of calculating noise levels from the Annual Average Weekday Traffic (AAWT) flows and from measured noise levels. Since publication in 1988 this document has been the nationally accepted standard in predicting noise levels from road traffic. The calculation methods provided include correction factors to take account of variables affecting the creation and propagation of road traffic noise, accounting for the percentage of heavy goods vehicles (HGV), different road surfacing, inclination, screening by barriers and relative height of source and receiver.

Document	Policy / guidance purpose
Design Manual for Roads and Bridges (DMRB), 2011	Volume 11, Part 3, Section 7 provides guidance on the environmental assessment of noise impacts from road schemes. DMRB contains advice and information on transport-related noise and vibration, which has relevance with regard to the construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing traffic related noise impacts.
ISO 3744	Specifies a method for measuring the sound pressure levels on a measurement surface enveloping a noise source, under essentially free field conditions near one or more reflecting planes, in order to calculate the sound power level produced by the noise source.
ISO 717	Defines single-number quantities for airborne sound insulation in buildings and of building elements such as walls, floors, doors, and windows.
ISO 9613-2	Specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a noise source.
WHO (1999) Guidelines for Community Noise	These guidelines present health-based noise limits intended to protect the population from exposure to excess noise. They present guideline limit values at which the likelihood of particular effects, such as sleep disturbance or annoyance, may increase. The guideline values are 50 or 55dB L_{Aeq} during the day, related to annoyance, and 45dB L_{Aeq} or 60dB L_{Amax} at night, related to sleep disturbance. The Guidance states: *"The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending on the nature of the source."* The WHO guidance also highlights that: "Night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45dB L_{Aeq}, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq}. To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

Document	Policy / guidance purpose
WHO (2009) Night Noise Guidelines for Europe	An extension to the WHO Guidelines for Community Noise (1999). It concludes that: "Considering the scientific evidence on the thresholds of night noise exposure indicated by L_{night} outside as defined in the Environmental Noise Directive (2002148/EC), an L_{night} outside of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. L_{night} outside value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach."
WHO (2018) Environmental Noise Guidelines for the European Region	The guidance states: "The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. They provide robust public health advice underpinned by evidence, which is essential to drive policy action that will protect communities from the adverse effects of noise."

25.4.2 Data Sources

65. Consideration of the surrounding environment was initially conducted using existing available geographical information including aerial and satellite photography and mapping data in order to determine the nearest NSRs and noise sources present within the noise and vibration study area for use in the assessment.

66. The desk data sources used in the assessment and the confidence levels associated with them which informed the desk-based assessment are provided in ***Table 25.7***.

Table 25.7 Desk-Based Data Sources to Inform the Assessment

Data obtained	Year	Data source used	Coverage	Confidence[2]
Location of noise and vibration sensitive receptors within the noise and	2016	Google Maps Aerial Photography	Onshore Noise and Vibration study area	High
	2018	Environment Agency Lidar Data	Onshore Noise and Vibration study area	High
	2018	Local Authority Local Plans	Onshore Noise and Vibration study area	High

[2] Confidence level based upon the organisation responsible for collating data source (high = regulatory, low = non-regulatory)

Data obtained	Year	Data source used	Coverage	Confidence[2]
vibration study area	2018	Ordnance Survey maps	Onshore Noise and Vibration study area	High
	2018	Construction Phasing Plans	Construction: • Landfall • Onshore Cable Route • Onshore Substation • National Grid Infrastructure	High
	2018	Information from other projects within the area	Onshore Noise and Vibration study area	High

67. Measurements of the existing ambient noise level were required to be taken at locations considered representative of the NSRs that had the potential to be affected by the construction and operation of the proposed East Anglia TWO project.

68. Full details of the baseline noise surveys are discussed in ***section 25.5*** and ***Appendix 25.3.***

69. ***Table 25.8*** outlines the baseline noise surveys undertaken. Noise monitoring survey locations were discussed and agreed with the SCDC's (now ESC) Environmental Health Officer prior to survey work commencing and are shown on ***Figure 25.2***.

70. The surveys were undertaken between 27th June 2018 to 12th July 2018 (with the findings used to inform the assessment presented within this ES). Noise measurements were undertaken in accordance with BS 7445-1:2003. It was proposed and agreed that a baseline vibration survey was not undertaken to inform the assessment.

Table 25.8 Onshore Baseline Noise Surveys

Survey	Surveying period	Summary of survey
Onshore development area – focussed on cable corridor and landfall	June-July 2018	Short term (daily) baseline noise surveys at the landfall and along the onshore cable corridor, which consisted of daytime and night-time attended noise measurements at locations representative of NSRs.
Onshore development area – focussed around onshore substation and National Grid	June-July 2018	Long-term (up to a week) baseline surveys in proximity to the onshore substation and National Grid infrastructure which consisted of unattended, continuous noise measurements at locations representative of NSRs.

Survey	Surveying period	Summary of survey
infrastructure location		

25.4.3 Impact Assessment Methodology

71. ***Chapter 5 EIA Methodology*** outlines the general assessment approach adopted in this EIA.

25.4.3.1 Construction Phase Noise Assessment

25.4.3.1.1 Construction Phase Impact Magnitude

72. BS 5228-1:2009+A1:2014 describes several methods for assessing noise impacts during construction projects.

73. The assessment approach utilised in this ES is the threshold based *"ABC"* method. The method is detailed within BS 5228-1:2009+A1:2014, which specifies a construction noise limit based on the existing ambient noise level and for different periods of the day. The predicted construction noise levels were assessed against noise limits derived from advice within Annex E of BS 5228. ***Table 25.9***, reproduced from BS 5228-1:2009+A1:2014 Table E.1, presents the criteria for selection of a noise limit for a specific receptor location (which are adopted in the noise impact magnitude criteria in ***Table 25.10, Table 25.11 and Table 25.12.***

Table 25.9 Construction Noise Threshold Levels Based on the ABC Method (BS 5228:2009+A1:2014)

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A[A)]	Category B[B)]	Category C[C)]
Night time (23.00 – 07.00)	45	50	55
Evenings and weekends (D)	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	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) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

74. The *"ABC method"* described in BS 5228-1:2009+A1:2014 establishes that there is no impact below the three thresholds presented above.

75. BS 5228-1:2009+A1:2014 states:

- *"If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect."*

76. The SoundPLAN noise model used in this construction phase assessment incorporated noise sources located in the noise and vibration study area, nearby residential dwellings and other buildings, intervening ground cover and topographical information.

77. Noise levels for the construction phase were calculated using the methods and guidance in BS 5228-1:2009+A1:2014. This Standard provides methods for predicting receptor noise levels from construction works based on the number and type of construction plant and activities operating on site, with corrections to account for:

- The *"on-time"* of the plant, as a percentage of the assessment period;
- Distance from source to receptor;
- Acoustic screening by barriers, buildings or topography; and
- Ground type.

78. Construction noise impacts were assessed using the impact magnitude presented in ***Table 25.10*** for the daytime period, ***Table 25.11*** for the evening and weekend periods, and ***Table 25.12*** for the night time.

Table 25.10 Day time Construction Noise Impact Magnitude Criteria

Impact magnitude	Construction noise level, decibels (dB)		
	A 65dB threshold	B 70dB threshold	C 75dB threshold
No Impact	<65	<70	<75
Negligible Impact	>65.1 - <65.9	>70.1 - <70.9	>75.1 - <75.9
Low Impact	>66.0 - <67.9	>71.0 - <72.9	>76.0 - <77.9
Medium Impact	>68.0 - <69.9	>73.0 - <74.9	>78.0 - <79.9
High Impact	>70	>75	>80

Table 25.11 Evening and Weekends Construction Noise Impact Magnitude Criteria

Impact magnitude	Construction noise level, decibels (dB)		
	A 55dB threshold	B 60dB threshold	C 65dB threshold
No Impact	<55	<60	<65
Negligible Impact	>55.1 - <55.9	>60.1 - <60.9	>65.1 - <65.9
Low Impact	>56.0 - <57.9	>61.0 - <62.9	>66.0 - <67.9
Medium Impact	>58.0 - <59.9	>63.0 - <64.9	>68.0 - <69.9
High Impact	>60	>65	>70

Table 25.12 Night time Construction Noise Impact Magnitude Criteria

Impact magnitude	Construction noise level, decibels (dB)		
	A 45dB threshold	B 50dB threshold	C 55dB threshold
No Impact	<45	<50	<55
Negligible Impact	>45.1 - <45.9	>50.1 - <50.9	>55.1 - <55.9
Low Impact	>46.0 - <47.9	>51.0 - <52.9	>56.0 - <57.9
Medium Impact	>48.0 - <49.9	>53.0 - <54.9	>58.0 - <59.9
High Impact	>50	>55	>60

79. A proposed construction phase programme detailing duration, deliveries and equipment requirements is provided in ***Chapter 6 Project Description***. Noise modelling scenarios were derived from the proposed construction phase programme and are detailed below.

25.4.3.1.2 Assumptions and Indicative Plant List

80. Based on ***Chapter 6 Project Description***, an indicative list of construction equipment has been developed and are detailed in ***Table 25.13***.

Table 25.13 Construction Plant – Proposed East Anglia TWO Project

Location	Name	No.	Source type	BS5228 Reference	L_{Aeq} (dB) at 10m	On time correction (%)
Landfall and Cable Route	D6 Dozer	Various based on Section and phase	Point	C2.11	84.0	85
	30T Excavator		Point	C2.16	79.4	85
	20T Dumper		Point	C2.30	86.8	85
	Smooth Drum vibro road roller		Point	C5.20	90.8	85

Location	Name	No.	Source type	BS5228 Reference	L_{Aeq} (dB) at 10m	On time correction (%)
	21T excavator		Point	C2.3	86.0	85
	5T Forward Tipping Dumper		Point	C4.7	91.6	85
	Loading shovel		Point	C10.4	91.5	85
	Tractor & fencing kit		Point	C4.74	84.2	85
	Tractor & trailer		Point	C4.75	94.0	85
	Tractor & Fuel bowser (or self-propelled)		Point	C6.38	89.6	85
	Tractor & Water bowser (for dust suppression)		Point	C6.38	89.6	85
	Grader		Point	C6.31	92.4	85
	Telehandler		Point	C2.35	86.2	85
	Mobile self-contained welfare unit		Point	N/A SoundPLAN Library	LwA 68.2	85
	Mobile generator		Point	C4.76	81.0	85
	Temporary lighting		Point	C4.76	81.0	85
	Road surface paver & roller		Point	C5.30	82.2	85
	Skip Wagon Movements		Line	C8.21	87.2	Split evenly over 12 hour day (7 – 19hrs)
	HDD Drill		Point	N/A	LwA 105	100 (24hrs/7 days)
	Mud Pump		Point	N/A	LwA 93	100 (24hrs/7 days)
	Power Supply		Point	N/A	LwA 105	100 (24hrs/7 days)
	Tractor & Cable Drum Roller		Point	C4.74	84.2	85
	Tractor & Soil Tiller		Point	C4.74	84.2	85

