SUFFOLK ENERGY ACTION SOLUTIONS

SUFFOLK ENERGY ACTION SOLUTIONS (SEAS)
WRITTEN REPRESENTATION

NOISE and VIBRATION

SEA LINK DCO

PINS Ref: EN020026 **SEAS IP:** [redacted]

Date: 18 November 2025 **WR: Deadline 1**

Introduction

1. Further to Suffolk Energy Action Solutions (SEAS) Relative Representation (RR-5210) on Noise and Vibration[1] dated 23 June 2025 and the Issue Specific Hearing One (ISH1) held on 11 November, we herewith make further comment in this Written Representation for Deadline 1:

2. These comments are intended to highlight specific deficiencies in the Applicant's submissions to date—particularly regarding the lack of verified evidence on noise and vibration impacts—and to recommend measures that would ensure the Examining Authority (ExA) obtains a robust and objective understanding of the proposal's potential effects.

3. SEAS engaged acoustic expert Rupert Thornely-Taylor and we encourage the Executive Authority to refer to his analytical report which is attached to SEAS RR-5210 (for ease see Appendix A below).

Main Comments

4. We are grateful for the Examining Authority's experience in planning matters and, we understand, ecology and traffic/transport. However, we are conscious that the ExA may not be experienced in dealing with the build of major electrical infrastructure and its impact upon the surrounding area, particularly on the subject of noise and vibration. At Issue Specific Hearing 1, the Applicant made various non-validated, vague and sweeping assertions that all the effects of these Proposals would either be of negligible significance, or would be mitigated, with nothing produced to evidence or support those assertions. As noise is such an important (and ongoing) issue well beyond the construction period, it is really critical that the ExA Panel ensures it can get substantive answers to the substantive questions in this subject area, and we suggest the ExA both lean on an expert such as Mr Thornely-Taylor and consider engaging

[1] https://nsip-documents.planninginspectorate.gov.uk/published-documents/EN020026-000628-09.%20SEAS%20Noise%20&%20Vibration%20RR%20FINAL%20-%20combined_Redacted.pdf

a noise and vibration expert to assist it. Certainly, it is vital the ExA does not rely solely on the views presented by the Applicant.

5. SEAS also suggests that the ExA panel obtains a fuller understanding of the nature of the Proposals, by considering existing or under construction infrastructure. For example (and see photo at Figure 1 provided below of the current state of build) the HVDC to HVAC converter station at Swardeston near Norwich, which will connect the Hornsea 3 windfarm to the UK 400kV Overhead Transmission Line. The Hornsea 3 windfarm power output and that of the Proposals at 2 GW are broadly comparable. Some sense of the noise, vibration and other amenity impacts may also be gauged by reference to the vehicles captured on the nearby A47 dual carriageway.

6. As the Applicant has only published indicative plans and no substantive images of the proposed SeaLink, SEAS has assumed a ground plan similar to that depicted below.

Major points of concern are as follows:

7. When in operation, the noise emissions from large scale electrical apparatus cannot be treated in the same way as noise arising from road traffic. The noise spectra are totally different. In the case of EA1(N) and EA2, the Applicant (SPR) disputed the existence of 'tonality', which would have demanded meeting lower noise levels, when the major concern of all local residents is the level of "hum", which is a characteristic of all mains frequency electrical apparatus, be it a refrigerator or electricity substation.

8. Low frequency 'hum' is generated by the repeated magnetisation, demagnetisation and re-magnetisation of the core element of the device which occurs 100 times each second (ie twice the UK 50 Hz mains frequency). Low frequency hum, such as that generated by large transformers, STATCOMS, reactors, harmonic filters, etc., can travel significant distances and experience relatively little absorption by the atmosphere and vegetation. It is important to recognise that all the equipment is essentially 'beating in time' and is synchronised to the UK mains frequency.

NGET's Operational Noise revision document AS-120

9. The latest revision of Sea Link ES 6.3.2.9.D Part 2 Suffolk Chapter 9 Appendix 2.9.D Suffolk Operational Noise Assessment (AS-120) would now appear to recognise that the HVAC transformers are a significant source of noise pollution at 100 Hz.

10. However, without a proper map showing accurately the position, layout and orientation of all the noise sources of the converter station, no meaningful independent calculation can be made to confirm the veracity of NG conjectures regarding additive noise levels.

11. Within the text of AS-120 there still seems to be a failure to recognise that all the noise generating equipment distributed across the site will be “synchronous” with the UK AC mains frequency of 50 Hz and that will affect the nature of the ‘phase front ‘and hence its propagation.

12. Admittedly, magnetically induced vibration and airflow, will give rise to some noise across the entire acoustic spectrum, but it needs to be recognised that that the revised spectrum is not like that of road traffic which is readily additive, but originates from the synchronous conversion of many megawatts of electrical power into another form.

13. It is noted that AS-120 still contains the following statements, as indicated below:

    1.4.27 *Depending on the level of noise generated relative to the existing levels, the introduction of the Saxmundham Converter Station would be distinctive against the existing noise climate in the vicinity of the converter station. Further consideration of the existing and potential noise levels is provided below.*

    1.4.29 *The assessment indicates that there would be no change to average ambient noise levels at nearby NSR during either daytime or night periods due to the introduction of the proposed Saxmundham Converter Station.*

    1.4.30 *As there is no anticipated change to average ambient noise levels, the change to the character of the noise climate is likely to be negligible during most periods.*

    There is, however, expected to be a change in the noise climate due to operational noise from the proposed Saxmundham Converter Station during the period in the middle of the night when existing background noise levels are lowest, and a potential change to spectral noise levels. This would be an adverse impact on the noise climate, but not sufficient to cause a significant adverse impact.

    1.4.31 *All nearby NSR are residential dwellings, with no high sensitivity non-residential NSR in the vicinity. The dwellings are a range of ages and styles, but it is anticipated that the dwellings do not include alternative forms of ventilation which would negate the need to open windows. The potential impact of noise from the proposed Saxmundham Converter Station would therefore need to consider the requirement for dwellings to have open windows for ventilation. This has been considered above, with the assessment indicating that suitable internal sound levels can be achieved with open windows.*

14. These paragraphs are so muddled as to obfuscate an answer to the question:

15. Will noise from the substation be audible to residents of Saxmundham and the area surrounding the substation?

16. The answer seems to be: Yes, No, Maybe, depending on which statement you choose to believe.

17. Furthermore, the data provided by the Applicant do not seem to include atmospheric factors which come into play at ranges >200 metres.

18. These include factors such as the low atmospheric attenuation at frequencies below 200 Hertz, the effect of wind shear and temperature inversion.

19. The Applicant should have published a scaled map of the converter station and surrounding area showing the predicted increase in soundscape shown as noise contours in dB(A).

20. The Applicant alludes to open/closed windows situation affecting perceived sound levels, but fails completely to recognise that continuous impingement of 100 and 200 Hertz sound pressure can excite standing waves in older properties with solid walls and floors, typical of this rural area.

21. It is recommended by SEAS that the ExA panel in scrutinising the Sea Link DCO application seek from the outset a clear demonstration from the Applicant of the existence of a coherent, engineering-based design (albeit limited in places) upon which to base the noise and vibration assessments. Such a baseline needs to be free from statements by the Applicant such as: "matter of engineering detail, dependent upon detailed design, subject of commercial confidentiality, conditioned by supply-chain issues, as low as engineeringly practical (LAEP), best engineering practice" etc., provisos that will obfuscate the submission.

22. Although the Applicant has published general arrangement drawings and a layout of a typical converter station—indicating two buildings housing the DC Hall, Valve Hall, and Reactor Hall—no information has been provided regarding the orientation of these buildings or the siting of exterior equipment. The precise location, scale, and configuration of the Sea Link converter station remain unclear, including whether the final design comprises one or two principal structures.

23. This lack of detail is significant: The effect of temperature inversion and wind direction upon sound propagation can materially affect noise as perceived by receptors at distances greater than about 250 metres and adverse effect in Saxmundham, Sternfield, and Friston cannot be discounted. It should thus be made quite clear to the Applicant that in the absence of a definitive design baseline, a contour of 30 dB (say) will be set by the Inspectorate to protect all noise receptors from intrusion.

24. In particular, SEAS draws attention to the fact that several of the receptors closest to the proposed converter station site are located within the Fromus Valley. This shallow, enclosed topography has the potential to act as an acoustic channel, amplifying and prolonging the transmission of low-frequency sound. Such terrain-induced amplification is well documented in acoustic literature and can result in greater perceptual intrusion than would be predicted by standard modelling assumptions that do not account for complex terrain effects. Given the known characteristics of electrical "hum" and its ability to travel long distances with minimal atmospheric attenuation, the presence of the Fromus Valley introduces a further layer of risk to residential amenity. It is therefore essential that the Applicant's modelling explicitly accounts for topographical amplification effects and that the Examining Authority seeks independent verification of any assumptions made in this regard.

25. In support of these concerns, SEAS draws attention to a recent baseline noise survey commissioned by the resident of Hurts Hall, Saxmundham (Report Reference: OES25/001RSHH, prepared by Oakridge Environmental Services Ltd, July 2025). The survey was conducted over a seven-day period within the grounds of Hurts Hall, a heritage property situated on the outskirts of Saxmundham, and provides detailed measurements of ambient and background noise levels across daytime, evening, and nighttime periods. The results confirm a quiet rural noise environment, consistent with the expectations of residential amenity in this part of Suffolk.

26. This baseline data is of particular relevance given the proximity of Hurts Hall to the proposed converter station site and its location within the Fromus Valley. The survey establishes a clear benchmark against which any future construction or operational noise can be assessed, including the potential for adverse impact or statutory nuisance. It is therefore imperative that the Applicant's modelling and mitigation proposals are tested against this locally gathered evidence, and that the Examining Authority considers the Hurts Hall survey as part of its evaluation of cumulative and site-specific noise risk.

27. The full report is appended to this submission for reference.

28. In Scotland, planning consent for the Blackhillock substation required the Applicant to install multiple acoustic enclosures for the HV transformers to achieve a noise reduction of 18-20 dB [NB 20dB = a factor of 100]. Such a design would be incompatible with the Hornsea 3 pattern of transformer installation. This emphasises the importance of noise reduction measures need to be included at the start and not as an "add-on". See Figure 2 photo below.

29. Regarding vibration, it is possible that vibration of the HVAC transformers could be detected at considerable distance by seismometers, but the displacement amplitudes are unlikely to be felt in the surrounding area. If however, pile-drivers are used during construction then the Parochial Church Councils (PCCs) for St John's Church in Saxmundham, Mary Magdalene in Sternfield

and St Mary the Virgin in Friston should be given judicial assurance the that the church structures (listed mediaeval buildings) and other heritage buildings are free from risk of damage, both long term and short term.

30. ***Figure 1: Swardeston Substation near Norwich currently under construction. Credit: Eastern Daily Press***

31. **Figure 2: HVAC Transformer with -20dB Acoustic Enclosure. Credit: Siemens and Kimpton Acoustics Ltd**

Conclusion

32. In summary, the examination process must ensure that the Applicant's claims are supported by verifiable data and sound engineering evidence, not broad or unsubstantiated assurances. Given the potential for persistent and intrusive noise, the unique low-frequency characteristics of electrical "hum," and the sensitivity of nearby communities and heritage structures, it is essential that the Examining Authority commission independent expert review of all noise and vibration assessments.

33. This is especially critical in light of two site-specific factors: first, the presence of the Fromus Valley, which may amplify low-frequency sound due to its topography and channel-like characteristics; and second, the baseline noise survey conducted at Hurts Hall, Saxmundham, which confirms a quiet rural acoustic environment and provides a robust benchmark against which future impacts can be measured. These locally grounded data points underscore the need for terrain-sensitive modelling and heritage-sensitive mitigation.

34. Only through transparent, evidence-based evaluation—grounded in real measurements and independent expertise—can confidence be established that the proposed SeaLink development will not result in unacceptable long-term harm to local residents or to the historic and environmental character of the area.

APPENDIX A

2025 BASELINE NOISE SURVEY HURTS HALL,

SAXMUNDHAM, SUFFOLK, IP17 1ER.

PREPARED BY C.J CORNISH.

DATE: 13 JULY 2025.

REPORT REFERENCE: OES25/001RSHH

APPENDIX B

SEAS Relative Representation (RR-5210) on Noise and Vibration dated 23 June 2025 including Acoustic Report prepared by Rupert Taylor Ltd dated 4 June 2025

APPENDIX A

Oakridge Environmental Services Limited

2025 Baseline Noise Survey Hurts Hall, Saxmundham, Suffolk, IP17 1ER

PREPARED BY

C.J. Cornish

Date: 13th July 2025

Report Reference: OES25/001RSHH

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1. Introduction

Oakridge Environmental Services limited have been instructed to carry out a noise survey at Hurst Hall, Saxmundham, Suffolk, IP17 1ER by the owners of the property.

1.1. Scope

The survey is to establish a baseline ambient and background noise environment representative of the properties noise environment and amenity at the time of the survey.

To obtain the required information the survey will consist of physical measurement within the grounds of Hurts Hall at a location deemed to an area where normal residential amenity can be enjoyed. Data will be obtained over a 7-day period.

Results of daytime, evening and nighttime ambient noise presented as an L_{Aeq} and Background noise presented as an L_{A90}. 1/3rd Octave frequency bands as a day and nighttime average level will also be produced.

These results will be useable to determine any impacts on the current noise environment should any new noise sources be introduced near to Hurts Hall in the future.

2. Noise Survey

Hurts Hall is a large detached residential property set within a parkland style estate on the southern outskirts of the town of Saxmundham.

The area around Hurts Hall and Saxmundham is a rural area dominated by agricultural fields, used for growing arable crops. The nearest road is the B1121 at a distance of 350m to the east with the A12 being 1.2km further east.

The noise survey seeks to establish the typical representative noise environment at the property.

2.1. Measurement Methodology

We undertook a noise survey at the site by leaving a logging sound level meter from 20th June to the 26th June 2025. The measurement position (ML1) was adjacent to a covered seating area within the garden south of the house. This location was chosen as being representative of an area where normal garden amenity would be enjoyed by residents and their guests.

The microphone was fixed at a height of 1.5m above ground on a heavy-duty tripod and in a free-field position. The meter had a continuous audio recording function which allowed us to listen and identify noise sources during post processing. Figure 1 shows the measurement location in aerial view. Figure 2 shows the microphone with weatherproof enclosure. Details of the equipment used calibration and weather conditions are shown in APPENDIX B.

Figure 1 – Monitoring Location on Google earth © Image

Figure 2 – Drone Image of monitoring location

Figure 3 – Monitoring location

The noise monitoring was undertaken using a calibrated Type 1 Sound level deployed with outdoor weather protections. The deployment and measurement methodology follows the guidance set out in section 8 of BS4142:2014 + A1:2019.

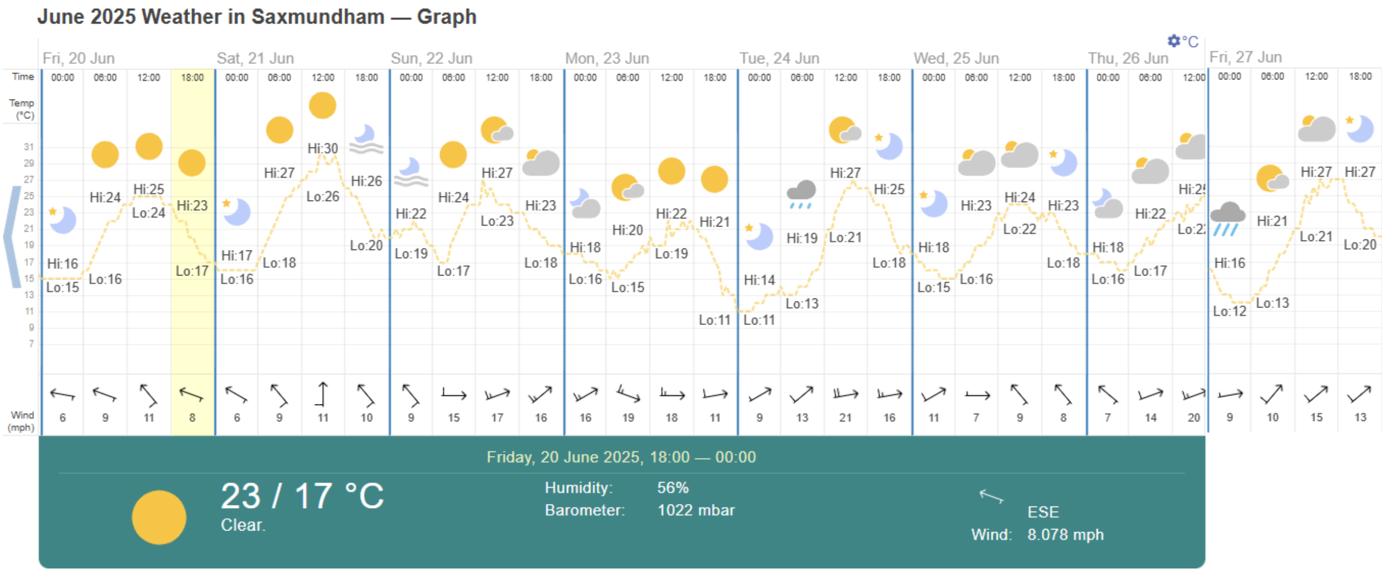
Deployment is over 7 days and nights to provide robust data sets for statistical calculations to establish the baseline.

2.2. Weather Conditions During Monitoring

Weather conditions were as shown in figure 4 which shows the historic weather for Saxmundham on the website time and date.com. Some periods have wind speeds listed above 5m/s,
https://www.timeanddate.com/weather/@2638464/historic?month=6&year=2025

The weather station for this site is set at 10m in height and will often have slightly higher windspeeds than at ground level. An analysis of the data does not show significantly increased levels because of wind speed or rainfall, the use of 15min data sets over 7 days reducing any marginal impacts to the data set.

Figure 5- Historic weather



2.3. Significance of results

The results starting for the baseline will be produced showing the daytime and nighttime LAeq, LA90 (using the modal) and 1/3 octave band results (Day and nighttime) over the 7 days.

This sets the baseline as of June 2025. The purpose will be to show if any future developments in the area cause an adverse impact to the noise environment and amenity of the property.

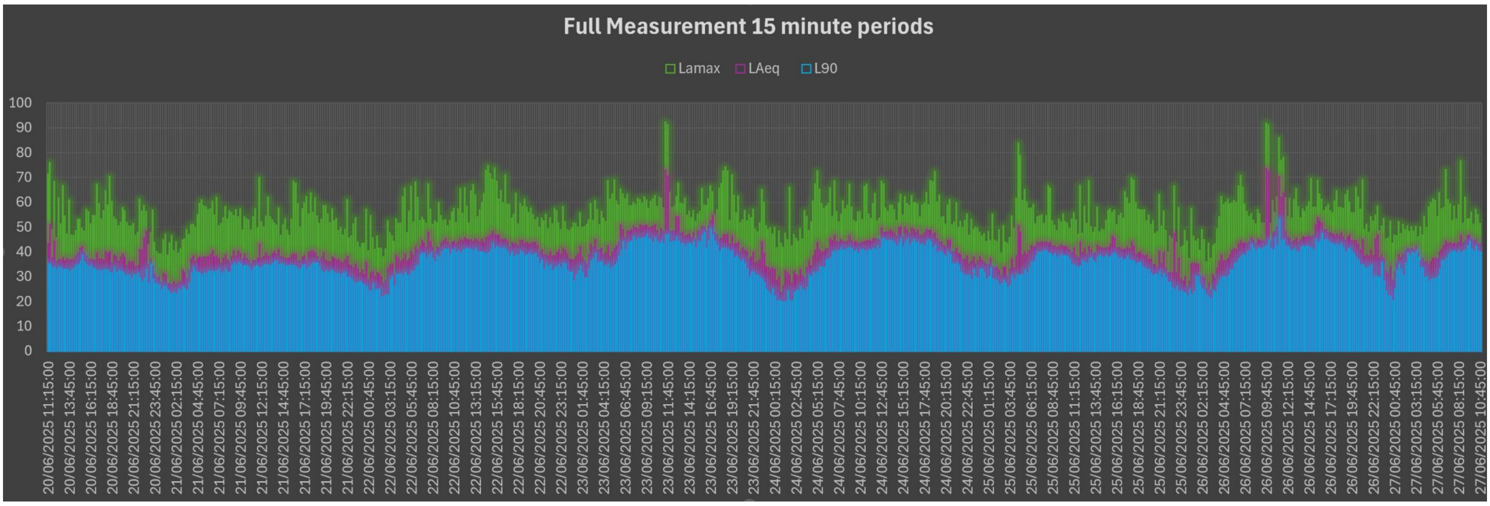
3. Results

.The ambient noise heard in the garden are of Hurts Hall at the monitoring position ML1 were as follows

- Birdsong
- Rustle of leaves in the breeze
- Distant traffic from the A12 just detectable amongst ambient noise.
- Local road noise detectable on the B1121
- Aeroplanes overflying at significant height
- Sounds of garden maintenance in the grounds of Hurts Hall

A full measurement graph of 15-minute periods is shown in Figure 6.

Figure 6 – Full measurement graph



The results for ambient and background noise are presented in table 1 and representative 1/3octave band levels are presented in figures 7 and 8. The graphs are presented in landscape format for easier interpretation in APPENDIX 1

Table 1 – June 2025 results mean

Location	LAeq16hours Daytime	LAeq8hours Nighttime	LA9016hours Daytime	LA90 8hours Nighttime	LAMAX # Daytime	LAMAX # Nighttime
ML1	43dB	36dB	40dB	32dB	57dB	52dB

- Average Lamax across all daytime 15min periods

Figure 7- Daytime 1/3 Octave Bands

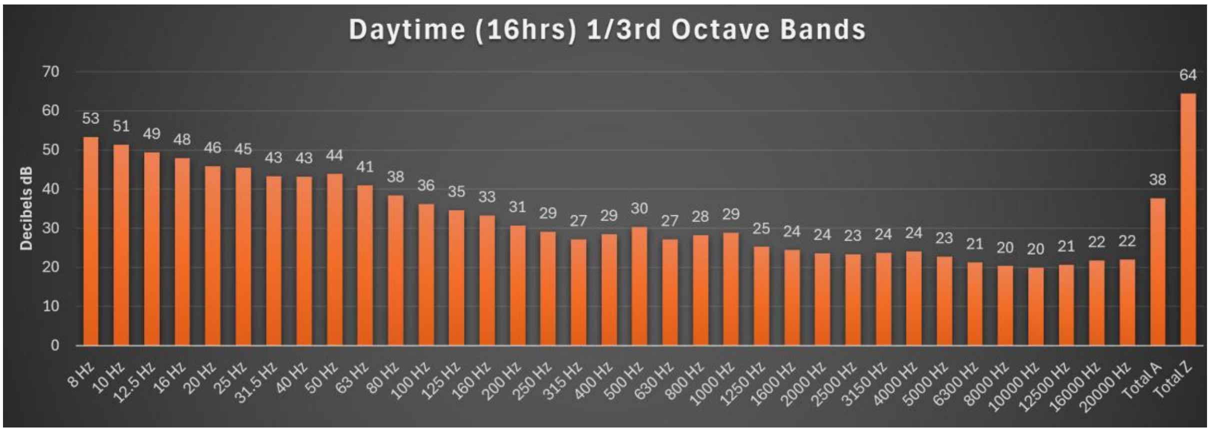
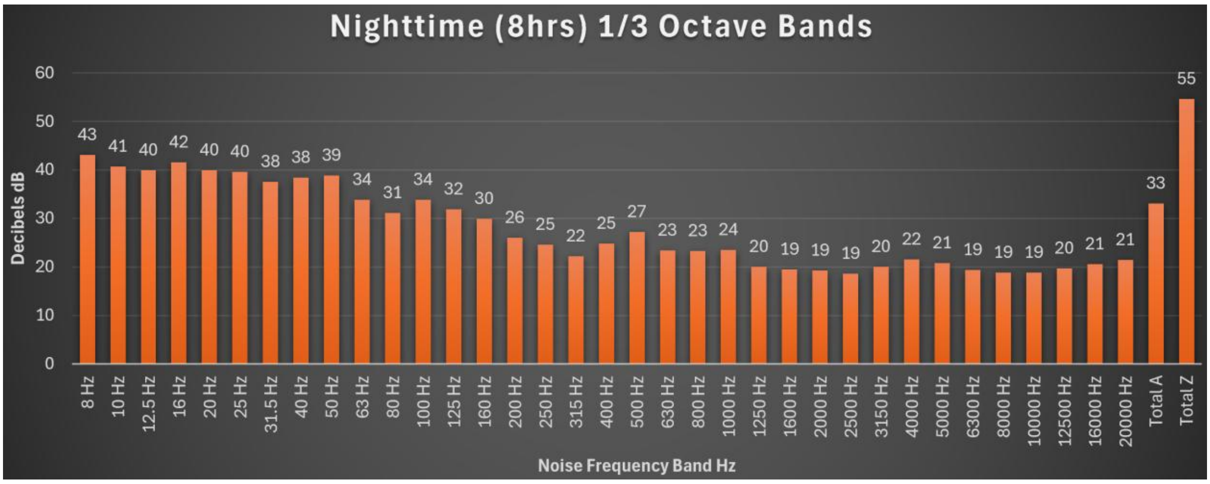


Figure 8- Nighttime 1/3 Octave Bands



4. Conclusions

The results of noise monitoring have provided base line data of the existing noise environment show typical backgrounds, ambient, maximum noise levels and the 1/3 octave band spread of the ambient sound.

The results show a quiet rural noise environment as would be expected on the outskirts of the rural town of Saxmundham.

These results can be used to consider any if construction or operational noise from any future planning applications are likely to have an adverse impact or to compare future operational noise to determine whether the noise environment has been adversely impacted causing a loss of amenity or potentially statutory nuisance.

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PREPARED BY

[redacted]