Location	Name	No.	Source type	BS5228 Reference	L_{Aeq} (dB) at 10m	On time correction (%)
	Cement Mixer		Point	C4.18	81.6	85
	Mobile Crane		Point	C4.41	77.4	85
	Crawler Crane		Point	C4.43	82.0	85
	Mobile generator		Point	C4.76	81.0	85
	Pump		Point	C2.45	75.0	85
	Cable Laying Tracked Crane		Point	C4.50	75.5	85
	Pre-Cast Concrete Truck		Point	C4.20	84.9	85
	Mobile Concrete Pump		Point	C3.26	85.6	85
	Cable Winch		Point	C4.52	78.5	85
	Hydraulic Hammer Piling Rig		Point	C3.2	LwA 118.3	75
Onshore Substation and National Grid Infrastructure As for Landfall and Cable Route plus the following additional plant	Concrete Batching Plant		Point	C4.22	81.7	85
	Dry Mix Silos		Point	C3.26	85.6	85
	JCB Wheeled Excavator		Point	C5.34	75.5	85
	3t Forward Tipping Dumper		Point	C4.9	86.5	85
	Scissor Lift		Point	C4.59	83.9	85
	Mobile Aerial Platform		Point	C4.57	80.4	85
	Mobile Crane		Point	C4.41	77.4	85
	Mobile Crane Heavy Use		Point	C4.50	75.5	85
	Specialist Gantry Crane		Point	C4.50	75.5	85
	Static Crane		Point	C4.48	85.5	85
	Forklift		Point	N/A	LwA 75.0	85
	Trench Roller		Point	C10.23	60.4	85
	Hydraulic Hammer Piling Rig		Point	C3.2	LwA 118.3	75

25.4.3.2 Construction Phase Traffic Noise Impact Magnitude

25.4.3.2.1 Road Traffic Noise and Vibration Emissions Assessment

81. Following the methodology contained in DMRB (Volume 11, Section 3, Chapter 7) an initial screening assessment was undertaken to assess whether there would be any significant changes in traffic volume and composition on surrounding local roads as a result of the proposed East Anglia TWO project. Any road links with a predicted increase in traffic volume of 25% or a decrease of 20% were identified. Such changes in traffic volume would correspond to a 1 dBA change in noise level at the relevant road link. A change in noise level of less than 1 dBA is regarded as being imperceptible and, therefore, of negligible magnitude. If there are no increases greater than 25% or a decrease of 20% or greater, then the DMRB guidance indicates that no further assessment needs to be conducted.

82. For completeness, the assessment in ***section 25.6.1.2*** and in the CIA, assess all road links used to be used during construction of the proposed East Anglia TWO project following the Basic Noise Level (BNL) calculation procedure within CRTN to predict a dB change for each link. The calculation also incorporates a correction for mean traffic speed and the percentage of HGVs.

83. Construction phase road link dB change was assessed using the impact magnitude criteria in ***Table 25.14***. The thresholds for differentiating the criteria are taken from DMRB for short-term impacts and are an indication of the relative change in ambient noise as a result of the proposed East Anglia TWO project.

Table 25.14 Magnitude Criteria for Relative Change Due to Road Traffic (Short Term)

Change in noise level ($L_{A10\ (18\ hour)}$ dB)	Impact magnitude
0.0	No change
0.1 – 0.9	Negligible Adverse
1.0 – 2.9	Minor Adverse
3.0 – 4.9	Moderate Adverse
5.0+	Major Adverse

84. Paragraph 3.32 of DMRB states that:

- *"PPVs [peak particle velocity] in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s. Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic"*

25.4.3.3 Construction Phase Vibration Impact Magnitude

25.4.3.3.1 Construction Phase Vibration Assessment

85. Ground-borne vibration can result from construction works and may lead to perceptible levels of vibration at nearby receptors, which at higher levels can cause annoyance to residents. In extreme cases, cosmetic or structural building damage can occur, however vibration levels have to be of a significant magnitude for this effect to be manifested and such cases are rare.

86. High vibration levels generally arise from 'heavy' construction works such as piling, deep excavation, or dynamic ground compaction. The use of piling during the construction of the onshore substation may be required.

87. Annex E of BS 5228-2:2009+A1:2014 contains empirical formulae derived by Hiller and Crabb (2000) from field measurements relating to resultant PPV with a number of other parameters for vibratory compaction, dynamic compaction, percussive and vibratory piling, the vibration of stone columns and tunnel boring operations. Use of these empirical formulae enables resultant PPV to be predicted and for some activities (vibratory compaction, vibratory piling and vibrated stone columns) they can provide an indicator of the probability of these levels of PPV being exceeded.

88. The empirical equations for predicting construction-related vibration provide estimates in terms of PPV. Therefore, the consequences of predicted levels in terms of human perception and disturbance can be established through direct comparison with the BS 5228-2:2009+A1:2014 guidance vibration levels.

89. Ground-borne vibration assessments may be drawn from the empirical methods detailed in BS 5228-2:2009+A1:2014, in the Transport and Road Research Laboratory (TRRL) 246: Traffic: Traffic induced vibrations in buildings, and within the Transport Research Laboratory (TRL) Report 429 (2000): Ground-borne vibration caused by mechanical construction works.

90. However, these calculation methods rely on detailed information, including the type and number of plant being used, their location and the length of time they are in operation. Given the mobile nature of much of the plant that has the potential to impart sufficient energy into the ground, and the varying ground conditions in the immediate vicinity of the construction works, it was considered that an accurate representation of vibration conditions using these predictive methods was not possible.

91. Consequently, a series of calculations, following the methodologies referred to above, were carried out based on typical construction activities that have the potential to impart sufficient energy into the ground, applying reasonable worst

case assumptions in order to determine set-back distances at which critical vibration levels may occur.

92. Humans are very sensitive to vibration, which can result in concern being expressed at energy levels well below the threshold of damage. Guidance on the human response to vibration in buildings is found in BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings, Part 1, Vibration sources other than blasting.

93. BS 6472 describes how to determine the VDV from frequency-weighted vibration measurements. VDV is defined by the following equation:

$$VDV_{b/d,\ day/night} = (\int_0^T a^4(t)dt)^{0.25}$$

94. The VDV is used to estimate the probability of adverse comment which might be expected from human beings experiencing vibration in buildings. Consideration is given to the time of day and use made of occupied space in buildings, whether residential, office or workshop.

95. BS 6472 states that in homes, adverse comments about building vibrations is likely when the vibration levels to which occupants are exposed are only slightly above thresholds of perception.

96. BS 6472 contains a methodology for assessing the human response to vibration in terms of either the VDV, or in terms of the acceleration or the peak velocity of the vibration, which is also referred to as PPV. The VDV is determined over a 16-hour daytime period or 8-hour night-time period.

97. The response of a building to ground-borne vibration is affected by the type of foundation, ground conditions, the building construction and the condition of the building. For construction vibration, the vibration level and effects detailed in ***Table 25.15*** were adopted based on BS 5228-2:2009+A1:2014. Limits for transient vibration, above which cosmetic damage could occur, are given numerically in terms of PPV.

Table 25.15 Transient Vibration Guide Values for Cosmetic Damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50mms^{-1} at 4Hz and above	
2	Un-reinforced or light framed structures Residential or light commercial type buildings	15mms^{-1} at 4Hz increasing to 20mms^{-1} at 15Hz	20mms^{-1} at 15Hz increasing to 50mms^{-1} at 40Hz and above

98. ***Table 25.16*** lists the minimum set-back distances at which vibration levels of reportable significance for other typical construction activities may occur. BS 5228-2:2009+A1:2014 calculation methods were used to derive the set-back distances outlined in ***Table 25.16***.

Table 25.16 Predicted Distances at Which Vibration Levels May Occur

Name	Set-back distance at which vibration level (PPV) occurs			
	0.3 mm/s	1.0 mm/s	10 mm/s	15 mm/s
Vibratory Compaction (Start-up)	166m	65m	9m	6m
Vibratory Compaction (Steady State)	102m	44m	8m	6m
Percussive Piling	48m	19m	3m	2m
HGV Movement* on uneven Haul Route	277m	60m	3m	2m
**Vibration level based on an HGV moving at 5mph*				

99. ***Table 25.17*** reproduced from research (Rockhill et al. 2014) details minimum safe separation distance for piling activities from sensitive receptors to reduce the likelihood of cosmetic damage occurrence.

Table 25.17 Receptor Proximity for Indicated Piling Methods

	Piling Method		
Building type (limits on vibrations from Eurocode 3)	**Press-in**	**25kJ drop hammer**	**170 kW 27Hz vibrohammer**
Architectural merit	2.6m	29.6m	27.7m
Residential	0.5m	11.8m	13.8m
Light commercial	0.14m	5.9m	5.5m

Piling Method			
Heavy industrial	0.06m	3.9m	3.7m
Buried services	0.03m	2.9m	2.2m

100. For construction vibration from sources other than blasting, the vibration level and effects presented in ***Table 25.18*** were adopted based on Table B-1 of BS 5228-2:2009+A1:2014. These levels and effects are based on human perception of vibration in residential environments.

Table 25.18 Construction Vibration - Impact Magnitude

Vibration limit PPV (mm/s)	Interpreted significance to humans	Impact magnitude
≤0.14	Vibration unlikely to be perceptible	No Impact
0.14 to 0.3	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction	Negligible
0.3 to 1.0	Vibration might just be perceptible in residential environments	Low
1.0 to ≤10.0	It is likely that vibration at this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents	Medium
≥10.0	Vibration is likely to be intolerable for any more than a brief exposure to this level	High

25.4.3.4 Operational Phase Noise Impact Magnitude

101. Where there are noise sources such as fixed plant associated with onshore assets, the most appropriate assessment guidance is BS 4142:2014+A1:2019. The guidance describes a method of determining the level of noise of an industrial noise source and the existing background noise level.

102. BS 4142:2014+A1:2019 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident, and combines procedures for assessing the impact in relation to:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;

- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

103. This standard is applicable to the determination of the following levels at outdoor locations:

- *"a) rating levels for sources of sound of an industrial and/or commercial nature; and*
- *b) ambient, background and residual sound levels, for the purposes of:*
  - *investigating complaints;*
  - *assessing sound from existing, proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and*
  - *assessing sound at proposed new dwellings or premises used for residential purposes."*

104. The standard is not intended to be applied to the assessment of indoor sound levels.

105. The standard incorporates a requirement for the assessment of uncertainty in environmental noise measurements and introduces the concepts of *"significant adverse impact"* rather than likelihood of complaints. Common principles with the previous edition are consideration of sound characteristics, time of day and frequency of occurrence.

106. The standard applies to industrial/commercial and background noise levels outside residential buildings and for assessing whether existing and new industrial/commercial noise sources are likely to give rise to significant adverse impacts on the occupants living in the vicinity.

107. Assessment is undertaken by subtracting the measured background noise level from the rating level; the greater this difference, the greater the magnitude of the impact.