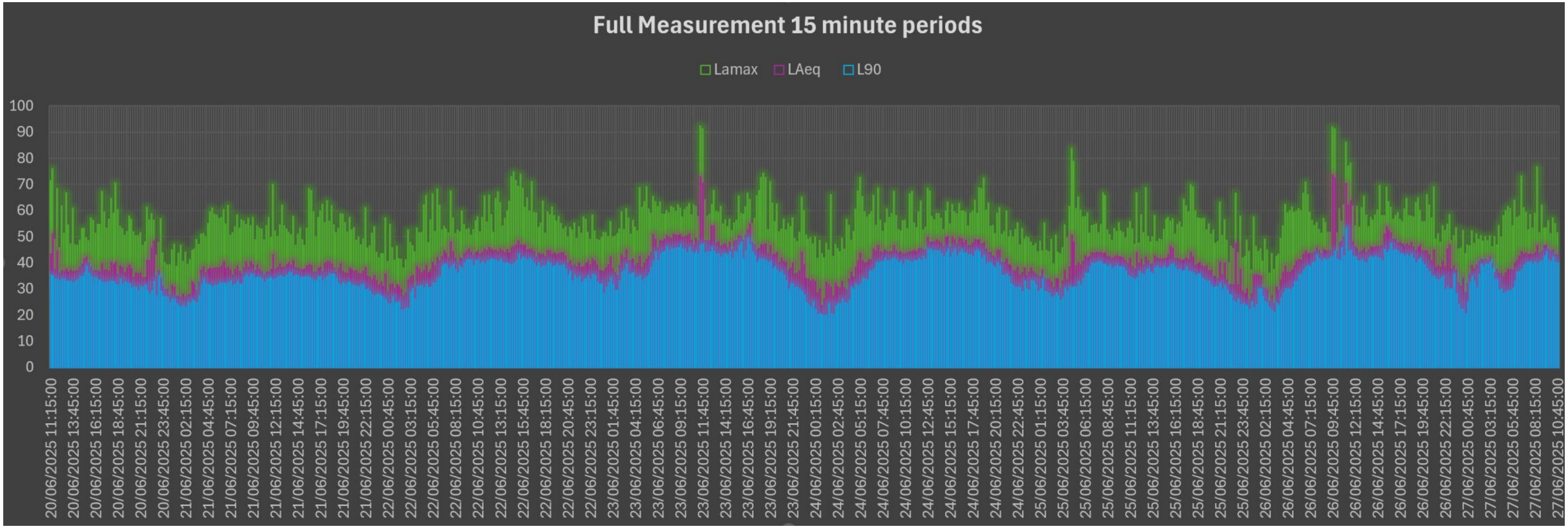
Chris Cornish BSc (Hons) MCIEH

Environmental Health Consultant

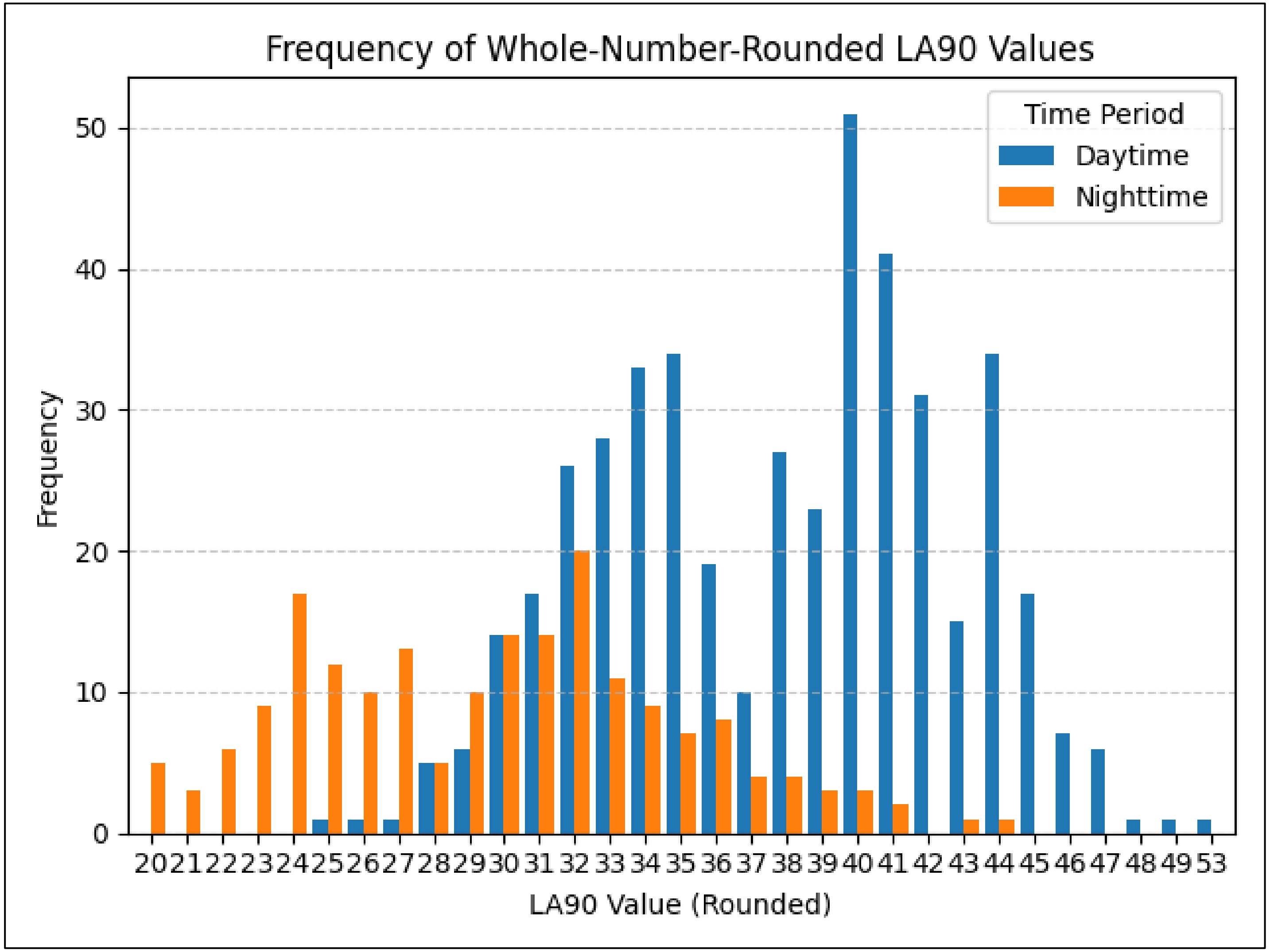
13th July 2025

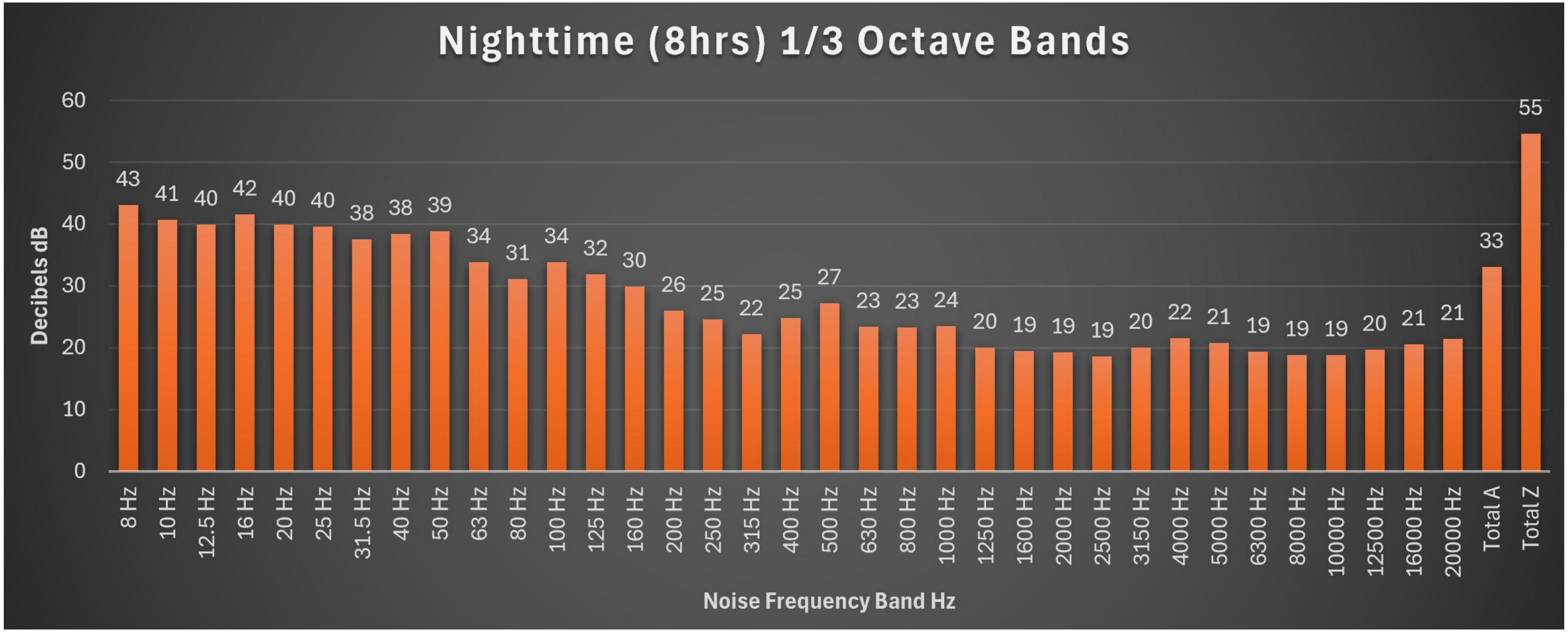
Appendix 1

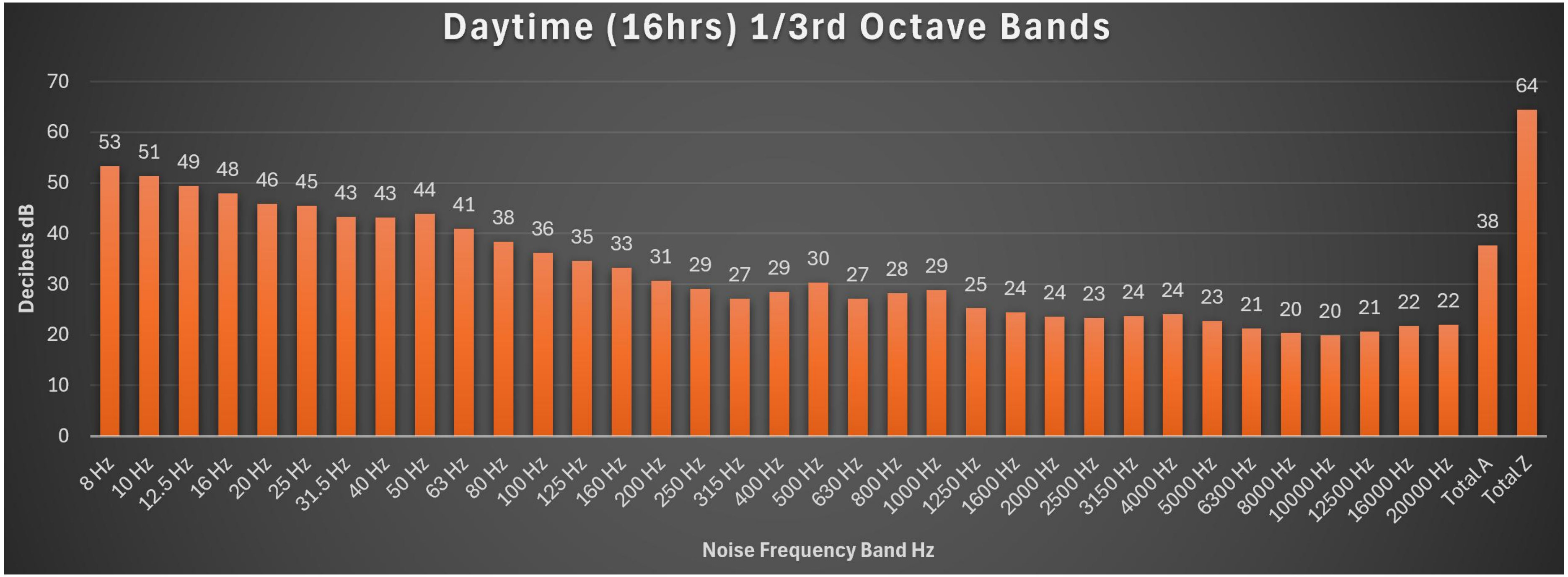
Noise Data



LA90 Modal Graph




Nighttime (8hrs) 1/3 Octave Bands
Decibels dB
Noise Frequency Band Hz
8 Hz 43
10 Hz 41
12.5 Hz 40
16 Hz 42
20 Hz 40
25 Hz 40
31.5 Hz 38
40 Hz 38
50 Hz 39
63 Hz 34
80 Hz 31
100 Hz 34
125 Hz 32
160 Hz 30
200 Hz 26
250 Hz 25
315 Hz 22
400 Hz 25
500 Hz 27
630 Hz 23
800 Hz 23
1000 Hz 24
1250 Hz 20
1600 Hz 19
2000 Hz 19
2500 Hz 19
3150 Hz 20
4000 Hz 22
5000 Hz 21
6300 Hz 19
8000 Hz 19
10000 Hz 19
12500 Hz 20
16000 Hz 21
20000 Hz 21
Total A 33
Total Z 55


Daytime (16hrs) 1/3rd Octave Bands
Decibels dB
0
10
20
30
40
50
60
70
53
51
49
48
46
45
43
43
44
41
38
36
35
33
31
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25
24
24
23
24
24
23
21
20
20
21
22
22
38
64
8 Hz
10 Hz
12.5 Hz
16 Hz
20 Hz
25 Hz
31.5 Hz
40 Hz
50 Hz
63 Hz
80 Hz
100 Hz
125 Hz
160 Hz
200 Hz
250 Hz
315 Hz
400 Hz
500 Hz
630 Hz
800 Hz
1000 Hz
1250 Hz
1600 Hz
2000 Hz
2500 Hz
3150 Hz
4000 Hz
5000 Hz
6300 Hz
8000 Hz
10000 Hz
12500 Hz
16000 Hz
20000 Hz
Total A
Total Z
Noise Frequency Band Hz

APPENDIX B

SUFFOLK ENERGY ACTION SOLUTIONS (SEAS)
Relevant Representation (RR):

NOISE & VIBRATION
SEA LINK DCO

PINS Ref: EN020026 **IP Ref: [redacted]**

Date: 17 June 2025 **RR Deadline: 23 June 2025**

RELEVANT REPRESENTATION: NOISE & VIBRATION — SEA LINK (EN020026)
Submitted by Suffolk Energy Action Solutions (SEAS) - [redacted]

1. Introduction

1.1 Suffolk Energy Action Solutions (SEAS) objects to the proposed Sea Link NSIP (EN020026) on the grounds that the operational and construction noise and vibration impacts — individually and cumulatively — are unacceptable and not mitigated to a degree that would make the project compliant with national policy and environmental standards.

1.2 This representation is based on a review of the Sea Link DCO's Environmental Statement (ES) and associated documentation submitted by the Applicant National Grid Electricity Transmission (NGET), acoustic expert input (Rupert Taylor Ltd.), and comparative analysis with another DCO case, EA1N.

1.3 This Representation should be read in conjunction with the Expert Report dated 17 June 2025 from Rupert Thornely-Taylor of Rupert Taylor Ltd, included below.

1.4 From the standard of NGET's submitted analysis and materials, it's hard not to conclude that NGET have decided that Sea Link will proceed, regardless of the outcome of this DCO, and therefore only nominal adherence to the requisite planning standards and regulations needed to be presented.

2. Operational Noise Impacts: Saxmundham Converter Station

2.1 Incomplete Design and Unverifiable Assumptions

2.1.1 Appendix 2.9.D of APP-138 acknowledges at paragraph 1.1.1 that the operational noise assessment is based on a generic converter station design, stating:

> "...this assessment is indicative and based on outline design information and is (sic) does not therefore provide a definitive indication of noise impacts..." (APP-138, paragraph1.1.1, p. ii).

2.1.2 It further asserts that the generic model represents a "likely worst-case scenario" but provides no supporting evidence or technical parameters that demonstrate how this can be concluded to be “likely worst case”. This introduces unacceptable uncertainty to this DCO.