108. BS 4142:2014 refers to the following:

- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*

- *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;* and
- *The lower the rating level relative to the measured background sound level the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context".*

109. When assessing the noise from a source, which is classified as the Rated Noise Level, it is necessary to have regard to the acoustic features that may be present in the noise. Section 9.1 of BS 4142:2014+A1:2019 states:

- *"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."*

110. An operational assessment in accordance with BS 4142:2014+A1:2019 has been undertaken for the onshore substation as it is the only noise source associated with the operational phase. Due to the separation distance, existing ambient soundscape and a detailed screening of the onshore substation plant and equipment, no penalty corrections for intermittency, tonality or impulsivity are required. Further detail is provided in ***Appendix 25.5.*** These acoustic features are added based on perceptibility at the receptor location.

111. In terms of intermittency, the onshore substation will typically operate for the full 24hrs each day, with no expected stops/starts to the fixed electrical plant. Therefore no intermittency penalty correction is required. Where there may be air cooling fans that stop/start, this is not considered to be distinctively audible at the receptor, above baseline sound characteristics due to masking effects.

112. In terms of impulsivity, the onshore substation will typically operate for the full 24hrs each day, with no expected stops/starts to the fixed plant. There are no items of fixed electrical plant with impulsive characteristics under typical operating conditions.

113. Tonality screening was in accordance with Annex C of BS4142:2014+A1:2019. All fixed electrical plant items were assessed based on source levels detailed in (***Table 25.31***). Further screening was undertaken of the predicted noise levels at the receptor in accordance with BS4142:2014+A1:2019. No tonality was identified based on the current available information.

114. The determination of the specific sound level free from sounds influencing the ambient sound at the assessment location is obtained by measurement or a combination of measurement and calculation. This is to be measured in terms of the $L_{Aeq, T}$, where 'T' is a reference period of:

- 1 hour during daytime hours (07:00 to 23:00 hours); and
- 15 minutes during night-time hours (23:00 to 07:00 hours).

115. The assessment of noise from proposed fixed plant associated with the proposed East Anglia TWO project was considered at NSRs.

116. To predict the noise from the operational aspects of the proposed East Anglia TWO project, SoundPLAN noise modelling software was utilised. The model incorporated proposed buildings based on elevation drawings, proposed fixed plant and additional noise sources (such as temporary generating plant) associated with the proposed East Anglia TWO project. The model also included nearby residential dwellings and other buildings in the onshore development area, intervening ground cover and topographical information.

117. Noise levels for the operational phase were predicted at the same NSR locations detailed in ***section 25.5***. The calculation algorithm described in ISO 9613 was used in the operational noise propagation modelling exercise.

118. The magnitude of impact that will be applied to the operational assessment, based on a quantitative assessment of noise impact using BS 4142:2014+A1:2019 is summarised in ***Table 25.19***.

119. It is considered and accepted that the smallest perceptible change in environmental noise is 3dBA. Therefore, a difference in noise level above the background of up to +3dBA is detailed as a negligible adverse impact magnitude.

120. BS4142:2014+A1:2019 states that "*a difference of around +5dB is likely to be an indication of an adverse impact, depending on the context*". Using this principle, a difference in sound level of between +3dBA to +5dBA is detailed as a minor adverse impact.

Table 25.19 Substation Operational Noise Impact Magnitude Criteria

BS4142 Rating level ($L_{Ar, Tr}$ dB)	BS4142 Impact magnitude	PPG/NPSE Category
≤ (L_{A90}) Background	No impact	NOEL
> L_{90} dBA to + <3 dB	Negligible Adverse	
> L_{90} dBA + >3 dB to <5 dB	Minor Adverse	LOAEL
> L_{90} dBA + >5 dB to 9.9 dB	Moderate Adverse	OAEL
L_{90} dBA + ≥10 dB	Major Adverse	SOAEL

121. The proposed East Anglia TWO project will commit to limiting operational noise from the onshore substation to a noise rating level (in accordance with BS4142:2014+A1:2019) of **no greater than 34dB $L_{Aeq\ (5\ minutes)}$** at any time at the NSRs (SSR2 and SSR5 NEW):

- The allowance for up to +5dBA above the representative background level was derived from consideration of the context of the existing environment and the proposed onshore infrastructure in accordance with BS4142:2014+A1:2019; and
- Therefore, it is considered that the operational noise rating limit (in accordance with BS4142:2014+A1:2019) of 34dBA is considered appropriate as this represents a limit of up to +5dBA (minor adverse) above the representative background L_{A90} derived for SSR5 from measured sound levels during June to July 2018.

122. The allowance for up to +5dBA above the representative background level as minor adverse is considered appropriate as BS4142:2014+A1:2019 states in section 11:

- *"For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
- *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*"

123. As SSR2 and SSR5 NEW are the closest receptors, by stipulating an operational noise rating limit (in accordance with BS4142:2014+A1:2019) of 34dBA, other NSRs would experience lower predicted levels due to their increased separation distance from the specific sound source (onshore substation). Therefore, this is considered a conservative assessment approach.

124. Furthermore, in the example of introducing an industrial/commercial sound source to an environment, BS4142:2014+A1:2019 discusses 'context' as a key assessment parameter. For example, although the plant noise may be considered as somewhat different in character to the existing acoustic environment (rural), the operational rating noise limit of 34dBA (post mitigation and compliance with the requirement of the draft DCO) is low and will have little impact on residents using their amenity space during the night time (most sensitive period).

125. The 2018 World Health Organization guidance establishes a 45dB L_{Aeq} external noise level as desirable. The windows, and any purge ventilation (i.e. trickle ventilators) are normally the weakest part of a brick and block façade and building envelope. BS8233:2014 states that "If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB".

126. In terms of NPPG and NPSE guidance an outside night time noise level of 45dB L_{Aeq}, is defined as the LOAEL. This is determined on the basis that a partially open window will attenuate the outside noise level by 15dBA, thus achieving the recommended night time resting criteria (30dBA) stated for habitable rooms.

127. The draft DCO requirement proposes the use of an external rating level (accordance with BS4142:2014+A1:2019) of 34dB $L_{Aeq,5mins}$. The proposed draft DCO requirement is considered appropriate as it is considerably below the external recommendation of 45dBA L_{Aeq} detailed in BS8233:2014, in order to achieve a night time internal level of 30dBA, even when relying on openable windows as a means of rapid ventilation.

128. The equipment required for the operational National Grid infrastructure does not include components which would contribute any significant noise to the surrounding area. This is explained further in ***section 25.3.2.1***. The National Grid infrastructure is therefore not included further as part of the operational noise modelling presented within this chapter.

129. Noise levels associated with any operational maintenance activities are not expected to be greater than the noise of the operational substation itself. Therefore, specific reference to maintenance activity is not considered further in this assessment.

25.4.3.5 Sensitivity

130. The aims of the NPPF and the NPSE require that a SOAEL should be *"avoided"* and that where a noise level which falls between SOAEL and LOAEL, then according to the explanatory notes in the statement:

- *"…reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."*

131. Further guidance can be found in the Planning Practice Guidance (PPG) notes which summarise the noise exposure hierarchy based on the likely average response, as summarised in ***Table 25.20***.

Table 25.20 Definitions of Sensitivity Levels for PPG Noise Exposure Hierarchy (reproduced from the NPPF)

Perception	Examples of outcomes	Increasing effect levels	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No OAE	No specific measures required
		LOAEL	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	OAE	Mitigate and reduce to a minimum
		Significant OAE	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant OAE	Avoid

Perception	Examples of outcomes	Increasing effect levels	Action
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

132. Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise sensitive commercial premises. ***Table 25.21*** presents the definitions used relating to the sensitivity of the receptor.

Table 25.21 Definitions of the Different Sensitivity Levels for a Noise Receptor

Sensitivity	Definition	Examples
High	Receptor has very limited tolerance of effect	Noise Receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable receptors. Such receptors include certain hospital wards (e.g. operating theatres or high dependency units) or care homes at night. Vibration Receptors have been categorised as high sensitivity where the receptors are listed buildings or Scheduled Monuments.
Medium	Receptor has limited tolerance of effect	Noise Receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected. Such subgroups include residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, (during the day); and temporary holiday accommodation at all times. Vibration Receptors have been categorised as medium sensitivity where the structural integrity of the structure is limited but the receptor is not a listed building or Scheduled Monument.
Low	Receptor has some tolerance of effect	Noise Receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particularly high noise levels may cause a moderate effect. Such subgroups include offices, shops, outdoor amenity areas, long distance footpaths, doctor's surgeries, sports facilities and places of worship. Vibration Receptors have been categorised as low sensitivity where the structural integrity of the structure is expected to be high. The level of vibration required to cause damage is very high and such levels are not expected to be reached during the proposed East Anglia TWO project.

Sensitivity	Definition	Examples
Negligible	Receptor generally tolerant of effect.	Noise Receptors have been categorised as negligible sensitivity where noise is not expected to be detrimental. Such subgroups include warehouses, light industry, car parks, and agricultural land. Vibration Receptors have been categorised as negligible sensitivity where vibration is not expected to be detrimental.

25.4.3.6 Impact Significance

133. Following the identification of receptor value and sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix as presented in ***Table 25-22*** will be used wherever relevant.

Table 25-22 Impact Significance Matrix

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

134. The impact significance categories are divided as shown in ***Table 25.23***.

135. Where impacts are considered to be significant (moderate or major), appropriate additional mitigation measures will be considered in order to give protection to sensitive receptors.

136. Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual impact will remain the same. If, however, additional mitigation is proposed there will be an assessment of the post-mitigation residual impact.

Table 25.23 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they

Impact Significance	Definition
	contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

25.4.4 Cumulative Impact Assessment

137. The proposed East Anglia TWO project CIA will initially consider the cumulative impact with only the East Anglia ONE North project against two different construction scenarios (i.e. construction of the two projects concurrently and sequentially). The worst case scenario of each impact is then carried through to the main body of the CIA which considers other developments which have been screened into the CIA assessment.

138. For a general introduction to the methodology used for the CIA please refer to ***Chapter 5 EIA Methodology.***

25.4.5 Transboundary Impact Assessment

139. There are no transboundary impacts with regards to noise and vibration as the onshore development area would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

25.5 Existing Environment

140. In order to characterise the existing noise climate within the noise and vibration study area a baseline noise survey was undertaken at locations representative of the nearest sensitive receptors as agreed with the Local Planning Authority, through the Noise and Vibration ETG (detailed in ***Table 25.24*** and shown on ***Figure 25.2***). Measurements were conducted between 26th June 2018 and 5th July 2018.

Table 25.24 Noise Sensitive Receptors Included in Assessment

Receptor Identifier[3]	Coordinates		Classification	Sensitivity
	X	Y		
LFR1	647538	260183	Residential	Medium
LFR2	647266	260059	Residential	Medium
LFR3	646550	260305	Residential	Medium
LFR4	646688	260908	Residential	Medium
CCR1	647541	261197	Residential	Medium
CCR2	647118	261983	Residential	Medium
CCR3	647140	262414	Residential	Medium
CCR4	646242	262318	Residential	Medium
CCR5	645467	261768	Residential	Medium
CCR5	645463	261788	Residential	Medium
CCR6	645357	262011	Residential	Medium
CCR7	645678	261211	Residential	Medium
CCR8	645325	260620	Residential	Medium
CCR9	644693	260360	Residential	Medium
CCR10	644545	260397	Residential	Medium
CCR11	644564	260583	Residential	Medium
CCR12	644883	260910	Residential	Medium
CCR13	643817	260563	Residential	Medium
CCR14	643347	260264	Residential	Medium
CCR15	643140	260577	Residential	Medium
CCR16	643387	260616	Residential	Medium
CCR17	642668	260438	Residential	Medium
CCR18	642093	261284	Residential	Medium
CCR19	642552	261552	Residential	Medium
SSR1	641720	261616	Residential	Medium
SSR2	641831	261173	Residential	Medium
SSR3	641229	261668	Residential	Medium
SSR4	640931	260748	Residential	Medium

[3] LFR = Landfall receptor, CCR = Onshore cable route receptor, SSR = Onshore substation and National Grid infrastructure receptor.

Receptor Identifier[3]	Coordinates		Classification	Sensitivity
	X	Y		
SSR5	641166	260801	Residential	Medium
SSR5 NEW*	641220	260648	Residential	Medium
SSR6	641432	260547	Residential	Medium
SSR7	641817	261644	Residential	Medium
SSR8	640353	260987	Residential	Medium
SSR9	640991	261683	Residential	Medium
SSR10	639932	260391	Residential	Medium
SSR11	640526	260309	Residential	Medium
SSR12	640441	261602	Residential	Medium

*SSR5 and SSR5 NEW represent different buildings at the same receptor location. SSR5 NEW represents the closest residential dwelling at the location, SSR5 an uninhabited agricultural barn building. SSR5 NEW is presented within the operational noise assessment only.

141. The onshore development area is predominantly rural and coastal in nature, with limited significant noise sources. In addition, there are numerous individual residential properties and farms located throughout the area. The key residential areas are Thorpeness (near to the Landfall), Leiston and Knodishall Common to the north of the cable corridor, and Friston to the south of the onshore substation (see ***Figure 25.1***).

142. There are a number of B roads that pass through the onshore development area, which form part of the noise environment. The closest major road is the A12.

143. The road links identified by the transport assessment as carrying construction traffic are presented below in ***Table 25.25.*** Road links likely to experience an increase in traffic flows greater than 25% were assessed further by undertaking calculations of BNL. This assessment is presented in ***section 25.6.1.2.***

Table 25.25 Construction Road Traffic Flows – 2023 the proposed East Anglia TWO project

Link ID	Description	2023 Baseline flows AAWT		2023 Baseline + Development		Overall Change (%)	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
1	A12 north of the B1122	13,740	1,275	14,089	1,485	2.5	16.5
2	A12 between the B1122 and A1094	11,677	1,146	11,962	1,356	2.4	18.3
3	A12 south of the A1094	18,612	1,114	18,968	1,324	1.9	18.9

Link ID	Description	2023 Baseline flows AAWT		2023 Baseline + Development		Overall Change (%)	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
4	B1122 from the A12 to Lover's Lane	2,980	253	3,256	368	9.3	45.4
5	B1121 from the A12 to Friston	1,310	60	1,376	60	5.1	0.0
6	A1094 from the A12 to the B1121/B1069	8,051	511	8,391	717	4.2	40.2
7	B1121 from Friston to the A1094	1,318	69	1,355	69	2.8	0.0
8	A1094 from the B1121/B1069 to Aldeburgh	5,799	261	5,869	269	1.2	2.8
9	B1069 from the A1094 to Coldfair Green	4,292	198	4,816	411	12.2	107.2
10	B1122 from Aldeburgh to the B1353	3,586	179	3,655	186	1.9	4.0
11	Lover's Lane	2,111	168	2,382	283	12.8	68.4
12	Sizewell Gap	3,267	114	3,538	229	8.3	100.6
13	Aldringham Lane	2,667	117	2,667	117	0.0	0.0
14	B1069 from Lovers Lane to B1119	2,980	253	3,131	253	5.1	0.0
15	B1069 from Coldfair Green to B1119	4,292	198	4,425	198	3.1	0.0

25.5.1 Survey Practice

144. Baseline survey measurements were conducted in accordance with current guidance, including BS 4142:2014 Method for Rating and Assessing Industrial and Commercial Sound[4] and BS 7445:2003 Description and measurement of environmental noise and the methodology used was agreed with relevant stakeholders during ETG meetings.

145. Sound Level Meters (SLM) were fully calibrated, traceable to UKAS standards and satisfied the requirements of BS EN 61672-1:2013 for a 'Class 1'SLM.

146. For all measurement locations during the noise survey, SLMs were set to record the following:

- L_{Aeq} – the equivalent continuous sound pressure level over the measurement period. This parameter was standardised as pertinent for land use within BS 7445:2003;
- L_{Amax} – the maximum sound pressure level occurring within the defined measurement period;
- L_{A90} – the sound pressure level exceeded for 90% of the measurement period and is indicative of the background noise level; and
- L_{A10} - the sound pressure level exceeded for 10% of the measurement period. The L_{A10} index is used within the CRTN as an appropriate descriptor of traffic noise.

147. The equivalent continuous sound pressure level (L_{Aeq}) is the conventional descriptor of environmental noise and is defined below:

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

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

149. Noise measurements were conducted with the SLMs mounted on tripods at a height of between 1.2m and 1.5m above ground level and 3.5m away from any reflecting surface other than the ground, i.e. in free-field conditions. The instruments were calibrated before and after the survey using a portable calibrator. No significant deviation in the calibration level was observed.

[4] Baseline survey undertaken in 2018 before amendments to latest BS4142 in 2019. A review confirmed compliance with BS4142:2014+A1:2019 requirements.

150. A record of the meteorological conditions during the survey was made. Any measurements taken during periods of rain or when average wind speeds exceed 5ms^{-1} were screened from the results.

25.5.2 Deriving Background Levels

151. Background noise levels used in the assessment were obtained from the baseline measurements. The measurement locations used were considered to be representative of the nearest NSR and had been previously agreed with the relevant local authority.

152. The background noise levels for the unattended measurement periods (ranging from 5 to 7 days) were assessed using statistical analysis of the measured L_{A90} values.

153. Assessment values for receptor locations at the onshore substation have been derived from long term and short-term measurements. Details of the baseline noise survey are presented in ***Appendix 25.3***. At some locations, there was no long-term monitor set up, due to land access issues. These locations are identified and discussed further in ***Appendix 25.3***. It is considered that the results of the baseline survey measurements are consistent with that expected for a rural context, particularly at night and therefore provide a robust baseline for assessment.

25.5.3 Anticipated Trends in the Baseline Conditions

154. The baseline noise monitoring survey provides a clear representation of the existing soundscape within the noise and vibration study area of the proposed East Anglia TWO project. Noise is managed and driven by EU, UK and local legislation and policies. The UK's noise strategy and standards are enacted through management actions at a local authority level. There is a policy trend towards the achievement and maintenance of the noise environment across the UK, which is reflected in the local planning policies detailed in ***section 25.4.1.3***. Predicted noise levels due to a change in land use, new developments and associated vehicles are assessed as part of the development planning and consent process.

155. Potential impacts to the prevailing soundscape should be minimised, avoided, or mitigated to suitable levels (in accordance with current legislation, policy and guidance), avoiding an adverse impact, where possible. In addition to planning controls there is a clear trend for noise from vehicle, commercial and industrial sources to be driven down in compliance with stricter legislation and guidance. Consequently, in relation to the proposed East Anglia TWO project and its immediate receiving environment it is reasonable to predict a general steady baseline soundscape would be maintained.

25.6 Potential Impacts

156. This section outlines potential impacts as a result of the proposed East Anglia TWO project and their significance, using the assessment methodology described in ***section 25.4*** and ***Chapter 5 EIA Methodology***. As the construction of the onshore substation will potentially have different impacts in terms of the type and magnitude than those of the onshore cable route, the magnitude of these are discussed separately under the same impact where relevant, however the greater of the two magnitudes is used to define the significance of that impact overall.

157. The following assessments focus on the impact of predicted noise on residential receptors as these are considered to be the determining receptor when considering impact significance. Residences are generally the nearest type of receptor to the proposed construction works. Commercial and leisure facilities are of a lower sensitivity and therefore where these are closer than residences to aspects of the construction, the impact significance would be less.

158. Along the onshore cable route there are locations where users of Public Rights of Way (PRoW) could be affected by noise from construction works but this would be temporary as the user passes the works; please refer to ***Chapter 30 Tourism, Recreation and Socio-Economics*** for amenity impacts upon PRoW.

159. There are potential inter-relationships with other disciplines, namely, ***Chapter 22 Onshore Ecology, Chapter 23 Onshore Ornithology, Chapter 24 Archaeology and Cultural Heritage, Chapter 26 Traffic and Transport, Chapter 27 Human Health*** and ***Chapter 30 Tourism Recreation and Socio-Economics.*** The potential impacts could be related to the construction and operational phases of the proposed East Anglia TWO project.

25.6.1 Potential Impacts during Construction

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

- Earthworks along the onshore cable route, at the landfall and at the onshore substation;
- General construction activities along the onshore cable route, at the landfall and at the onshore substation;
- HDD works (at landfall and if used to cross the Sandlings SPA)
- Optional Piling works (at landfall, onshore substation and National Grid infrastructure); and
- HGVs delivering to site.

25.6.1.1 Impact 1: Increased Noise on Residential Receptors Along the Onshore Development Area

161. As a worst-case scenario, HDD has been assumed to be in operation at the landfall location for 24 hours a day during certain periods and assessed accordingly; for all other construction activities at the landfall, onshore cable route and substation the assessment is based on construction between the hours of 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturday (i.e. day time as outlined in ***Table 25.9***). Piling works may be required to provide a stable platform base for the HDD works at landfall, and for substructure works at the onshore substation and National Grid infrastructure. To present a conservative assessment, piling activity was included in the construction noise modelling and assumed to take place during early mobilisation works in Month 1 to Month 4 at the landfall, and at the onshore substation location between Month 7 and Month 10. Piling work in the assessment is based on construction between the hours of 07:00 to 19:00 Monday to Friday, and 07:00 to 13:00 on Saturday.

162. During construction of the onshore cable route, onshore substation or National Grid infrastructure, should there be exception works (as detailed in ***Chapter 6 Project Description***) required outside these hours (i.e. night time) these will be appropriately mitigated to ensure compliance with night time noise thresholds presented in ***Table 25.9***.

163. ***Table 25.26*** presents the predicted noise level at the nearest residential receptors to the landfall including embedded mitigation for the construction phase, as outlined in ***section 25.3.3***.

Table 25.26 Landfall Construction Noise proposed East Anglia TWO Project – Predicted Impacts Month 1 to 24

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Worst Case Impact Magnitude	Worst Case Impact Significance
LFR1	Daytime	A (65)	50.3	No Impact	Negligible
	Evening	A (55)	40.4	No Impact	Negligible
	Night	B (50)	40.7	No Impact	Negligible
LFR2	Daytime	A (65)	49.9	No Impact	Negligible
	Evening	A (55)	38.8	No Impact	Negligible
	Night	A (45)	38.9	No Impact	Negligible
LFR3	Daytime	A (65)	47.7	No Impact	Negligible
	Evening	A (55)	35.7	No Impact	Negligible

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Worst Case Impact Magnitude	Worst Case Impact Significance
	Night	A (45)	35.8	No Impact	Negligible
LFR4	Daytime	A (65)	49.1	No Impact	Negligible
	Evening	A (55)	35.3	No Impact	Negligible
	Night	A (45)	35.7	No Impact	Negligible

164. The results show that predicted noise levels from construction works during the proposed East Anglia TWO project at the landfall location would be of no impact magnitude on receptors of medium sensitivity and therefore impacts would be of **negligible** significance. Therefore, no additional mitigation is required.