2.1.3 By contrast, in the East Anglia ONE North DCO process, similar generic designs were accepted only because the DCO contained specific, enforceable operational noise limits as part of the Requirements.

2.1.4 Sea Link’s draft DCO includes no such binding requirement. There is therefore no enforceable mechanism to ensure future compliance with acceptable operational noise thresholds.

2.2 Misquotation and Misapplication of BS 4142:2014+A1:2019

2.2.1 The assessment in APP-138, paragraph 1.2.4 (p. iii) misquotes the relevant British Standard BS 4142, omitting the qualifying word "around" in the thresholds of adverse and significant adverse impacts. The ES states:

> “A difference of +10 dB or more is likely to be an indication of a significant adverse impact… A difference of +5 dB could be an indication of an adverse impact…”

2.2.2 BS 4142 (2014+A1:2019) actually states:

> “A difference of around +10 dB is likely to be a significant adverse impact… A difference of around +5 dB is likely to be an adverse impact…”

2.2.3 NGETs misuse of the BS definition is not merely a “trivial slip of the pen”, as it markedly softens the criteria by implication and misrepresents the precautionary intent of BS 4142, potentially leading to an underestimation of the number and scale of significant impacts.

2.3 Incomplete Frequency Modelling and Attenuation Inaccuracy

2.3.**1 Appendix 2.9.D or APP 138 Table 1.4 p9 lists A-weighted** sound power levels for six converter transformers but omits the octave band frequency content (APP-138, p. 9). This is critical because transformer noise is dominantly tonal at 100 Hz & 200Hz (ie harmonics of the base AC frequency of 50Hz), but not necessarily across the wider frequency spectrum.

2.3.2 The authors claim use of ISO 9613-2:2024 for propagation modelling. This standard allows substitution of 500 Hz attenuation values, only if no spectral data are available. Without stating the actual frequency used, the ES may default to 500 Hz, thereby producing an optimistically low noise prediction.

2.3.3 "..shifting the frequency of the transformer from 100Hz to 500Hz results in an over-optimistic prediction..."
(p3 Noise & Vibration Expert Report by Rupert Taylor Ltd.)

2.3.4 This potential modelling error may have significant implications for real-world intrusiveness.

2.4 Room Resonance and Indoor Noise Impacts

2.4.1 The assessment assumes a 15 dB reduction between outdoor and indoor levels to justify NGET dismissing night-time impacts based on indoor thresholds (APP-138, paragraph1.4.20). However, this assumption:

- Is based on road traffic noise — not transformer noise,
- Fails to account for potential room resonance at 100 Hz, which can lead to negative attenuation, i.e. the transformer sound actually being louder indoors than outdoors,
- Ignores constructive interference occurring between multiple transformers, which can lead to the aggregate SPL being higher than the sound level of each individual transformer. This issue would be further reinforced if there were more converter stations sited adjacent to the proposed Sea Link location e.g. for Lion Link and Sea Link 2.

2.4.2 APP-138 Table 1.8 shows rating levels exceeding background by up to 10 dB at R_5764 and up to 8 dB at R_14222. With proper use of “around” from BS 4142 and the resonance considerations above, both these receptors may experience significant adverse impacts, not “Small to Large ” or “Small to medium”.

3. Operational Noise: Friston Substation

3.1 Although scoped out of the main assessment, ESC requested an evaluation. APP-139 addresses GIS (gas insulated switchgear) and backup generators, concluding impacts are “low” — but this is non-binding and not part of the Environmental Statement.

3.2 These impacts were also under-assessed in EA1N, where the Ex. A raised concerns about residual tonal emissions and cumulative acoustic effects. There is no mitigation requirement for GIS noise in the Sea Link DCO.

4. Construction Noise and Vibration

4.1.1 Unacceptable Noise Levels Without Mitigation

Table 9.20 in Chapter 9 of APP-056 (p32) identifies four “Residential” receptors with Major, significant construction noise impacts without mitigation.

4.1.2 However, Table 9.23 (APP-056, p. 45) then applies a uniform 10 dB mitigation factor to all receptors — without demonstrating the feasibility of achieving such a reduction at each location, relying on BPM.

4.1.3 This optimistic assumption is unsupported by specific design or site context and contradicts guidance in BS 5228, which requires source-specific and receptor-specific mitigation modelling.

4.2 Reliance on "Best Practicable Means" (BPM)

4.2.1 The Outline Construction Noise and Vibration Management Plan (APP-350) repeatedly states that mitigation will be implemented through BPM, which does not guarantee any specific noise level outcome (see APP-350, paragraph 4.2–4.3, pp. 12–15).

4.2.2 Without defined limits or enforceable outcomes, BPM alone is insufficient to ensure compliance or protection of residential amenity, especially in tranquil rural areas like Saxmundham with a population of almost 5,000.

4.3 SOAEL Exceedances at Landfall – Trenchless Crossing

4.3.1 Contrary to generalised claims of minimal impact, (Figure 6.4.2.9.3, APP-236, 'Construction Noise Outputs Night-time' – Without Mitigation, not individually filed) shows that four properties near the trenchless crossing at landfall are predicted to exceed the SOAEL threshold for night-time noise.

4.3.2 This is a critical oversight. The ES and public-facing summary materials suggest broad compliance — when in fact unacceptable impacts are already predicted at specific, sensitive locations.

5. Use of Non-Site-Specific Source Data

5.1 The converter station noise model cited in APP-138 References in Table 1.4 on 9 is based on sound power data derived from the Celtic Interconnector Preliminary Acoustic Study (WSP, 2020).

5.2 This source concerns a project in Ireland with different baseline conditions, receptor distribution, and noise sensitivity. There is no justification nor evidence provided to support its direct application to this specific Suffolk setting. It should therefore be discounted and ignored.

6. Cumulative Impact

6.1 Sea Link fails to assess cumulative acoustic impacts with:

- EA1N and EA2 (including overlapping Friston substation operations),

- LionLink (another HVDC converter station with multiple transformers, planned to be co-located nearby),
- Sizewell C (major, long-duration construction and operation).

6.2 Given these overlapping projects, local communities could experience decades of chronic noise exposure, yet the ES and CNVMP solely assess Sea Link in isolation.

6.3 This violates both the EIA Regulations and NPS EN-1 which require assessment of cumulative and synergistic effects, particularly all those projects that can reasonably be foreseen as likely to proceed eg Lion Link etc

7. Policy Conflict

7.1 The Sea Link project's noise and vibration impacts directly conflict with the policy objectives and assessment principles in the following key national documents:

7.2 National Policy Statement EN-1 (Overarching Energy NPS)

7.2.1 Paragraph 5.12.1 of EN-1 acknowledges the wide-ranging impacts of excessive noise, including on:

- Human health,
- Quality of life,
- Use and enjoyment of tranquil areas and high-quality landscapes.

7.2.2 Sea Link fails to preserve these aspects for affected communities of over 5000 people in Saxmundham and Friston, where ambient noise levels are extremely low. Measured background night-time levels at survey locations S_L1–S_L6 were typically 20–25 dB LA90 (APP-135, Tables 1.1–1.7, pp. 5–23).

7.3 NPS EN-1: Application Requirements

7.3.1 Paragraph 5.12.6 requires the applicant to:

- Identify noise-sensitive receptors (NSRs),
- Predict how the noise environment will change at different times of day and in different seasons,
- Assess the effects of predicted changes in noise on health and quality of life,
- Consider the specific implications of development in areas with low ambient noise.

7.3.2 Sea Link's ES fails this test:

- The use of generic designs (APP-138, paragraph1.1.1, p. ii) prevents a full, receptor-specific analysis.
- The inappropriate use of BS 4142 thresholds (APP-138, paragraph1.2.4, p. iii) understates potential adverse effects.

- The omission of frequency-specific resonance and tonal effects from the context assessment means changes are not properly evaluated for health and amenity implications at night.

7.4 NPS EN-1: Mitigation and Controls

7.4.1 EN-1 requires applicants to take "all reasonable steps" to mitigate and minimise adverse effects. However:

- The operational phase of Sea Link has no enforceable limits (unlike EA1N),
- Construction mitigation is predicated on an assumed 10 dB benefit without evidential basis (Chapter 9, Table 9.23, EN020026-000241, p. 45),
- APP-350 only requires the use of Best Practicable Means (APP-350, paragraph 4.2–paragraph 4.3, pp. 12–15) — which is not sufficient to guarantee compliance.

7.5 National Noise Policy (NPSE)

7.5.1 The Noise Policy Statement for England (2010) sets out a policy aim of:

> “Avoiding significant adverse impacts on health and quality of life…”

7.5.2 Sea Link’s ES identifies impacts up to 10 dB above background (APP-138, Table 1.8, p. 16), which BS 4142 and NPSE both identify as likely to be significant adverse effects.

7.5.3 Yet, the project offers no legally binding measures to prevent or limit these impacts, even though these impacts are likely to last thirty or more years.

7.5.4 Moreover, throughout the ES there is a persistent attempt by NGET to downplay or understate noise and vibration consequences of this proposed development as either “negligible “, “minimal” or “not significant” without adequate evidence to support those assertions.

8. Planning Balance and the Cumulative Environment

8.1 High Sensitivity Context

8.1.1 The rural communities affected — including Friston, Sternfield, Aldringham, Knodishall, and Saxmundham with combined populations of over 7,500 people — exhibit:

- Low existing sound levels (LA90 values below 30 dB at night),
- High acoustic sensitivity,
- A strong local reliance on the tranquillity and amenity of the countryside.

8.1.2 These qualities are confirmed in the baseline measurements of the ES (APP-135, Tables 1.1–1.7), which show low ambient sound levels across all surveyed locations, indicating high acoustic sensitivity in rural communities such as Friston, Sternfield, Aldringham, and Saxmundham.

8.2 Cumulative Impact and Project Overlap

8.2.1 NGET has not provided a cumulative noise assessment that includes:

- EA1N and EA2 substations at Friston,
- LionLink (a proposed HVDC interconnector to be located nearby),
- Sizewell C (with predicted decades of construction noise).

8.2.2 This is contrary to the EIA Regulations 2017, which require assessment of cumulative and synergistic effects.

8.2.3 The East Anglia ONE North Examining Authority raised precisely this concern in its own report (EN010077-009799, Chapter 13, paragraphs 13.2–13.5), stating that despite embedded mitigation, there remained:

> “Residual concern about long-term noise character from operational plant, and the absence of full cumulative assessment.” (EN010077-009799, pp. 223–265)

9.SEAS Conclusions and Recommendation

9.1 SEAS submits that the Sea Link application totally fails to comply with the policy and regulatory framework that governs the assessment and control of environmental noise and vibration. In particular, it:

- 9.1.1 Fails to provide a definitive or site-specific operational noise assessment, relying instead on generic designs (APP-138, paragraph1.1.1).
- 9.1.2 Misrepresents BS 4142 thresholds, potentially leading to underestimation of adverse effects (APP-138, paragraph1.2.4, p. iii)
- 9.1.3 Assumes “Likely Attenuation” ie mitigation (>10 dB) without any technical justification, in Table 9.23 (APP-056, p. 45).
- 9.1.4 Omits enforceable operational noise limits in the DCO, unlike EA1N and EA2.
- 9.1.5 Ignores frequency-specific impacts, particularly 100 Hz transformer tone, which may cause resonance in dwellings.
- 9.1.6 Fails to assess cumulative effects with other major infrastructure projects in the area.

9.2 SEAS therefore requests that development consent should be refused.

End

DCO Documents

- **APP-056** – Environmental Statement Chapter 9: Noise and Vibration
- **APP-135** – ES Appendix 2.9.A: Suffolk Noise Survey Data
- **APP-138** – ES Appendix 2.9.D: Suffolk Operational Noise Assessment
- **APP-139** – ES Appendix 2.9.E: Friston Substation and OHL Operational Noise Information (Informative)
- **APP-236** – ES Figures: Suffolk Noise and Vibration (includes Figure 6.4.2.9.3)
- **APP-350** – Outline Construction Noise and Vibration Management Plan – Suffolk

Other Documents (attached)

- **Rupert Taylor Ltd. Expert Report**
- **WSP (2020) Celtic Interconnector Preliminary Acoustic Study**
- **EN010077-009799** – EA1N Examining Authority's Recommendation Report (Vol 1)

Non-DCO Documents – Publicly Available

- **BS 4142:2014+A1:2019** – *Methods for Rating and Assessing Industrial and Commercial Sound* (British Standard)
- **BS 5228-1:2009+A1:2014** – *Code of Practice for Noise and Vibration Control on Construction Sites* (British Standard)
- **NPSE (2010)** – *Noise Policy Statement for England* (DEFRA)
- **NPS EN-1 (2024)** – *Overarching National Policy Statement for Energy (January 2024)*
- **NPS EN-5 (2024)** – *National Policy Statement for Electricity Networks Infrastructure*
- **NPS EN-3 (2024)** – *Renewable Energy Infrastructure*

(Note: NPS EN-1, EN-3, EN-5 are referenced in the DCO planning policy documents via APP-228.)

RUPERT TAYLOR

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Suffolk Energy Action Solutions
(SEAS)
By email

04 June 2025

Dear SEAS,

Application by National Grid Electricity Transmission for an order granting development consent for the Sea Link project (EN020026)

As instructed, I have reviewed the Environmental Statement noise and vibration assessment and appendices which have been submitted in support of the above application.

Executive summary

The Operational Noise and Vibration Assessment in the ES contains merely a generic assessment and does provide a definitive indication of noise impacts. Unlike the recent EA1N and EA2 DCOs this shortcoming is not overcome by including control of noise requirements in the DCO.

The assessment is further flawed as a result of defective references to the key British Standard used for assessing noise impacts. Transformer noise is concentrated at a single frequency of 100Hz, and no source spectrum taking this into account has been properly considered, with the result that distance attenuation appears to have been over-optimistic. The assessment relies on a broad correction for the difference between outside and inside noise levels which does not allow for the room resonance effects which 100Hz pure tones cause. There has been no consideration of the adverse effect of multiple sources having the same single frequency.

For these reasons the conclusions about the absence of a significant effect cannot be relied upon, and the wording of the DCO provides no protection.

The conclusions of the Construction Noise and Vibration Assessment rely on a blanket mitigation effect of 10 dB applied in every case without any specific calculation to demonstrate that such a reduction is practicable. Should it in any case be found to be impracticable, the prediction of no more than minor significant effects will not be achieved.

There is insufficient consideration of potential cumulative effects with other projects in the locality.

Detailed report

The documents I have taken into account are:

EN020026-000168-3.1 draft Development Consent Order.pdf
EN020026-000192-7.5.8.1 Outline Construction Noise and Vibration Management Plan - Suffolk.pdf
EN020026-000241-6.2.2.9 Part 2 Suffolk Chapter 9 Noise and Vibration.pdf
EN020026-000313-6.3.2.9.A ES Appendix 2.9.A Suffolk Noise Survey Data.pdf
EN020026-000314-6.3.2.9.B ES Appendix 2.9.B Suffolk Construction Noise and Vibration Data.pdf
EN020026-000315-6.3.2.9.C ES Appendix 2.9.C Suffolk Construction Traffic Noise Assessment.pdf
EN020026-000316-6.3.2.9.D ES Appendix 2.9.D Suffolk Operational Noise Assessment.pdf
EN020026-000317-6.3.2.9.E ES Appendix 2.9.E Friston Substation and OHL Operational Noise Information (Informative).pdf
EN020026-000463-6.4.2.9 ES Figures Suffolk Noise and Vibration.pdf

as well as Celtic-Interconnector-Preliminary-Acoustic-Study-Report.pdf which is cited in the ES.

The following issues arise:

Operational noise and vibration

Absence of operational noise control provisions in the draft DCO

The ES (Appendix 2.9.D 1.1.1.) states in its introduction that it "does not provide a definitive indication of noise impacts from the proposed Saxmundham Converter Station" and instead presents "an assessment of noise from a 'generic' converter station with standard noise mitigation measures applied".

That obviously leads to increased uncertainty, and the same paragraph continues "Further detailed design would be undertaken by the developer, if consent is granted, and noise would be considered as a design parameter, with specific mitigation measures applied. The assessment of operational noise from the proposed Saxmundham Converter Station presented in this appendix therefore represents a likely worst-case scenario". No detailed support is provided for the assumption that the result of presenting an assessment of a scheme not yet designed would be worst case.

1.4.4 of Appendix 2.9.D states "As noted in the introduction to this appendix, this assessment is indicative and based on outline design information and is does not therefore provide a definitive indication of noise impacts from the proposed Saxmundham Converter Station."

In 2020/21 an examination was held into the applications by East Anglia ONE North and East Anglia TWO Limited offshore windfarm schemes. Those applications did not have a detailed design at the examination stage, but that matter was dealt with by including specific noise limits in the DCO which contained extensive requirements including "Control of noise during operational phase". There is no requirement of this kind in the draft Sea Link DCO.

Incorrect reference to BS 4142

In assessing operational noise at Samundham use is made of BS 4142, but its basic assessment criteria are incorrectly quoted in 1.2.4 of Appendix D.

The correct quotation is

“b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.”

but 1.2.4 removes the word “around” and incorrectly states:

“A difference of +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of +5 dB could be an indication of an adverse impact, depending on the context.”

Inappropriate or inadequate consideration of transformer noise spectra

Table 1.4 lists 6 transformers as the principal noise source, but gives the sound power level solely in dBA terms with blanks in the frequency spectrum.

Transformer noise is almost all concentrated at the frequency of 100Hz as is confirmed in the WSP report (cited in Table 2.5) on the Celtic Interconnector table D-1.

The authors of the Sea Link ES have used a model which calculates noise levels in accordance with the methodology described in ISO 9613-2:2024. This standard states in section 1 Scope “If only A-weighted sound power levels of the sources are known, the attenuation terms for 500Hz may be used to estimate the resulting attenuation.”

However, shifting the frequency of the transformer from 100Hz to 500Hz results in an over optimistic prediction, and the magnitude of this is not estimated. It is possible that 100Hz was used and not 500Hz, but this is not stated.

Weather conditions

Noise predictions at the distances concerned are highly dependent on weather conditions, which ISO 9613-2:2024 takes into account. While it is normal to assume weather conditions that give a worst case result in an ES assessment, it is not clear that this has been done in this case.

Inappropriate assessment

Table 1.8 summarises the BS 4142 ratings, appearing to show R_5764 as the only receptor with a large night time noise impact, but while that has a difference of up to 10 dB R_14222 has a difference of 8 dB and if the word “around” had not been omitted, given all the uncertainties, this location may also have a large outcome. none of the entries in Table 1.8 complies with the ESC aim quoted in 1.2.9 “for the rating level to be at least 5 dB below the background sound level, where feasible.”

The assessments in table 1.8 are then modified by consideration of context, and the main consideration is the indoor noise levels at night with partially open windows. The specific noise level of 28 dBA at R_5764 and 26 dBA at R_14222 are found to be 13 dBA and 11 dBA respectively assuming a 15 dB reduction outside-to-inside. That assumption is a typical figure for traffic noise, not transformers, and even for traffic noise a reduction of as little as 10 dB is often quoted, and with fully open windows it could be only 5 dB. What is not considered under "context" is that at a frequency of 100Hz (a medium to low hum) many rectangular rooms have resonant modes, and should a room happen to have a resonant mode at exactly 100Hz the outside-to-inside reduction could even be negative, (i.e. it could be noisier indoors than outdoors). There is also an effect when there are two or more transformers where their individual noise levels can combine (through a process called constructive interference) to give a higher cumulative total than the energy sum normally used. In their report on EA2 the ExA found that "interference may occur and cannot be ruled out". These effects mean that it is not safe to invoke "context" as a means of dismissing the conclusions of Table 1.8.

Construction noise and vibration

Table 9.20 of the ES presents Construction Noise Assessment Summary of Potential Significant Effects (Without Additional Mitigation) including four receptors with a large impact of major significance.

Inadequate consideration of methods of mitigation of construction noise

Table 9.23 then presents the results with a blanket mitigation effect of 10 dB applied in every case without any specific calculation to demonstrate that such a reduction is practicable. The Construction Noise and Vibration Management plan relies on a requirement to achieve "Best Practicable Means" and therefore if a mitigation measure capable of achieving a 10dB reduction proves impracticable, the results in Table 9.23 will not be achieved.

Cumulative effects

While there is consideration elsewhere in the ES of cumulative effects with other projects in the localities affected, including LionLink, there is insufficient consideration of potential cumulative effects in the Noise and Vibration reports in the ES to justify the fact that they have been scoped out with respect to these topics.

Yours faithfully

[redacted]

R.M. Thornely-Taylor
Director

EirGrid

CELTIC INTERCONNECTOR

Preliminary Acoustic Study

Co-financed by the European Union
Connecting Europe Facility

MAY 2020

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Preliminary Acoustic Study

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EXECUTIVE SUMMARY

On behalf of EirGrid, WSP has undertaken a preliminary acoustic study of potential noise levels from the operation of a High Voltage Direct Current (HVDC) converter station at the three site options: Ballyadam (site reference CSS1); Meeleen (site reference CSS12), and Knockraha (site reference CSS9B).

The study comprises 3D acoustic models of each of the sites to establish the likely noise levels at the nearest Noise Sensitive Locations (NSLs). The models are based upon an assumed preliminary site layout, representative noise data for the proposed HVDC equipment, and Digital Terrain Modelling (DTM) data provided by Ordnance Survey Ireland. Please note that the assessment has been carried out in the absence of site-specific studies, including topographical surveys.

In the absence of baseline noise measurements, which will be undertaken to inform a further assessment at the planning stage, two sets of indicative noise limits have been proposed, based on those set out in Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). The limits in NG4 on which this study is based are the general noise limits and the more onerous noise limits for areas of low background noise. This study assumes the night-time noise limits in both cases, which are more stringent than the associated daytime and evening limits.

The guidance and limits in NG4, whilst intended for use in the assessment of industrial sites licensed by the Environmental Protection Agency (EPA), serve as a reasonable noise limits for the purposes of this assessment of non-licensed utility sites, as has been suggested in advisory document Environmental Noise Guidance for Local Authority Planning & Enforcement Departments (dated June 2019) by the Association of Acoustics Consultants of Ireland (AACI).

The modelling results indicate that, for the initial indicative site layout and orientation and in the absence of mitigation, there are NSLs around each of the sites, which are predicted to be exposed to noise levels in excess of the NG4 guidance noise limits. It is important to note, however, that these indicative limits may be subject to change at the planning stage, once targeted site studies, including baseline noise measurements have been undertaken to establish noise levels.

An investigation of the site layout, site orientation and of noise source mitigation options has been undertaken to minimise noise levels at the nearest NSLs to all three site options. It is predicted that noise levels at NSLs around the three site options are likely to be able to meet the most stringent noise limit of 30 dB as set out in NG4, should it be needed. This could be achieved with mitigation applied to equipment within the site compound whilst maintaining the site layout and orientation. The 30 dB noise limit equates to the noise limit for areas of low background noise during the night time set out in NG4 and includes a 5 dB penalty to account for the possibility of tonal character exhibited from noise sources within the converter station site compound.

The site option at which noise levels predicted at the most exposed NSL are lowest is Meeleen. However, the background noise levels at the most exposed NSL to Meeleen may also be lower than at the other two site options. The proximity of existing noise sources to Knockraha (i.e. substation) and Ballyadam (N25 dual carriageway), for example, may preclude the need for such low noise limits at these sites. Therefore, the site which may be considered the best performing with regard to noise would depend on the existing background noise levels around each of the sites and their associated NSLs.

Note that as this study has been undertaken in the absence of baseline noise measurements the results should be read as preliminary and indicative and are for use at the consultation stage only.

1 INTRODUCTION

1.1.1. EirGrid is undertaking a programme of public consultation events for the Celtic Interconnector project, which proposes the construction and operation of a HVDC converter station and associated onshore cables in Ireland.

1.1.2. There are currently three site options being considered during the public consultation process, which are in Ballyadam; Meeleen; and Knockraha, County Cork. At present, consultation responses have included reference to the operational noise of the converter station as being a primary concern.

1.1.3. Consequently, EirGrid has appointed WSP to undertake a preliminary acoustic study of potential noise impacts from the operation of the converter station at the three site options.

1.1.4. This study is part of the pre-planning consultation process and site layouts may continue to evolve as part of the micro-siting exercise. This report describes the preliminary site layouts it is based on which were current at the time of the study. Any distances to closest receptors and the like are based on these layouts.

1.1.5. A 3D acoustic model has been created for each of the sites to establish the likely noise levels at the nearest Noise Sensitive Locations (NSLs). The models are based upon a preliminary site layout, representative noise data for the proposed HVDC equipment, and DTM data provided by Ordnance Survey Ireland. However, the assessment which will take place at the planning stage will take into account the engineered ground and finished floor levels, based upon topographical surveys and ground investigation.

1.1.6. As part of the study, a range of potential noise mitigation options have been explored, in order to minimise the likelihood of noise impacts at the NSLs. The results of the modelling exercise are used to inform a comparison of the three sites, to establish which is likely to be the most favourable in terms of noise.

1.1.7. Note that whilst the results of the modelling exercise are compared to noise guidance to provide some context, the purpose of this study is not to determine compliance with noise limits. This will be needed at the planning stage with criteria to be informed by the results of baseline noise measurements and relevant planning policy. As such, the modelling results and subsequent assessment herein should be considered preliminary and indicative for use at the pre-planning consultation stage only.

1.1.8. Please also note that the assessment has been carried out in the absence of site-specific studies, including topographical surveys.

2 PROPOSED DEVELOPMENT AND SITE DESCRIPTIONS

2.1 INTRODUCTION

2.1.1. This section provides details of the site layout and dominant noise sources within the converter station compound and a description of each of the three proposed sites. Plans indicating the approximate location of each of the three modelled sites are provided in **Appendix A**. These modelled sites are based on indicative site areas in advance of the micro-siting exercise being carried out as part of the detailed design stage of the project.

2.2 PROPOSED DEVELOPMENT

2.2.1. The proposals include an HVDC converter station compound with a footprint of up to 45,000 m^2, which will connect to the existing Knockraha substation and facilitate the transmission of electrical power between Ireland and France. The indicative converter station comprises the following key structures and components:

- Buildings
  - Valve hall
  - DC hall
  - Reactor hall
  - Control building
  - Store building
- Transformers
  - Converter transformers
  - Transformer cooling fans
- Valve cooling fan banks
- AC harmonic filters and switchyard
  - AC Filter reactors
  - AC Filter capacitors
  - Compensation reactor

2.2.2. Of the structures and components listed above, the dominant noise sources are the converter transformers, the transformer cooling fans and the valve cooling fan banks. These plant items are all external to the buildings for safety reasons and to allow sufficient airflow. Noise from equipment located within the buildings is usually not dominant owing to the sound insulation performance of the building envelope. The internal noise sources have been excluded from this assessment.

2.2.3. The proposed development is understood to operate continuously throughout the day and night time periods, with variations in power output correlating with typical diurnal energy demands.

2.3 THE MODELLED SITES

BALLYADAM

2.3.1. The modelled site is located in a rural area which lies between the towns of Carrigtohill and Midleton. The modelled converter station area within the Ballyadam site is based on an indicative location identified at an early stage of the pre-panning consultation work and prior to the micro-siting exercise and, therefore, may evolve as the project progresses.

2.3.2. A railway line is located parallel to the northern site boundary at a distance of approximately 90 m and the site is bounded to the east and west by agricultural land, interspersed with dwellings. The N25 dual carriageway lies approximately 240 m south of the southern site boundary and Milebush Quarry, is located south of the N25.

2.3.3. It is anticipated that the dominant existing noise sources in proximity to the site are road traffic on the N25 and passing trains along the railway which are limited to 05:00 and 23:00 hours during a typical weekday. Operational noise from particular activities in the quarry, such as blasting and drilling (if present) and crushing may be perceptible in the area surrounding the site, however operations are restricted to daytime hours and are likely to be masked to a significant degree by road traffic on the intervening N25.

2.3.4. There are approximately 56 NSLs located within 1 km of the site boundary, the closest of which is located north of the railway line, approximately 130 m from the northern site boundary. The remaining NSLs are located in all directions around the site.