165. ***Table 25.27*** presents the predicted daytime noise level at the nearest residential receptors along the onshore cable route including embedded mitigation for the construction phase, as outlined in ***section 25.3.3***.

Table 25.27 Onshore Cable Route Construction Noise proposed East Anglia TWO Project – Predicted Impacts Month 1 to 24 Daytime

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
CCR1	Daytime	A (65)	58.9	Month 13 to15	No Impact	Negligible
CCR2	Daytime	A (65)	64.6	Month 7 to 10	No Impact	Negligible
CCR3	Daytime	A (65)	48.8	Month 7 to 10	No Impact	Negligible
CCR4	Daytime	A (65)	50.2	Month 13 to 15	No Impact	Negligible
CCR5	Daytime	A (65)	52.5	Month 7 to 10 and Month 11 to 12	No Impact	Negligible
CCR6	Daytime	A (65)	48.2	Month 16 to 17	No Impact	Negligible
CCR7	Daytime	A (65)	49.4	Month 16 to 17	No Impact	Negligible
CCR8	Daytime	A (65)	50.3	Month 11 to 12	No Impact	Negligible
CCR9	Daytime	A (65)	54.6	Month 13 to 15	No Impact	Negligible
CCR10	Daytime	A (65)	57.8	Month 16 to 17	No Impact	Negligible
CCR11	Daytime	A (65)	56.5	Month 13 to 15	No Impact	Negligible

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
CCR12	Daytime	A (65)	50.7	Month 18 to 20	No Impact	Negligible
CCR13	Daytime	A (65)	55.0	Month 11 to 12	No Impact	Negligible
CCR14	Daytime	A (65)	54.0	Month 7 to 10	No Impact	Negligible
CCR15	Daytime	A (65)	54.0	Month 7 to 10	No Impact	Negligible
CCR16	Daytime	A (65)	53.7	Month 16 to 17	No Impact	Negligible
CCR17	Daytime	A (65)	55.3	Month 7 to 10	No Impact	Negligible
CCR18	Daytime	A (65)	51.7	Month 7 to 10	No Impact	Negligible
CCR19	Daytime	A (65)	47.2	Month 7 to 10	No Impact	Negligible

166. The results show that predicted noise levels from construction works during the proposed East Anglia TWO project at the onshore cable route NSRs would be of no impact magnitude on receptors of medium sensitivity and therefore impacts would be of **negligible** significance. Therefore, no additional mitigation is required.

167. ***Table 25.28*** presents the predicted noise level at the nearest residential receptors in proximity to the onshore substation and National Grid infrastructure including embedded mitigation for the construction phase, as outlined in ***section 25.3.3***.

Table 25.28 Onshore Substation and National Grid Infrastructure Construction Noise Proposed East Anglia TWO Project – Predicted Impacts Month 1 to 24 Daytime

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
SSR1	Daytime	A (65)	54.7	Month 7 to 10	No Impact	Negligible
SSR2	Daytime	A (65)	58.0	Month 7 to 10	No Impact	Negligible
SSR3	Daytime	A (65)	55.4	Month 1 to 6	No Impact	Negligible
SSR4	Daytime	A (65)	51.8	Month 1 to 6	No Impact	Negligible
SSR5	Daytime	A (65)	54.2	Month 1 to 6	No Impact	Negligible
SSR6	Daytime	A (65)	52.2	Month 13 to 15	No Impact	Negligible
SSR7	Daytime	A (65)	53.1	Month 7 to 10	No Impact	Negligible

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
SSR8	Daytime	A (65)	48.2	Month 1 to 6	No Impact	Negligible
SSR9	Daytime	A (65)	54.5	Month 1 to 6	No Impact	Negligible
SSR10	Daytime	A (65)	43.4	Month 1 to 6	No Impact	Negligible
SSR11	Daytime	A (65)	46.2	Month 1 to 6	No Impact	Negligible
SSR12	Daytime	A (65)	48.5	Month 1 to 6	No Impact	Negligible

168. The results show that predicted daytime noise levels from construction works during the proposed East Anglia TWO project at the substation locations would be of no impact magnitude on receptors of medium sensitivity and therefore impacts would be of **negligible** significance. Therefore, no additional mitigation is required.

25.6.1.2 Impact 2: Increased Noise on Residential Receptors from Off-Site Construction Traffic Noise

169. ***Table 25.25*** shows road links identified as carrying construction traffic. All road links to be used during the construction of the proposed East Anglia TWO project have been assessed further by undertaking of a BNL calculation. Assessment against the 2023 baseline is presented in ***Table 25.29***. This is considered the worst case year for assessment as the earliest full year for the start of construction. Any later years would have higher baseline traffic flows and therefore a lesser impact magnitude. Assessments of construction commencing in later years (2024, 2026, 2028 and 2030) are included in ***Appendix 25.4***.

Table 25.29 Calculated BNL – 2023 Baseline vs. 2023 Baseline and the proposed East Anglia TWO project Traffic

Link ID	Description	Speed (mph)	2023 Baseline BNL, dBA $L_{10,18hr}$	2023 Baseline and the proposed East Anglia TWO project BNL, dBA, $L_{10,18hr}$	Overall Change dBA	Impact Magnitude
1	A12 north of the B1122	30.0	70.4	70.8	0.4	Negligible
		40.0	71.7	72.0	0.3	Negligible
2	A12 between the B1122 and A1094	30.0	69.8	70.3	0.5	Negligible
		50.0	72.4	72.8	0.4	Negligible
		60.0	73.8	74.1	0.3	Negligible

Link ID	Description	Speed (mph)	2023 Baseline BNL, dBA $L_{10,18hr}$	2023 Baseline and the proposed East Anglia TWO project BNL, dBA, $L_{10,18hr}$	Overall Change dBA	Impact Magnitude
3	A12 south of the A1094	30.0	70.9	71.2	0.3	Negligible
		50.0	73.8	74.0	0.2	Negligible
4	B1122 from the A12 to Lover's Lane	30.0	63.6	64.6	1.0	Minor
		40.0	64.9	65.8	0.9	Negligible
		60.0	67.6	68.4	0.8	Negligible
5	B1121 from the A12 to Friston	30.0	59.0	59.1	0.1	Negligible
		40.0	60.4	60.6	0.2	Negligible
		60.0	63.4	63.6	0.2	Negligible
6	A1094 from the A12 to the B1121/B1069	30.0	67.4	68.1	0.7	Negligible
		40.0	68.7	69.4	0.7	Negligible
7	B1122 from Friston to the A1094	30.0	59.2	59.3	0.1	Negligible
		60.0	63.5	63.6	0.1	Negligible
8	A1094 from the B1121/B1069 to Aldeburgh	30.0	65.4	65.5	0.1	Negligible
		60.0	69.8	69.9	0.1	Negligible
9	B1069 from the A1094 to Coldfair Green	30.0	64.1	65.7	1.6	Minor
		40.0	65.6	67.0	1.4	Minor
10	B1122 from Aldeburgh to the B1353	30.0	63.5	63.6	0.1	Negligible
		40.0	64.9	65.0	0.1	Negligible
		60.0	67.8	67.9	0.1	Negligible
11	Lover's Lane	60.0	66.0	67.2	1.2	Minor
12	Sizewell Gap	60.0	67.2	68.0	0.8	Negligible
13	Aldringham Lane	30.0	62.0	62.0	0.0	No change
		40.0	63.5	63.5	0.0	No change
14	B1069 from Lovers Lane to B1119	30.0	63.6	63.7	0.1	Negligible
15	B1069 from Coldfair Green to B1119	30.0	64.1	64.2	0.1	Negligible
		40.0	65.6	65.7	0.1	Negligible

170. ***Table 25.29*** shows that predicted impacts are at worst of a minor impact magnitude at a medium sensitivity receptor resulting in a **minor adverse** significance. Therefore, no additional mitigation is required.

25.6.1.3 Impact 3: Construction Vibration

171. Operation of HDD rigs and ancillary equipment is expected to produce the greatest vibration impacts and is therefore taken forward as the worst case for vibration assessment.

172. Vibration levels decay very rapidly with distance from a source (BS 5228-2:2009+A1:2014). A representative example of HDD given within BS 5228-2:2009+A1:2014 is for boring through silts overlying sandstone with a PPV of 8 mm/s at 4.5m from the source, decreasing to a PPV of 2.7mm/s at 7m from the source and 1.8mm/s at 12m from the source.

173. Given the distances between sources of vibration during the construction works and the NSRs it is clear that PPV levels would be below the criteria outlined in ***section 25.4.3.3*** at the NSRs along the onshore development area. Vibration impacts from construction activities would be of negligible magnitude on receptors of medium sensitivity and therefore of **minor adverse** significance. Therefore, no additional mitigation is required.

174. HGVs on smooth road surfaces do not produce significant levels of vibration at road side receptors. However, vibration can result from sudden wheel impacts as vehicles pass over holes and cracks on the road surface. Potentially this may result in transient exceedances of BS 5228-2:2009+A1:2014 criteria. The majority of buildings would be resilient to the worst case vibration levels anticipated.

175. Should discontinuities (e.g. potholes) exist on the roads adjacent to any listed buildings (***Chapter 24 Archaeology and Cultural Heritage***) within the onshore highway study area (***Chapter 26 Traffic and Transport***), it is considered that there is the potential for vibration levels to exceed the minimum PPV as specified within ***Table 25.16***.

176. As part of the embedded mitigation, prior to construction, a CoCP and CTMP will be submitted to the Local Planning Authority for approval to discharge the requirements of the draft DCO which will contain measures required to limit any potential impact. Therefore, vibration impacts from construction vehicles would be of negligible magnitude on receptors of medium sensitivity and therefore of no worse than **minor adverse**.

25.6.2 Potential Impacts during Operation

25.6.2.1 Operation Impact 1: Increased Noise on Residential Receptors from the Onshore Substation

177. The impact assessment has been undertaken using the unmitigated worst case scenario (***Table 25.30***) for the potential components that could be used at the onshore substation and based on the fixed plant requirements detailed in ***Chapter 6 Project Description*** and presented in ***Table 25.30***, ***Table 25.31*** and ***Table 25.32***.

178. Operations at the onshore substation are proposed 24 hours a day. A detailed SoundPLAN noise model was created to assess noise levels as a result of the proposed plant required. Ground absorption was incorporated into the SoundPLAN model using a coefficient of 1.0 to represent the ground between the sound sources and receiver for the topographical data.