MEELEEN

2.3.5. The modelled site is located in a largely rural area approximately 1.4 km north east of Knockraha village. The site is bounded immediately to the north and west by Kilquane forest and by open land to the south and east.

2.3.6. There are no significant noise sources noted in close proximity to the site, with the nearest road located approximately 370 m to the south east of the site, which is an unnamed and unmarked single carriageway. The M8, located approximately 3.3 km to the west, may be perceptible under certain weather conditions. As such, there appear to be no dominant noise sources close to the site.

2.3.7. There are approximately 16 NSLs located within 1 km of the site boundary, the closest of which is located approximately 400 m south-east of the site. The remaining NSLs are located to the north-west and south-east of the site.

KNOCKRAHA

2.3.8. The modelled site is located in a largely rural area to the south east of Knockraha village. Approximately 160 m to the west lies Knockraha substation and approximately 60 m to the south lies an unmarked and unnamed single carriageway. The site is bounded to the north and east by agricultural land.

2.3.9. It is anticipated that the dominant source of noise in proximity to the site is operational noise from Knockraha substation, which operates continuously during the daytime and night time periods. Noise from traffic on the road to the south is likely to be perceptible, however vehicle movements are anticipated to be infrequent.

2.3.10. There are approximately 32 NSLs located within 1 km of the site boundary, the closest of which is located approximately 230 m to the east of the site. The remaining NSLs are located in all directions around the site.

3 NOISE GUIDANCE

3.1 INTRODUCTION

3.1.1. This section presents a summary of the noise guidance and limits for proposed industrial development in Ireland and a review of their suitability for the proposed development. Further noise guidance details are provided in **Appendix B**.

3.2 GUIDANCE NOTE FOR NOISE: LICENCE APPLICATIONS, SURVEYS AND ASSESSMENTS IN RELATION TO SCHEDULED ACTIVITIES (NG4)

3.2.1. Guidance note NG4 (dated January 2016), produced by the Environmental Protection Agency (EPA), is designed to provide acoustic guidelines to the operators of activities which are listed in the First Schedule of the Environmental Protection Agency Act (EPAA)[1]. Such activities include those undertaken in industrial, waste and agricultural sectors regulated by the EPA, and whilst HVDC converter stations are *not* subject to EPA regulation, or listed in the First Schedule of the EPAA, NG4 is commonly applied to such development, in the absence of other more authoritative Irish noise guidance. Note also that NG4 adopts key elements of BS 4142: 2014: *Methods for rating and assessing industrial and commercial sound*, which is the guidance document used in the UK for the assessment of noise from development such as the proposed converter station.

3.2.2. The document provides guidelines on acceptable environmental noise survey practices and a clear four-step procedure for setting applicable noise limits. The four steps are:

- Step 1 – Quiet area screening of the development location
- Step 2 – Baseline environmental noise survey
- Step 3 – Screen for areas of low background noise
- Step 4 - Determine appropriate noise criteria

3.2.3. Noise limits are typically set at the most exposed window of NSLs, however this is implied rather than stated in the guidance. NSL's are defined as:

"*…any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels*"

3.3 THE SUITABLE APPLICATION OF NG4

3.3.1. The application of noise limits presented in NG4 for utility installations outside of EPA regulation is recognised in the advisory document *Environmental Noise Guidance for Local Authority Planning & Enforcement Departments* (dated June 2019), published by the Association of Acoustics Consultants of Ireland (AACI). Section 11 of the document states:

"Industrial installations regulated by the EPA are typically subject to noise limits drawn from EPA document NG4 Guidance note for noise: Licence applications, surveys and assessments in relation

[1] First Schedule to the EPA Act 1992 as amended

to scheduled activities (2016). On this basis, NG4 is also arguably the most relevant guidance document with respect to industrial facilities regulated by Local Authorities."

3.3.2. Furthermore, we note that in granting planning consent for Knockraha substation reconfiguration (planning reference *ABP PL.04.244030/CCC Reg. Ref. 13/06402*), located in proximity to the proposed Knockraha site, An Bord Pleanála attached the following condition, which imposes noise limits for the substation, which bear similarity to the general noise limits set out in NG4:

"The noise level from the proposed development during operational stage shall not exceed 55 dB(A) rated sound level at the nearest noise sensitive location between 0800 and 2000 hours, Monday to Saturday inclusive, and shall not exceed 45 dB(A) at any other time."

3.3.3. Therefore, whilst it is acknowledged that HVDC converter stations are *not* industrial installations which are subject to licensing by the EPA, the limits and procedure for defining them presented in NG4 may be considered to provide a reasonable indication of the likely limits imposed at the planning stage by An Bord Pleanála and bear similarity to limits imposed on other industrial power sites.

4 ACOUSTIC MODELLING

4.1 INTRODUCTION

4.1.1. This section presents details of the approach to the modelling exercise for each of the three sites, including information regarding the modelled sources of noise. Also presented are any assumptions made in generating the models.

4.2 GENERAL

4.2.1. Detailed acoustic models of the three sites and their respective surrounding areas have been produced to assist in calculating the preliminary noise levels at the facades of NSLs located within 1 km of each of the sites. The models have been generated using CadnaA® noise mapping software and the modelled site is based upon the preliminary site layout drawing provided by the WSP Power Systems engineering team, which is presented in **Appendix C**, for reference.

4.2.2. The topography included in the models has been based on Digital Terrain Model (DTM) data provided by Ordnance Survey Ireland (OSI). For the purpose of this assessment it has been assumed that the finished levels across the sites will be similar to the existing topography, however, at the planning stage, the noise assessment will be based on finished floor levels, which will be provided by ground engineers. The DTM data provided by OSI were of a resolution which varied between 2m and 10m. A review of the land between the three modelled sites and the NSLs indicated that the topography does not undulate sufficiently to require more detailed DTM data for the purpose of this assessment. However, higher resolution DTM will be acquired for the detailed assessments required for the planning stage work.

4.2.3. The following general assumptions have been made in the preparation of the acoustic models:

- The model assumes downwind conditions which is considered a reasonable worst case.
- Ground absorption has been set at 1 to reflect the soft ground cover between the noise sources and the proposed facades.
- The dwellings and other miscellaneous buildings in the areas surrounding the three sites have been modelled at a height of 8 m.
- Given that the proposed development operates continuously, it follows that any noise impacts at NSLs are most likely during the night time period, when background noise levels are typically at their lowest and residents are at their most sensitive to noise. As such, receivers (i.e. calculation points) have been set at a height of 4.5 m above local ground level to reflect the typical location of bedrooms at first floor level.
- Receivers have been located at the facades of NSLs which are nearest to the three sites.

4.3 THE PROPOSED DEVELOPMENT

4.3.1. The orientation of the converter station compound in all three site options was modelled such that the AC switchyard was located closest to Knockraha substation to minimise the three-phase cable route between the two compounds. However, the final design will be based on further noise modelling which may influence the orientation of the converter station such that the propagation of noise to the NSLs is minimised.

4.3.2. The converter station building heights have been set based upon experience from similar projects and have been reviewed by WSP's Power Systems engineering team to ensure reasonable clearance is provided for equipment located within the buildings.

4.3.3. Noise transmission through the building envelope from equipment located within the buildings (e.g. thyristors) has not been modelled as the dominant sources of noise across the site are the equipment which are located externally. However, internal noise sources will be included in the more detailed planning stage noise model.

4.3.4. Noise data for the converter station have been sourced from publicly available information and from WSP's own library of data from previous interconnector projects which are no longer subject to non-disclosure agreements. These data have been reviewed by WSP's Power Systems engineering team to ensure that they are representative of the equipment which might be included in the final design. The noise data used in the model have been input in octave band format between 31 Hz (i.e. low frequency) and 8000 Hz.

4.3.5. The externally located equipment included in the noise model is as follows:

- 3 no. converter transformers (i.e. one per phase)
- 36 no. transformer cooling fans (i.e. 12 per transformer)
- 10 no. valve cooling fan banks
- 3 no. AC filter capacitors (i.e. one per phase)
- 3 no. AC filter reactors (i.e. one per phase)
- 1 no. compensation reactor (i.e. one three-phase reactor)

4.3.6. The octave band and A-weighted noise data for each of the above items, along with the assumed modelled heights is provided in tabular form in **Appendix D**.

4.3.7. A preliminary model for each of the three sites has been prepared, which is based upon the provided site layout and orientation and does not include any mitigation. Where noise levels at NSL's are predicted to exceed the proposed likely noise limits, a range of preliminary mitigation options have been explored, which are described in further detail in Section 5.5 of this report.

5 NOISE ASSESSMENT

5.1 INTRODUCTION

5.1.1. This section provides a preliminary assessment of the potential noise effects at the nearest and/or most exposed NSLs to the three sites and explores potential mitigation options to minimise noise levels. This assessment is based upon a Quiet Area site review and indicative noise limits – see Section 3, above.

5.1.2. Also provided is a comparison of the three sites to establish which is likely to be the most favourable in terms of noise.

5.1.3. Note that, in lieu of baseline noise measurements, the findings in this section should be treated as preliminary and indicative, only.

5.2 QUIET AREA SITE REVIEW

5.2.1. A review of each of the sites is presented, below, to establish whether any may be designated a 'Quiet Area'. This review has been undertaken using publicly available mapping data.

Table 5.1 – Quiet Area screening review for the three site options

Quiet area screening criteria	Ballyadam*	Meeleen	Knockraha
At least 3 km from urban areas with a population >1,000 people	x	✓	✓
At least 10 km from any urban areas with a population >5,000 people	x	x	x
At least 15 km from any urban areas with a population >10,000 people	x	x	x
At least 3 km from any local industry	x	✓	✓
At least 10 km from any major industry centre	x	x	x
At least 5 km from any National Primary Route	x	✓	✓
At least 7.5 km from any Motorway or Dual Carriageway	x	x	x
*Ballyadam modelled site is approximately 3km from the western edge of Midleton which has a population of >1,000 people.			

5.2.2. Table 5.1 indicates that none of the three sites satisfy all of the criteria for a 'Quiet Area', with the Ballyadam site meeting none of the seven criteria and Meeleen and Knockraha both meeting three. Therefore, it is anticipated that planning stage noise limits are likely to be based upon those set out in NG4 for *areas of low background noise* (Step 3), or the higher limits set out in NG4 known as the *general noise limits,* which are proposed for sites with more elevated background noise levels and which are based upon the limits set out in World Health Organisation's *Guidelines for community noise*[2].

5.3 INDICATIVE NOISE LIMITS

5.3.1. In the absence of baseline noise measurements, at this preliminary stage, two sets of indicative noise limits are proposed which are based upon the limits in NG4 for areas of low background noise and the less onerous general noise limits. Both sets of noise limits are provided in Table 5.2, below.

Table 5.2 – Noise limits set out in NG4 for areas of low background noise and general noise

NG4 Noise Limit	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night Noise Criterion, dB $L_{Ar,T}$ (23:00 to 07:00hrs)
Limits for areas of low background noise	45	40	35
General noise limits	55	50	45

5.3.2. Both sets of limits comprise day, evening and night time noise levels. However, as the proposed development will operate continuously over the 24-hour period, the primary consideration is the night time, when noise limits are most stringent. It follows, however, that if predicted noise levels at NSLs meet the required limits during the night time period, then noise limits are likely to be met comfortably during the day and evening periods. As such, this may be considered the worst case-scenario.

5.3.3. NG4 states that during the night time period, '*tonal noise from the facility should not be audible at any NSL*', however a 5 dB penalty should be applied for any audible tonality at NSLs during the day and evening. The likelihood of tonal noise cannot, at this preliminary stage, be discounted. Therefore, consideration is given to noise limits which account for audible tonality.

5.3.4. A 5 dB penalty for tonality has been applied to the night time criteria which results in limits of 40 dB in accordance with general noise limits in NG4 and 30 dB in accordance with the more onerous noise limit for areas of low background noise.

5.4 PRE-MITIGATION NOISE LEVELS

5.4.1. The most exposed NSL to each of the three sites are as follows:

- Ballyadam –NSL located 130 m to the north
- Meeleen – NSL located 400 m to the south-east
- Knockraha – NSL located 550 m to the west*

  * - Note that the *nearest* NSL to the Knockraha site is located 230 m to the east of site, however due to the screening effect from buildings within the proposed development, this NSL is not predicted to be the NSL most exposed to noise. This is with reference to the indicative layout at the pre-planning consultation stage and will be reviewed as the layout evolves as part of the micro-siting exercise.

[2] Guidelines for Community Noise. World Health Organisation, 1999

5.4.2. Noise levels have been predicted at each of the above NSLs, which are presented below in Table 5.3, along with the two indicative noise limits from NG4 (with and without the 5 dB penalty for tonality). The pre-mitigation noise levels at each site are also presented as noise contour plots in **Appendix E**.

Table 5.3 – Predicted noise levels at the most exposed NSLs and night-time noise limits

Site option	**Most exposed NSL**	**Predicted noise level, dB**	**General noise limit in NG4, dB**		**Area of low background noise limit in NG4, dB**	
			Night-time Limit	Night-time Limit (inc. tonality)	Night-time Limit	Night-time Limit (inc. tonality)
Ballyadam	130 m to the north	43	45	40	35	30
Meeleen	400 m to the south-east	36				
Knockraha	550 m to the west	37				

5.4.3. Table 5.3 indicates that the predicted noise level at the most exposed NSL to the Ballyadam site is 43 dB, which falls below the night-time general noise limit in NG4 by 2 dB (or exceeds the limit by 3 dB including the penalty for tonality) and exceeds the low background noise limit by 8 dB (or by 13 dB including the penalty for tonality).

5.4.4. The predicted noise level at the most exposed NSL to the Meeleen site during the night time is 36 dB, which falls below the general noise limit in NG4 by 9 dB (or by 4 dB including the penalty for tonality) and exceeds the low background noise limit by 1 dB (or by 6 dB including the penalty for tonality).

5.4.5. The predicted noise level at the most exposed NSL to the Knockraha site during the night time is 37 dB, which falls below the general noise limit in NG4 by 8 dB (or by 3 dB including the penalty for tonality) and exceeds the low background noise limit by 2 dB (or by 7 dB including the penalty for tonality).

5.4.6. The above results indicate that there is the potential at each site for noise levels to exceed night-time noise limits, particularly should noise sources exhibit tonal acoustic character. Therefore, consideration is given below to possible mitigation measures to ameliorate potential noise impacts at NSLs.