179. For clarity, the modelled plant is detailed in ***Table 25.30***.

Table 25.30 Modelled Noise Sources from Onshore Substation

Noise Source	Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Drawing Item	Height (m)
Main Transformer (with enclosure)	2		58 at 1m from enclosure	1	2.5
Main Transformer (without enclosure)	2	101 per unit		1	2.5
Main Transformer (Forced Cooling System)	2	81 per unit		2	1.5
Shunt Reactor	2		62 at 1m from enclosure	3	2.5
STATCOM Air core reactor	6	81/phase	-	4	2
STATCOM Filter Air Core Reactor	6	70/phase 75/3 phases	-	5	At three heights: 2, 4 and 6
STATCOM Filter Capacitor Bank	6	81/phase	-	6	At three heights: 2, 4 and 6

Noise Source	Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Drawing Item	Height (m)
Aux. Transformer	2	67 per unit	-	7	2
Air Coolers	10	80 per unit	-	8	2
STATCOM High Voltage Alternating Current (HVAC) Units	4	79 per unit	-	9	2
Harmonic Filters	2 banks of 3	82 per bank	-	n/a	18
Extractors (GIS Building)	15	See Noise HVAC Table	-	10	

180. Extractor vents included in model associated with the onshore substation GIS building design are detailed in ***Table 25.31***.

Table 25.31 GIS Building Noise Sources

Fan	Model	Location	Sound Pressure Level dB(A)	Height (m)
EF1	Vent Axia (VSP40014)	GIS room (4 units)	46 at 3m	8.2 (lowest point to GFL)
EF2	Vent Axia (VSP25012)	Relay room (1 unit)	50 at 3m	3.5
		Store room (1 unit)		
		Mess room (1 unit)		
		Meter room (1 unit)		
		Generator room 1 (1 unit)		
		Generator room 2 (1 unit)		
EF3	Vent Axia (315-12B)	Store room (2 units)	58 at 3m	3.5
		Cleaner (1 unit)		
EF4	Vent Axia (171 04 020F)	Cleaner (2 units)	34 at 3m	3.5

181. Spectral data for plant included in the model associated with the onshore substation are detailed in ***Table 25.32***.

Table 25.32 Frequency Spectrum 1/1 Octave - Plant

Plant	Octave Band Centre Frequency (Hz)/dB(A)							
	63	125	250	500	1K	2K	4K	8K
Auxiliary Transformer	62	63	56	52	49	42	40	58
STATCOM HVAC Units	51	61	73	73	75	70	59	47
STATCOM Air Core Reactor	42	78	43	75	73	16	12	12
STATCOM Filter Capacitor Bank	42	78	43	75	73	16	12	12
Harmonic Filter	43	79	44	76	74	17	13	13
Air Coolers	52	62	74	74	76	71	60	48
Main Transformer Forced COOLING SYSTEM	53	63	75	75	77	72	61	49
STATCOM Filter Aircore Reactor	31	67	32	64	62	5	1	1
Main Transformer Enclosed	53	62	60	58	49	37	33	49
Shunt Reactor Enclosed	50	69	57	59	49	41	31	29

182. Calculated operational noise levels have been determined at GF – Ground Floor (Daytime) and 1st Floor levels (Night time) and compared with the background noise levels at each receptor, which have been derived from the measured baseline noise data contained within ***Appendix 25.3***.

183. The impact of the predicted noise levels from the onshore substation (including the installation of harmonic filters) at surrounding residential receptors (assessed as having medium sensitivity) are presented in ***Table 25.33***. The magnitude of effect has been assessed in accordance with BS 4142:2014 by comparison with impact criteria within ***section 25.4.3.4***.

184. Using the BS4142 criteria, the unmitigated results show that noise levels would be of no impact magnitude of effect at most receptors of medium sensitivity during the night time and therefore of **negligible** significance, except for receptor SSR2, where a negligible magnitude is predicted giving a **minor adverse** significance.

25.6.2.2 Compliance with Operational Noise Limit

185. The proposed East Anglia TWO project will limit operational noise from the onshore substation through a requirement of the draft DCO. The requirement of the draft DCO stipulates an operational rating noise limit (in accordance with BS4142:2014+A1:2019) of 34dBA at the nearest sensitive receptors during the day time and night time.

186. As SSR5 NEW and SSR2 are the closest receptors to the onshore substation, by stipulating an operational rating noise limit at these receptors, other NSRs would

experience lower predicted levels due to their increased separation distance from the specific sound source (onshore substation). Therefore, this is considered a conservative assessment approach.

187. A final design of the onshore substation will be produced which is able to meet the rigorous standards of low noise emissions expected by both the UK regulatory bodies and stakeholders. Noise reduction technology and design approach is discussed below and there are many proven measures that, through the detailed design process, can be combined to create a design that will meet the required low noise emissions and operational noise requirement of the draft DCO.

188. An examination of the predicted noise levels (from the SoundPLAN modelling) provides useful information regarding the contribution from each item of the proposed fixed plant.

189. Investigative noise modelling and subsequent analysis of the operational noise level at SSR2 and SSR5 NEW shows that the highest noise level is attributable to the Harmonic Filters of the onshore substation.

190. Design solutions are available from many fixed plant suppliers who are able to provide site specific performance requirements i.e. acoustic enclosure/shielding which would result in compliance with the operational noise limit.

191. However, applying further mitigation (if required) would be most beneficial and form an integral part of the post consent detailed design stage, to ensure the operational rating level in the requirement of the draft DCO.

192. Following compliance with the operational noise limit, this would result in an impact magnitude of no impact at SSR2 (medium sensitivity) and therefore be of **negligible** significance.

193. Detailed design for each project will be set out in an Operational Noise and Vibration Management Scheme to be agreed with the Local Planning Authority to discharge a requirement of the draft DCO. Additional measures likely to be considered as part of these schemes involve:

- Selection of quieter equipment;
- Installation of acoustic enclosures;
- Installation of acoustic barriers;
- Silencing of exhausts/outlets for air handling/cooling units; and
- Locating and orientating equipment to take advantage of screening inherent in the design.

Table 25.33 Predicted Onshore Substation Operational Noise Impact East Anglia TWO – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference Rating Level and Measured Baseline Background L_{90} (dBA)(	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference Operational noise limit and Background L_{90} (dBA)	Difference Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit)	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR1	Medium	33	29.0	-4.0	No impact	Negligible	34	+1.0	-5.0	No Impact	Negligible	NOEL
SSR2	Medium	31.5	33.0	+1.5	Negligible	Minor	34	+2.5	-1.0	No Impact	Negligible	NOEL
SSR3	Medium	30	26.8	-3.2	No impact	Negligible	34	+4.0	-7.2	No Impact	Negligible	NOEL
SSR4*	Medium	29	19.3	-9.7	No impact	Negligible	34	+5.0	-14.7	No Impact	Negligible	NOEL
SSR5 NEW	Medium	29	21.3	-7.7	No impact	Negligible	34	+5.0	-12.7	No Impact	Negligible	NOEL
SSR6*	Medium	29	21.4	-7.6	No impact	Negligible	34	+5.0	-12.6	No Impact	Negligible	NOEL
SSR7	Medium	35	27.5	-7.5	No impact	Negligible	34	-1.0	-6.5	No Impact	Negligible	NOEL
SSR8*	Medium	29	16.2	-12.8	No impact	Negligible	34	+5.0	-17.8	No Impact	Negligible	NOEL
SSR9**	Medium	29	23.2	-5.8	No impact	Negligible	34	+5.0	-10.8	No Impact	Negligible	NOEL
SSR10	Medium	31	11.0	-20.0	No impact	Negligible	34	+3.0	-23.0	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference Rating Level and Measured Baseline Background L_{90} (dBA)(	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference Operational noise limit and Background L_{90} (dBA)	Difference Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit)	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR11	Medium	30	13.7	-16.3	No impact	Negligible	34	+4.0	-20.3	No Impact	Negligible	NOEL
SSR12	Medium	29	16.1	-12.9	No impact	Negligible	34	+5.0	-17.9	No Impact	Negligible	NOEL

* Background taken from SSR5, **Background taken from SSR12

25.6.3 Potential Impacts during Decommissioning

194. No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.

25.6.4 East Anglia TWO Onshore Substation Alternative Location

195. ***Appendix 25.4 and Appendix 25.5*** present the project alone impacts in the eventuality that the onshore substation for the proposed East Anglia TWO project used the alternative onshore substation location, as allowed for in the draft DCO. In summary, there would be a small change in the noise experienced at each NSR during construction of the onshore substation in the alternative (western) location. However, impacts would be no worse than those assessed for the intended development strategy in ***section 25.6.1.1*** and ***section 25.6.2.1.***

25.6.4.1 Construction of Onshore Substation Alternative Location

196. ***Table 25.34*** presents the predicted noise level at NSR in proximity to the onshore substation alternative location.

Table 25.34 East Anglia TWO Onshore Substation Alternative Location (and National Grid Infrastructure) Construction Noise – Predicted Impacts Month 1 to 24 Daytime

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
SSR1	Daytime	A (65)	52.7	Month 1 to 6	No Impact	Negligible
SSR2	Daytime	A (65)	53.5	Month 7 to 10	No Impact	Negligible
SSR3	Daytime	A (65)	55.4	Month 1 to 6	No Impact	Negligible
SSR4	Daytime	A (65)	53.4	Month 7 to 10	No Impact	Negligible
SSR5	Daytime	A (65)	57.8	Month 7 to 10	No Impact	Negligible
SSR6	Daytime	A (65)	52.7	Month 7 to 10	No Impact	Negligible

Receptor Identifier	BS5228 Reference Period	BS5228 Derived Threshold Category dBA	Maximum Predicted Receptor Noise level dBA	Construction Period of Maximum Predicted Noise	Impact Magnitude	Impact Significance
SSR7	Daytime	A (65)	51.2	Month 1 to 6	No Impact	Negligible
SSR8	Daytime	A (65)	48.4	Month 1 to 6	No Impact	Negligible
SSR9	Daytime	A (65)	54.5	Month 1 to 6	No Impact	Negligible
SSR10	Daytime	A (65)	43.6	Month 7 to 10	No Impact	Negligible
SSR11	Daytime	A (65)	46.8	Month 7 to 10	No Impact	Negligible
SSR12	Daytime	A (65)	48.6	Month 1 to 6	No Impact	Negligible

25.6.4.2 Operation of Onshore Substation Alternative Location

197. ***Table 25.35*** presents the predicted operational noise level from the onshore substation alternative location at all NSR.

Table 25.35 Predicted East Anglia TWO Onshore Substation Alternative Location Operational Noise Impact – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference Rating Level and Measured Baseline Background L_{90} (dBA)(	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference Operational noise limit and Background L_{90} (dBA)	Difference Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit)	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR1	Medium	33	21.8	-11.2	No impact	Negligible	34	-1.0	-12.2	No Impact	Negligible	NOEL
SSR2	Medium	31.5	23.7	-7.8	No impact	Negligible	34	+2.5	-10.3	No Impact	Negligible	NOEL
SSR3	Medium	30	24.4	-5.6	No impact	Negligible	34	+4.0	-9.6	No Impact	Negligible	NOEL
SSR4*	Medium	29	27.9	-1.1	No impact	Negligible	34	+5.0	-6.1	No Impact	Negligible	NOEL
SSR5 NEW	Medium	29	29.4	+0.4	Negligible	Minor	34	+5.0	-4.6	No Impact	Negligible	NOEL
SSR6*	Medium	29	25.7	-3.3	No impact	Negligible	34	+5.0	-8.3	No Impact	Negligible	NOEL
SSR7	Medium	35	20.6	-14.4	No impact	Negligible	34	-1.0	-13.4	No Impact	Negligible	NOEL
SSR8*	Medium	29	20.7	-8.3	No impact	Negligible	34	+5.0	-13.3	No Impact	Negligible	NOEL
SSR9**	Medium	29	23.8	-5.2	No impact	Negligible	34	+5.0	-10.2	No Impact	Negligible	NOEL
SSR10	Medium	31	15.5	-15.5	No impact	Negligible	34	+3.0	-18.5	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference Rating Level and Measured Baseline Background L_{90} (dBA)(	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference Operational noise limit and Background L_{90} (dBA)	Difference Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit)	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR11	Medium	30	19.0	-11.0	No impact	Negligible	34	+4.0	-15.0	No Impact	Negligible	NOEL
SSR12	Medium	29	18.4	-10.6	No impact	Negligible	34	+5.0	-15.6	No Impact	Negligible	NOEL

25.7 Cumulative Impacts

25.7.1 Cumulative Impact with Proposed East Anglia ONE North Project

198. The East Anglia ONE North offshore windfarm project (the proposed East Anglia ONE North project) is also in the application phase. The proposed East Anglia ONE North project has a separate DCO application which has been submitted at the same time as the proposed East Anglia TWO project. The two projects share the same landfall location and onshore cable corridor and the two onshore substations are co-located and connect into the same National Grid substation.

199. The proposed East Anglia TWO project CIA will therefore initially consider the cumulative impact with only the East Anglia ONE North project.

200. The CIA considers the proposed East Anglia TWO project and the proposed East Anglia ONE North project under two construction scenarios:

- Scenario 1 - the proposed East Anglia TWO project and proposed East Anglia ONE North project are built simultaneously; and
- Scenario 2 - the proposed East Anglia TWO project and the proposed East Anglia ONE North project are built sequentially.

201. The worst case (based on the assessment of these two construction scenarios) for each impact is then carried through to the wider CIA which considers other developments which have been screened into the CIA (***section 25.7.2***). The operational phase impacts will be the same irrespective of the construction scenario. For a more detailed description of the assessment scenarios please refer to ***Chapter 5 EIA Methodology***.

202. Full assessment of scenario 1 and scenario 2 can be found in ***Appendix 25.2***. This assessment found that the overall significance of the impacts are the same irrespective of construction scenario. Impacts are identified in ***Table 25.37***.

25.7.1.1 Cumulative Operational Impact 1: Increased Operational Noise on Residential Receptors from the Onshore Substations

203. SoundPLAN noise modelling software was utilised to predict the East Anglia ONE North and East Anglia TWO onshore substations cumulative operational noise from the normal anticipated site operational aspects of the projects. Operations are proposed 24 hours a day. Full details of this assessment are presented in ***Appendix 25.2.***

204. The impact of the predicted noise levels from the onshore substations (including the installation of harmonic filters) at surrounding residential receptors (medium sensitivity) are presented in ***Table 25.36.***

205. Using the BS4142 criteria, the results show that unmitigated noise levels would be of no impact magnitude of effect at most receptors of medium sensitivity during the night time and therefore of **negligible** significance.

206. Using the BS4142 criteria, the results show that unmitigated noise levels would be of negligible magnitude of effect at SSR2 and SSR5 NEW (medium sensitivity) during the night time and therefore of **minor** significance.

207. As discussed in ***section 25.6.2.1,*** final design of the onshore substations will be produced which is able to meet the rigorous standards of low noise emissions expected by both the UK regulatory bodies and stakeholders. Noise reduction technology and design approach is discussed below and there are many proven measures that, through the detailed design process, can be combined to create a design that will meet the required low noise emissions and operational noise requirements of the draft DCOs.

208. Following compliance with the operational rating noise limit of 34dBA, this would result in an impact magnitude of no impact at SSR2 and SSR5 NEW (medium sensitivity) and therefore be of **negligible** significance

Table 25.36 Predicted East Anglia TWO and East Anglia ONE North Substations Operational Noise Impact – Night time

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference in Rating Level and Measured Background L_{90} (dBA)	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference in Operational noise limit and Background L_{90} (dBA)	Difference in Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit))	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR1	Medium	33	29.8	-3.2	No impact	Negligible	34	+1.0	-4.2	No Impact	Negligible	NOEL
SSR2	Medium	31.5	33.4	+1.9	Negligible	Minor	34	+2.5	-0.6	No Impact	Negligible	NOEL
SSR3	Medium	30	28.8	-1.2	No impact	Negligible	34	+4.0	-5.2	No Impact	Negligible	NOEL
SSR4*	Medium	29	28.4	-0.6	No impact	Negligible	34	+5.0	-5.6	No Impact	Negligible	NOEL
SSR5 NEW	Medium	29	30.1	+1.1	Negligible	Minor	34	+5.0	-3.9	No Impact	Negligible	NOEL
SSR6*	Medium	29	26.9	-2.1	No impact	Negligible	34	+5.0	-7.1	No Impact	Negligible	NOEL
SSR7	Medium	35	28.3	-6.7	No impact	Negligible	34	-1.0	-5.7	No Impact	Negligible	NOEL
SSR8*	Medium	29	22.0	-7.0	No impact	Negligible	34	+5.0	-12.0	No Impact	Negligible	NOEL
SSR9**	Medium	29	26.5	-2.5	No impact	Negligible	34	+5.0	-7.5	No Impact	Negligible	NOEL
SSR10	Medium	31	16.8	-14.2	No impact	Negligible	34	+3.0	-17.2	No Impact	Negligible	NOEL

Name	Receptor Sensitivity	Measured Baseline Background Noise Level L_{90} (dBA)	Predicted Rating Noise Level Night time (dBA)	Difference in Rating Level and Measured Background L_{90} (dBA)	Impact magnitude (BS4142)	Impact significance (BS4142)	Operational noise limit (dBA)	Difference in Operational noise limit and Background L_{90} (dBA)	Difference in Rating Level and 34dBA Operational Limit (dBA)	Residual Impact magnitude (Compliance with 34dBA Limit))	Residual Impact Significance (Compliance with 34dBA Limit)	PPG/NPSE Category (Compliance with 34dBA Limit)
SSR11	Medium	30	20.1	-9.9	No impact	Negligible	34	+4.0	-13.9	No Impact	Negligible	NOEL
SSR12	Medium	29	20.4	-8.6	No impact	Negligible	34	+5.0	-13.6	No Impact	Negligible	NOEL

Table 25.37 Summary of Potential Impacts for Noise and Vibration under Either Construction Scenario

Potential Impact	Receptor	Sensitivity	Value	Magnitude	Significance	Mitigation Measures	Residual Impact Significance
Cumulative Construction Impacts with the proposed East Anglia ONE North project							
Impact 1: Increased noise on residential receptors along the Onshore Development Area	Residential	Medium	Medium	No Impact	Negligible	n/a	**Negligible**
Impact 2: Increased noise on residential receptors from off-site construction traffic noise	Residential	Medium	Medium	Minor Impact	Minor adverse	n/a	**Minor adverse**
Impact 3: Vibration disturbance along	Residential	Medium	Medium	Negligible	Minor adverse	n/a	**Minor adverse**

Potential Impact	Receptor	Sensitivity	Value	Magnitude	Significance	Mitigation Measures	Residual Impact Significance
the Onshore Development Area							
Cumulative Operation Impacts with the proposed East Anglia ONE North project							
Impact 1: Increased operational noise on residential from the substations	Residential	Medium	Medium	No Impact to minor	Negligible to minor adverse	Both EA2 and EA1N onshore substation will restrict operational noise rating level (in accordance with BS4142:2014+A1:2019) to 34dBA. Best Practice Measures (BPM), use of quieter equipment, use of enclosures and localised screening.	**Negligible**
Cumulative Decommissioning Impacts with the proposed East Anglia ONE North project							
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.							

25.7.2 Cumulative Impact Assessment with Other Developments

209. The assessment of cumulative impacts has been undertaken here as a two stage process. Firstly, all impacts considered in ***section 25.6*** have been assessed for the potential to act cumulatively with other projects. Potential cumulative impacts are set out in ***Table 25.38.***

Table 25.38 Potential Cumulative Impacts

Impact	Potential for Cumulative Impact	Rationale
Construction		
Other proposed and consented developments and their associated road traffic.	Yes	There is potential for impacts associated with noise and vibration generated during the construction phase site works to lead to a cumulative impact with other proposed developments (already consented and those in the planning system) where the construction phases of other schemes overlap with East Anglia TWO Scenario 1 and Scenario 2, and where activities will occur in proximity to the same receptors.
Operation		
Other onshore electrical infrastructure within the vicinity of the onshore substation	Yes	There is a potential for a cumulative impact associated with operational phase to occur during operation of the onshore substation in conjunction with other operational noise sources within the vicinity of the onshore substation. Implementation of appropriate mitigation within the detail design should ensure that any impacts will be of negligible significance.
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

210. The second stage of the CIA is an assessment of whether there is spatial overlap between the extent of potential effects of the onshore infrastructure and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature and extent of effects arising from all projects scoped into the CIA have been identified and any overlaps between these and the effects identified in ***section 25.6.*** Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.

211. Following a review of projects which have the potential to overlap temporally or spatially with the proposed East Anglia TWO project, two developments have been scoped into the CIA. ***Table 25.39*** provides detail regarding these projects.

212. The full list of projects for consideration has been developed in consultation with the Local Planning Authority. The remainder of the section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

Table 25.39 Summary of Projects considered for the CIA in Relation to Noise and Vibration

Project Name	Status	Development Period	[5]Distance from East Anglia TWO Onshore Development Area	Project Definition	Level of information available	Included in CIA	Rationale
Sizewell C New Nuclear Power Station	PEIR formally submitted 04.01.19.	Planning application expected in 2020. Construction expected to commence in 2021.	1.4km	A new nuclear power station at Sizewell in Suffolk. Located to the north of the existing Sizewell B Power Station Complex, Sizewell C New Nuclear Power Station would have an expected electrical capacity of approximately 3,260 megawatts (MW). Full PEIR available: https://www.edfenergy.com/download-centre?keys=&tid=1380&year%5Bvalue%5D%5Byear%5D=	Tier 5[6]	Yes	As this project is subject to an EIA, it is likely that this development will implement site-specific measures to mitigate noise associated with construction works which would be implemented as part of a CoCP specific for the development. This is outlined in the Sizewell C PEIR documentation. It is therefore not anticipated that any cumulative effects associated from construction activities will be significant. Traffic associated with the construction of Sizewell C will travel on some of the

[5] Shortest distance between the considered project and East Anglia TWO– unless specified otherwise

Project Name	Status	Development Period	[5]Distance from East Anglia TWO Onshore Development Area	Project Definition	Level of information available	Included in CIA	Rationale
							same road links as East Anglia TWO.
Sizewell B Power Station Complex	Planning application formally submitted 18.04.19. Awaiting Decision.	Construction expected to commence in 2022. Expected construction timetable of 53 months. Peak construction is expected in 2022, completion of construction expected in 2027.	1.4km	The demolition and relocation of facilities at the Sizewell B Power Station Complex. In outline, demolition of various existing buildings (including the outage store, laydown area, operations training centre and technical training facility), and erection of new buildings, including a visitor centre, and the construction of new access road, footpath and amended junction at Sizewell Gap; and associated landscaping and earthworks/recontouring. Full planning application available: https://publicaccess.eastsuffolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=PQ5NVGQXJJ100	Tier 4[7]	No	This development will implement site-specific measures to mitigate noise associated with construction works which would be implemented as part of a CoCP specific for the development. This is outlined in their PEIR documentation provided. It is therefore not anticipated that any cumulative effects associated with the construction phase will be significant. The most intensive period of construction is expected to occur in 2022, and therefore there will be no temporal overlap during this period with East Anglia

Project Name	Status	Development Period	[5]Distance from East Anglia TWO Onshore Development Area	Project Definition	Level of information available	Included in CIA	Rationale
							TWO, which will commence in Q3 2023. There is no data presented within the Sizewell B ES for subsequent construction years, and therefore the cumulative impact with East Anglia TWO and Sizewell C could not be considered. However, it is anticipated that, as this project would form part of the enabling works for Sizewell C, that consideration of impacts associated with the peak construction period of Sizewell C would represent a worst-case scenario.