5.5 MITIGATION

5.5.1. Consideration is given below to mitigation options which may be applied to the most dominant noise sources, or at the site boundary. Consideration is also given to the site layout and the orientation of the sites in relation to their surroundings.

SITE LAYOUT

5.5.2. When exploring options for reconfiguring the site layout to minimise potential noise impacts, priority must be given to ensuring that the operation of the site is not undermined and that any proposed changes do not significantly impact on other design considerations. The preliminary site layout used for this assessment is shown in **Appendix C.**

5.5.3. The dominant sources of noise within the compound are the transformers and associated fans; the valve cooling fan banks; and the equipment located in the AC switchyard (i.e. harmonic filters, capacitors and reactors).

5.5.4. The transformers and fans are located adjacent to the reactor hall which is common to converter station design and necessary to operation. This configuration provides NSLs which are located towards the DC end of the site with some acoustic screening from the hall. Additionally, the blast walls located on either side of the transformers as a safety feature also act as an effective barrier to noise which is emitted laterally from the equipment to the NSLs.

5.5.5. The valve cooling fan banks have been located between the control building, store building and the DC, valve and reactor halls, providing effective acoustic screening laterally and towards the DC end of the compound. Locating valve cooling fan banks between these buildings is a common design feature of converter stations in that the banks need to be in proximity to the halls and benefit from acoustic screening from the nearby buildings. As such, locating the fans between the buildings is deemed the most effective in terms of noise.

5.5.6. It is noted at the Ballyadam site option, however, that the most exposed NSL is located 130 m to the north of the site where the nearest sources of noise from within the converter station compound would be the valve cooling fan banks, assuming the initial indicative layout. Should the site buildings and equipment be reconfigured slightly, such that the valve, reactor and DC halls are located towards the northern area of the site with the fan banks located further south, the most exposed NSL benefits from acoustic screening from the fan banks, afforded by the buildings within the converter station compound. The viability of reconfiguring the buildings in this way will need to be seen alongside other site constraints during the planning stage work to ensure the effective operation of the converter station.

5.5.7. This revised site layout has been incorporated into the noise model in the absence of any other form of mitigation. The predicted noise level during the night-time period at the most exposed NSL to the north is 41 dB, which is 2 dB lower than the predicted level assuming the initial indicative layout (as indicated in Table 5.3).

5.5.8. The predicted noise level at the nearest NSL to the south of the Ballyadam site, which is located approximately 500 m south of the southern boundary of the site, is 40 dB assuming the revised layout, which is equal to the predicted noise level at the NSL assuming the default site layout. Consequently, the relocation of the valve cooling fan banks is predicted to be of benefit to the NSL to the north and of no detriment to the other NSLs surrounding the site. As stated above, it is important to note, however, that whilst this revised site layout is predicted to be the better option in terms of minimising noise impacts at NSLs around the site, there are other design considerations which must be accounted for to ensure the effective operation of the converter station.

5.5.9. With regard to the location of valve cooling fan banks at the Meeleen and Knockraha sites, the locations of the NSLs around the sites are such that any potential acoustic benefit which may be afforded by relocating the fans, is predicted to be negligible.

5.5.10. The equipment in the AC switchyard is perhaps less constrained in terms of space than the transformers and valve cooling fan banks, however, the equipment connections in this area are reasonably rigid and an amount of clearance is required between equipment for safety and access. Consequently, the equipment in this area cannot be confined to a smaller footprint and the acoustic benefit which is likely to be achieved in doing this would be negligible, given the comparatively large distances between the NSLs and the converter station site options.

5.5.11. In summary, the dominant sources of noise are reasonably constrained in terms of relocation as allowances need to be made for effective operation of the site. However, reconfiguring the layout at the Ballyadam site such that the valve cooling fan banks are relocated towards the southern boundary and the halls relocated towards the north, is anticipated to reduce noise levels at the most exposed NSL located north of the site. Therefore, it is advised that consideration should be given to the feasibility of this reconfigured layout as the scheme evolves.

BOUNDARY ACOUSTIC BARRIER

5.5.12. Acoustic screening located on or around a site boundary is typically in the form of an acoustic fence or earth berm (or a combination of both).

5.5.13. Table 5.4 presents the predicted noise levels at the most exposed NSL to each site, with the inclusion of an acoustic fence, or an earth berm on the site boundary. In order to directly compare the predicted acoustic screening effect from both barrier options, the acoustic fence and berm have been modelled at a height of 2 m, which would provide an element of visual screening at ground level and have also been modelled at a height of 5 m (i.e. a height at which some acoustic screening effect would be anticipated). Note that the results indicate the effect of the barriers, alone, and the site includes no other forms of mitigation.

Table 5.4 – Predicted noise levels at the most exposed NSLs including an acoustic fence or berm

Barrier height	Predicted noise level at the most exposed NSL, dB					
	Ballyadam*		Meeleen		Knockraha	
	Fence	Berm	Fence	Berm	Fence	Berm
no barrier	43		36		37	
2 m	43		36		37	
5 m	41	38	36		34	
*Ballyadam results are for the initial indicative layout.						

5.5.14. It can be seen in Table 5.4 that the predicted noise levels at the most exposed NSL for the Ballyadam site range from 43 dB with no acoustic fence at the boundary to 41 dB with a 5 m high barrier, which is a range of 2 dB. A 2 m high fence is predicted to yield no attenuation.

5.5.15. At the same NSL, the noise level is predicted to be 38 dB with a 5 m high berm, with no attenuation predicted with the inclusion of a 2 m high berm. The improved performance of the berm in comparison to the fence is likely to be attributable to the intervening topography between the NSL and the sources of noise within the site, which increases in height from the sources in the direction of the NSL.

5.5.16. The typical footprint required to construct a berm of 5 m in height means that the crest of the berm is located 15 m from the site boundary, assuming the berm is located as close to the boundary as possible, where topographical levels are higher than those at the site. The acoustic fence, however, is located at the site boundary, where topographical levels are lower. In effect, the crest of the berm is higher than that of the fence, relative to the sources and NSL, despite both being 5 m high relative to their respective local topographical level. The result of this at the Ballyadam site is that the berm is predicted to be more effective at attenuating noise to the north of the site than the fence.

5.5.17. The predicted noise levels at the most exposed NSL for the Meeleen site indicate that a 2 m high fence and a 2 m high berm would each yield no noise attenuation and 5 m high fence and a 5 m high berm would also each yield less than 1 dB of noise attenuation.

5.5.18. The predicted noise levels at the most exposed NSL for the Knockraha site range from 37 dB with no acoustic mitigation at the boundary to 34 dB with a 5 m high fence or a 5 m high berm , which is a range of 3 dB. A 2 m high fence or berm is predicted to yield no attenuation.

5.5.19. In summary, these results indicate that:

- a 2 m high fence or berm is likely to be ineffective in attenuating noise from any of the sites;
- a 5 m high fence is predicted to provide 3 dB attenuation at the Knockraha site, 2 dB at the Ballyadam site and no attenuation at the Meeleen site; and
- a 5 m high berm is predicted to provide 3 dB attenuation at the Knockraha site (i.e. the same predicted attenuation as the fence), 5 dB at the Ballyadam site (i.e. 3 dB more attenuation than the 5m high fence), and no attenuation at the Meeleen site (i.e. the same as the fence).

5.5.20. Therefore, both the fence and berm offer similar performance at the three sites, with the exception of Ballyadam, where the berm is predicted to offer a 2 dB improvement in noise attenuation at the most exposed NSL to the north of the site when compared to the fence. This improvement is as a result of the topography surrounding the Ballyadam site.

5.5.21. Whilst the above results indicate that some acoustic screening is afforded by the inclusion of a fence or berm, consideration should be given to the amount of attenuation achievable on balance with the practicalities and cost of these options. Typically, the application of mitigation to the *sources* of noise (i.e. applied to the equipment) is preferable to mitigation applied *further afield* (i.e. in the intervening land between the noise sources and the NSLs, such as berms or fences), as mitigation applied closest to the source is considered the most effective (where practicable). Therefore, options for mitigation at the noise source are explored, below.

NOISE SOURCE MITIGATION

5.5.22. Table 5.5 presents the source mitigation measures which have been considered in this section. Details of the sound insulation performance are provided in tabular form in **Appendix C**.

Table 5.5 – Range of potential mitigation options to equipment within the compound

Equipment	Mitigation applied
Converter transformers	acoustic enclosure
Transformer cooling fans	attenuators to all fans
Valve cooling fan banks	acoustic barrier / louvered enclosure and acoustic lined cowl
AC filter capacitors	sound shield
AC filter reactors	top hat and sound shield
Compensation reactor	top hat and sound shield

5.5.23. With particular regard to the valve cooling fan banks, there exist a number of potential mitigation measures which may be applied. Potential options include:

- An acoustic L-shaped barrier located at the side of the fan banks nearest to the site boundary (adjoining the control building).
- A louvered enclosure around the perimeter of the banks from ground level to the height of the fan outlet and an acoustically lined cowl extending vertically upward from the fan outlet around each fan within the banks.
- Reduced fan speed.
- Lower fan heights (default height at 3 m), with an increased number of fans to compensate for the reduced airflow.

5.5.24. Of the options presented above, the least effective in terms of noise mitigation is anticipated to be the lower fan heights with additional fans within the banks to compensate for the reduced airflow. Whilst the minimum height to which the fans can be lowered has not been determined at this preliminary stage (this is dependent on fan airflow requirements which would be specified at the detailed design stage), it is not likely that the fans can be significantly lower than one metre, to allow for the fan dimensions.

5.5.25. The fan banks have been modelled at each of the sites at one metre in height (rather than 3m in height used for the initial indicative layout – see noise model outputs in **Appendix E**) to establish the likely limits of any acoustic benefit which may be afforded (i.e. the lower the fans, the better, acoustically). The lowered fans have been modelled in the absence of any other mitigation to noise sources within the compound or acoustic barriers at or around the boundary.

5.5.26. For each site, the predicted noise level from the fan banks at the most exposed NSL decreased by no more than 2 dB when compared with predicted noise levels from fan banks at 3 m in height. Furthermore, as the number of additional fans needed to compensate for the required airflow has not been determined at this preliminary stage, the increase in noise level as a result of the additional fans has not been accounted for. As such, the increase in noise level from the additional fans is likely to (at least in part) offset the potential reduction in noise level at the most exposed NSLs achieved by lowering the fans.

5.5.27. The inclusion of a louvered enclosure around the perimeter of the fan banks (though open faced at the top to allow for airflow), along with acoustically lined cowls for each of the fans is conservatively estimated to attenuate fan noise emissions by 7 dB. By comparison, the modelling results indicate a similar level of noise attenuation for the fan banks can be achieved at the most exposed NSL to

Ballyadam through the inclusion of a 6 m high acoustic L-shaped barrier located north of the fan banks.

5.5.28. For the Knockraha site, the NSL most exposed to noise emissions specifically from the fan banks (i.e. not considering other noise sources within the compound) is located approximately 230 m east of the site boundary. This is closer than the most exposed NSL mentioned in Section 5.4.1 above which is the most exposed NSL when considering noise from all sources within the compound. To achieve a similar level of noise attenuation as the louvered enclosure and cowls at the NSL to the east, a 7 m high barrier acoustic barrier located between the DC hall and the store building towards the eastern boundary is predicted to be sufficient. This acoustic barrier would be in place of the L-shaped barrier adjoining the control building.

5.5.29. For the Meeleen site, noise emissions from the fan banks are not anticipated to dominate the noise climate at the most exposed NSL and, consequently, the inclusion of an acoustic barrier has not been considered.

5.5.30. As an additional option, a reduction in fan speed is conservatively estimated to reduce noise emissions from the fan banks by 3 dB, though this is typically determined through the fan specification at the design stage.

5.5.31. Whilst reducing the fan speed is not deemed the most effective measure in isolation, it may be used in combination with other mitigation options, should it be required. It should be noted that, whilst each of the other mitigation options for attenuating noise emissions from the fan banks have been considered in isolation for comparative purposes, they may also be applied in combination, to provide increased attenuation. The above comparison is intended at this stage to provide an indication of the efficacy of the available options. It is advised that further assessment of the most appropriate form of mitigation or combination of measures for the fan banks is undertaken at the planning stage, when the scheme has developed further.

5.5.32. The following sections set out potential mitigation measures which may be adopted to meet the indicative noise limits for each of the three sites; the resulting contours are presented in **Appendix E**. The options which have been explored are limited to noise source mitigation of equipment located within the converter station compound and do not account for any additional acoustic benefit which may be afforded by reconfiguration of the site layout, or inclusion of an acoustic barrier at or around the site boundary, both of which have been discussed earlier in this report. It should be noted, however, that these other forms of mitigation can be used in combination with the noise source mitigation measures set out below, to reduce noise levels even further at the most exposed NSLs.

5.5.33. Note also that for the attenuation of noise emissions from the fan banks in the sections below, the form of mitigation adopted is the acoustic barrier, as space for such a barrier has been demarked in the site layout plan provided by WSP Power Systems engineering team. However, this is for illustrative purposes and sufficient noise mitigation of noise emissions from the fan banks is also likely to be achievable through the inclusion of the louvered enclosure and cowls.

Ballyadam

5.5.34. The dominant sources of noise predicted at the most exposed NSL (with and without mitigation), are as follows:

1. Transformer cooling fans
2. Valve cooling fan banks
3. Converter transformers
4. AC filter capacitors
5. AC filter reactors

5.5.35. To meet a noise limit of 35 dB during the night time at the most exposed NSL (and all other NSLs by extension), which equates to the low background noise limit not including the penalty for tonality, the following mitigation would need to be applied.

Table 5.6 – Mitigation required to meet 35 dB during the night time

Equipment	Mitigation applied
3 no. converter transformers	acoustic enclosure
10 no. valve cooling fan banks	acoustic barrier of 5 m in height
36 no. transformer cooling fans	attenuators to all fans

5.5.36. To meet a noise limit of 30 dB during the night time at the most exposed NSL, which equates to the low background noise limit including the penalty for tonality (i.e. the lowest limit), the following mitigation would need to be applied.