25.7.2.1 Cumulative Impact during Construction

213. There is the potential for cumulative impacts at landfall and onshore cable route receptors in proximity to the proposed East Anglia TWO project works as a result of the simultaneous construction of proposed East Anglia TWO project, proposed East Anglia ONE North project and Sizewell C New Nuclear Power Station onshore project infrastructure. However, the magnitude of effect of any cumulative effects is dependent on the construction phasing of the Sizewell C New Nuclear Power Station project relative to the proposed East Anglia TWO project.

214. Sizewell C New Nuclear Power Station is subject to an EIA, and as such will need to consider the impacts of noise and vibration, including those cumulative impacts with the proposed East Anglia TWO project. Furthermore, it is likely that this development will implement site-specific measures to mitigate noise associated with construction works which would be implemented as part of a CoCP specific for the development. It is therefore not anticipated that any cumulative effects associated with the construction phase (plant) will be significant.

215. EDF Energy have embarked upon a Stage 4 consultation exercise scheduled to run from 18th July to 27th September 2019. This Stage 4 consultation document does not contain sufficient information in terms of a freight management strategy to facilitate a quantitative assessment, therefore it is unable to be incorporated into the proposed East Anglia TWO project cumulative assessment.

216. Recognising that Stage 3 information released by EDF Energy is out of date, a detailed quantitative CIA cannot be provided at this stage because a detailed CIA alone would potentially be based upon out of date and incorrect information.

217. Therefore, it has not been possible to undertake a quantitative assessment of the cumulative construction phase road traffic emissions with Sizewell C New Nuclear Power Station. This CIA presented recognises the potential for cumulative impacts but recognising the low magnitude of effects from the proposed East Anglia TWO and East Anglia ONE North projects relative to the Sizewell C New Nuclear Power Station.

25.7.2.1.1 Additional Mitigation

218. Prior to construction, the proposed East Anglia TWO project will produce a CoCP and CTMP that will be submitted to the Local Planning Authority for approval to discharge the requirements of the draft DCO. It is anticipated the Sizewell C development will also produce a CTMP prior to construction.

25.7.2.1.2 Residual Impact

219. It is anticipated that any cumulative impacts from construction activities (plant) with Sizewell C New Nuclear Power Station will be **not significant** due to distance between the onshore development area and the Sizewell C New Nuclear Power Station development area and mitigation included within the CoCP.

220. When considering the mitigation that will form part of the CoCP and CTMP**,** residual impacts of increased noise on from off-site construction traffic are predicted to be **minor adverse.**

25.7.2.2 Cumulative Impact during Operation

221. A cumulative operational assessment with Sizewell C New Nuclear Power Station was not undertaken. Noise emitted from the operation of Sizewell C New Nuclear Power Station would not be expected to contribute to any effect at the substation sensitive receptors considered as part of the proposed East Anglia TWO project. This is due to the separation distance (>5km) between the onshore substation and National Grid substation and the likely location of the Sizewell C New Nuclear Power Station.

25.8 Inter-relationships

222. A summary of the likely inter-related effects arising from the proposed East Anglia TWO development on noise and vibration is provided in ***Table 25.40*** below.

Table 25.40 Inter-relationships Relevant to The Assessment of Noise Impacts

Inter-relationship all phases and linked chapter	Section where addressed	Rationale
Chapter 22 Onshore Ecology	***Table 25.26***	Noise and vibration disturbance to protected species
Chapter 23 Onshore Ornithology	***Table 25.27***	Noise and vibration disturbance to protected species
Chapter 24 Archaeology and Cultural Heritage	***Table 25.28***	There could be potential noise impacts related to construction traffic movements and construction plant operating in proximity.
Chapter 26 Traffic and Transport	***Table 25.29***	Influence of construction traffic on local amenity.
Chapter 27 Human Health	***Table 25.33***	There could be potential noise impacts related to construction traffic movements construction plant operating in proximity.
Chapter 30 Tourism, Recreation and Socio-economics	***Table 25.33***	There could be potential noise impacts related to construction traffic movements construction plant operating in proximity.

25.9 Interactions

223. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The areas of interaction between impacts are presented in ***Table 25.41,*** along with an indication as to whether the interaction may give rise to synergistic impacts. This provides a screening tool for which impacts have the potential to interact. ***Table 25.42*** then provides an assessment for each receptor (or receptor group) related to these impacts in two ways. Firstly, the impacts are considered within a development phase (i.e. construction, operation or decommissioning) to see if, for example, multiple construction impacts could combine. Secondly, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across development phases. The significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the different effects are combined upon the same sensitivity receptor. If minor impact and minor impact were added this would effectively double count the sensitivity.

224. The receptors considered in the noise and vibration assessment is:

- Residential (construction noise, traffic noise, vibration).

Table 25.41 Interactions Between Impacts

Interactions between Impacts **Construction impacts**			
	Impact 1: Increased noise on residential receptors along the Onshore Development Area	**Impact 2: Increased noise on residential receptors from off-site construction traffic noise**	**Impact 3: Vibration disturbance along the Onshore Development Area**
Impact 1: Increased noise on residential receptors along the Onshore Development Area	-	Yes	Yes
Impact 2: Increased noise on residential receptors from off-site	Yes	-	Yes

Interactions between Impacts			
construction traffic noise			
Impact 3: Vibration disturbance along the Onshore Development Area	Yes	Yes	-
Operation impacts			
	Operation Impact 1: Increased operational noise on residential receptors from the substations		
Operation Impact 1: Increased operational noise on residential receptors from the substations	-		
Decommissioning impacts			
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.			

Table 25.42 Potential Interactions Between Impacts on Noise and Vibration

Receptor	Construction	Operational	Decommissioning	Phase Assessment	Lifetime Assessment
Residential (construction noise, traffic noise, vibration)	Minor adverse	Negligible	Minor adverse	**No greater than individually assessed impact** The impacts (*Impacts 1-3*) are considered to have no to minor magnitude of effect on the individual receptors, with impact significance dependent upon the sensitivity of the receptor. Given that the magnitudes are none to minor and that each impact will be managed with standard and best practice methodologies it is considered that there would either be no interactions or that these would not result in greater impact than assessed individually.	**No greater than individually assessed impact** There will only be noise during construction phase at the landfall and onshore cable route, therefore no lifetime effects for receptors in these parts of the onshore development area. At the onshore substation, there will be negligible noise levels throughout the project lifetime.

25.10 Summary

225. A summary of the findings of the ES for noise and vibration is presented in ***Table 25.43***. In accordance with the assessment methodology presented in ***section 25.4***, this table should only be used in conjunction with the additional narrative explanations provided in ***section 25.6***.

226. This assessment demonstrates that construction phase impacts (impact 1) from the proposed East Anglia TWO project within the noise and vibration study area have a maximum residual impact of **negligible adverse** significance.

227. This assessment demonstrates that construction phase road traffic noise emissions (impact 2) from the proposed East Anglia TWO project have a maximum residual impact of **minor adverse** significance.

228. Vibration disturbance during construction (impact 3) within the noise and vibration study area from the proposed East Anglia TWO project will be of **minor adverse** significance.

229. This assessment demonstrates that, post mitigation, all operational impacts (operational noise from the onshore substation) have a maximum residual impact of **negligible** significance.

230. There will therefore be no impacts resulting from the proposed East Anglia TWO development that are considered to be significant in EIA terms (i.e. moderate or major adverse).

231. A summary of potential cumulative impacts for noise and vibration is also presented in ***Table 25.43.***

Table 25.43 Potential Impacts Identified for Noise and Vibration of the proposed East Anglia TWO project

Potential Impact	Receptor	Sensitivity	Value	Magnitude	Significance	Mitigation Measures	Residual Impact Significance
Construction							
Impact 1: Increased noise on residential receptors along the Onshore Development Area	Residential	Medium	Medium	No Impact	Negligible	n/a	**Negligible**
Impact 2: Increased noise on residential receptors from off-site construction traffic noise	Residential	Medium	Medium	Minor Impact	Minor adverse	n/a	**Minor adverse**
Impact 3: Vibration disturbance along the Onshore Development Area	Residential	Medium	Medium	Negligible	Minor adverse	n/a	**Minor adverse**
Operation							
Impact 1: Increased operational noise on residential from the substations	Residential	Medium	Medium	No Impact to Negligible	Negligible to Minor	EA2 onshore substation will restrict operational noise rating level (in accordance with BS4142:2014+A1:2019) to 34dBA. Best Practice Measures (BPM), use of quieter equipment, use of enclosures and localised screening.	**Negligible**

Potential Impact	Receptor	Sensitivity	Value	Magnitude	Significance	Mitigation Measures	Residual Impact Significance
Decommissioning							
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.							
Cumulative Construction Impacts with Other Developments							
Impact 1: Increased noise on residential receptors along the Onshore Development Area	Residential	Medium	Medium	No Impact	Negligible adverse	n/a	**Negligible**
Impact 2: Increased noise on residential receptors from off-site construction traffic noise	Residential	Medium	Medium	No Impact to Major Impact	Negligible adverse to Major adverse	Working together with EDF Energy.	**Minor adverse**
Impact 3: Vibration disturbance along the Onshore Development Area	Residential	Medium	Medium	Negligible	Minor adverse	n/a	**Minor adverse**

Potential Impact	Receptor	Sensitivity	Value	Magnitude	Significance	Mitigation Measures	Residual Impact Significance
Cumulative Operation Impacts with Other Developments							
A cumulative operational assessment with Sizewell C New Nuclear Power Station was not undertaken. Noise emitted from the operation of Sizewell C New Nuclear Power Station would not be expected to contribute to any effect at the substation sensitive receptors considered as part of the proposed East Anglia TWO project. This is due to the separation distance (>5km) between the onshore substation and National Grid substation and the likely location of the Sizewell C New Nuclear Power Station							
Cumulative Decommissioning Impacts with Other Developments							
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.							

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