Table 5.7 – Mitigation required to meet 30 dB during the night time

Equipment	Mitigation applied
3 no. converter transformers	acoustic enclosure
36 no. transformer cooling fans	attenuators to all fans
10 no. valve cooling fan banks	acoustic barrier of 7 m in height
3 no. AC filter capacitors	sound shield
3 no. AC filter reactors	top hat and sound shield

Meeleen

5.5.37. The dominant sources of noise predicted at the most exposed NSL, are as follows:

1. Transformer cooling fans
2. Converter transformers

5.5.38. To meet a noise limit of 35 dB during the night time at the most exposed NSL (and all other NSLs by extension), which equates to the low background noise limit not including the penalty for tonality, the following mitigation would need to be applied.

Table 5.8 – Mitigation required to meet 35 dB during the night time

Equipment	Mitigation applied
36 no. transformer cooling fans	attenuators to all fans

5.5.39. To meet a noise limit of 30 dB during the night time at the most exposed NSL, which equates to the low background noise limit including the penalty for tonality (i.e. the lowest limit), the following mitigation would need to be applied.

Table 5.9 – Mitigation required to meet 30 dB during the night time

Equipment	Mitigation applied
36 no. transformer cooling fans	attenuators to all fans
3 no. converter transformers	acoustic enclosure

Knockraha

5.5.40. The dominant sources of noise predicted at the most exposed NSL, are as follows:

1. Converter transformers
2. Transformer cooling fans
3. Valve cooling fan banks
4. AC filter capacitors
5. AC filter reactors
6. Compensation reactor

5.5.41. To meet a noise limit of 35 dB during the night time at the most exposed NSL (and all other NSLs by extension), which equates to the low background noise limit not including the penalty for tonality, the following mitigation would need to be applied.

Table 5.10 – Mitigation required to meet 35 dB during the night time

Equipment	Mitigation applied
3 no. converter transformers	acoustic enclosure

5.5.42. To meet a noise limit of 30 dB during the night time at the most exposed NSL, which equates to the low background noise limit including the penalty for tonality (i.e. the lowest limit), the following mitigation would need to be applied.

Table 5.11 – Mitigation required to meet 30 dB during the night time

Equipment	Mitigation applied
3 no. converter transformers	acoustic enclosure
36 no. transformer cooling fans	attenuators to all fans
10 no. valve cooling fan banks	acoustic barrier (of 7 m in height to the east, between the store building and DC hall)
3 no. AC filter capacitors	sound shield
3 no. AC filter reactors	top hat and sound shield
compensation reactor	top hat and sound shield

5.5.43. Note that noise from the valve cooling fan bank, passing between the control building and the DC hall will need to be controlled through the installation of a 7 m high barrier between the store building and DC hall, to ensure noise levels at the nearest NSL located approximately 230 m to the east of the site, meet the proposed limit.

SITE ORIENTATIONS

5.5.44. The current site orientations for the three sites, which are indicative at this stage and have been assumed only for the purposes of this study, are understood to have been determined such that the distances between the AC end of the site (i.e. switchyard) and the substation are minimised. At all sites, NSLs are located sparsely but in a number of directions around the boundary, which limits the directions in which the sites can be re-orientated.

5.5.45. Figures E-2, E-6 and E-10 in **Appendix E** present the contours for each of the sites in the absence of mitigation. The location of NSLs around each of the sites is such that there is no re-orientation option available which ensures that all NSLs are likely to be sufficiently protected from noise from the site in the absence of other mitigation measures.

5.6 SITE COMPARISON

5.6.1. Based on the predicted noise levels at each of the sites and the mitigation which is adjudged to be required to achieve the proposed noise limits, the site option at which noise levels predicted at the most exposed NSL are lowest is Meeleen. As such, the amount of mitigation likely to be required to achieve the indicative noise limits is anticipated to be lower than for the Ballyadam and Knockraha sites.

5.6.2. It should be noted, however, that whilst achieving lower noise levels at the most exposed NSL may be easier at the Meeleen site, the background noise levels at the most exposed NSL may also be lower than at the other two site options. The proximity of existing noise sources to Knockraha (i.e. substation) and Ballyadam (N25 dual carriageway), for example, may preclude the need for such low noise limits at these sites. Therefore, the site which may be considered most feasible with regard to noise would depend on the existing background noise levels around each of the sites and their associated NSLs and should be determined at the planning stage.

5.6.3. It is also acknowledged, that the noise impacts need to be judged alongside other design considerations and that the current standing of the three sites in terms of noise may not reflect the overall merits of the three sites, when considered with those other design considerations.

6 CONCLUSIONS

6.1.1. A preliminary acoustic study of potential noise impacts from the operation of the converter station at the three site options has been undertaken to support the pre-planning consultation process.

6.1.2. The study comprises 3D acoustic models of each of the sites to establish the likely noise levels at the nearest NSLs. The models are based upon an assumed preliminary site layout, representative noise data for the proposed HVDC equipment, and DTM data provided by Ordnance Survey Ireland.

6.1.3. In the absence of baseline noise measurements, two sets of indicative noise limits have been proposed, based on the general noise limits and the more onerous noise limits for areas of low background noise, set out in guidance document NG4 for the night time period. A review of the indicative site locations indicates that none of the three sites meet the criteria for a designated Quiet Area.

6.1.4. The modelling results indicate that, for the initial indicative site layout and orientation and in the absence of mitigation, there are NSLs around each of the sites, which are predicted to be exposed to noise levels in excess of the indicative noise limits. It is important to note, however, that, these indicative limits may be subject to change at the planning stage, once baseline noise measurements have been undertaken to establish the prevailing noise climate.

6.1.5. An investigation of the site layout, site orientation and of noise source mitigation options has been undertaken to minimise noise levels at the nearest NSLs to all three sites. It is predicted that noise levels at NSLs around the three sites are likely to meet an onerous noise limit of 30 dB, with mitigation applied to equipment within the site compound whilst maintaining the site layout and orientation. The 30 dB noise limit equates to the noise limit for areas of low background noise during the night time set out in NG4 and includes a 5 dB penalty to account for the possibility of tonal character exhibited from noise sources within the compound.

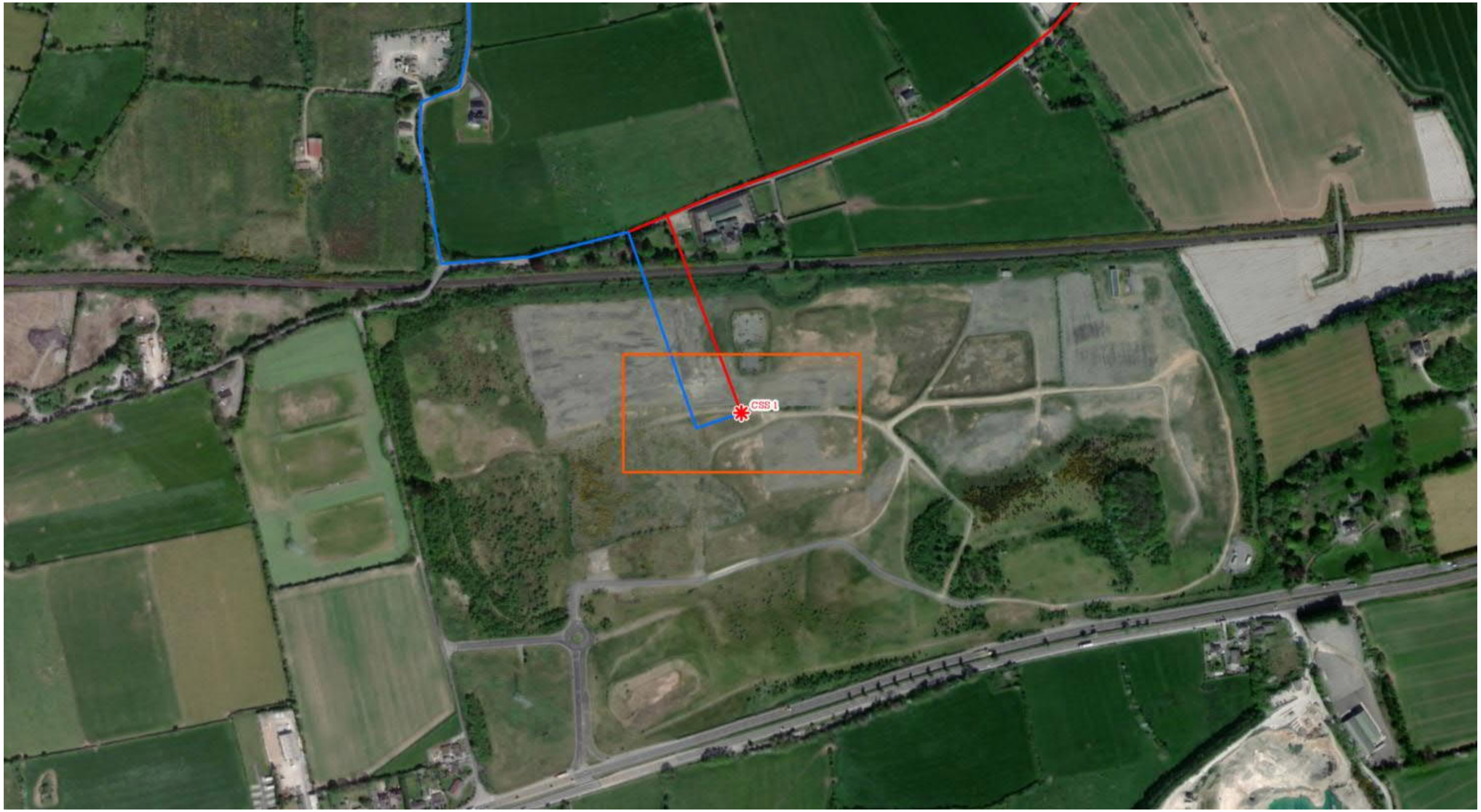
6.1.6. The site option at which noise levels predicted at the most exposed NSL are lowest is Meeleen. However, the background noise levels at the most exposed NSL to Meeleen may also be lower than at the other two site options. The proximity of existing noise sources to Knockraha (i.e. substation) and Ballyadam (N25 dual carriageway), for example, may preclude the need for such low noise limits at these sites. Therefore, the site which may be considered the best performing with regard to noise would depend on the existing background noise levels around each of the sites and their associated NSLs and should be determined at the planning stage.

6.1.7. Note that this study has been undertaken in the absence of baseline noise measurements and as such, the results should be read as preliminary and indicative for use at the consultation stage only.

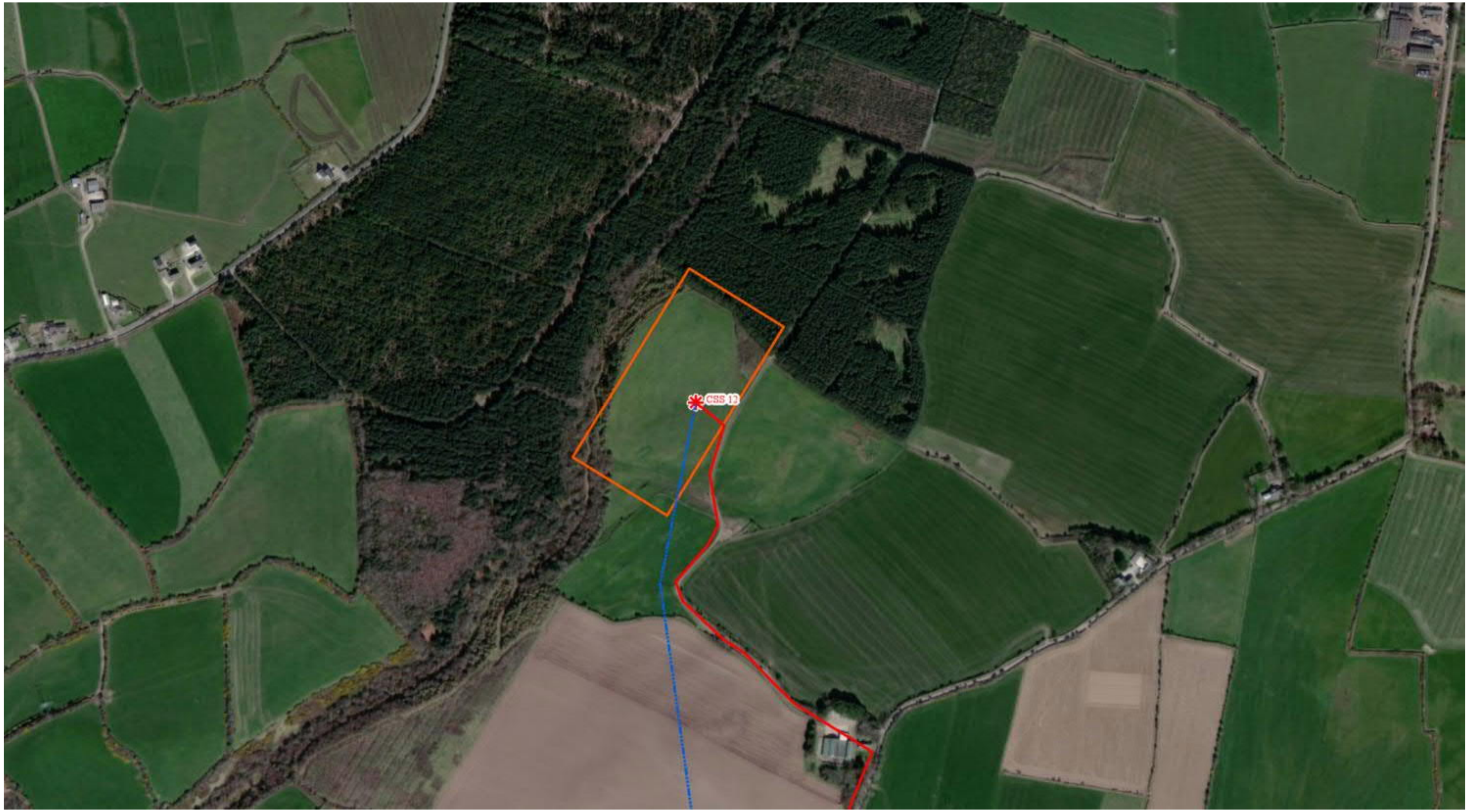
Appendix A

SITE LOCATIONS

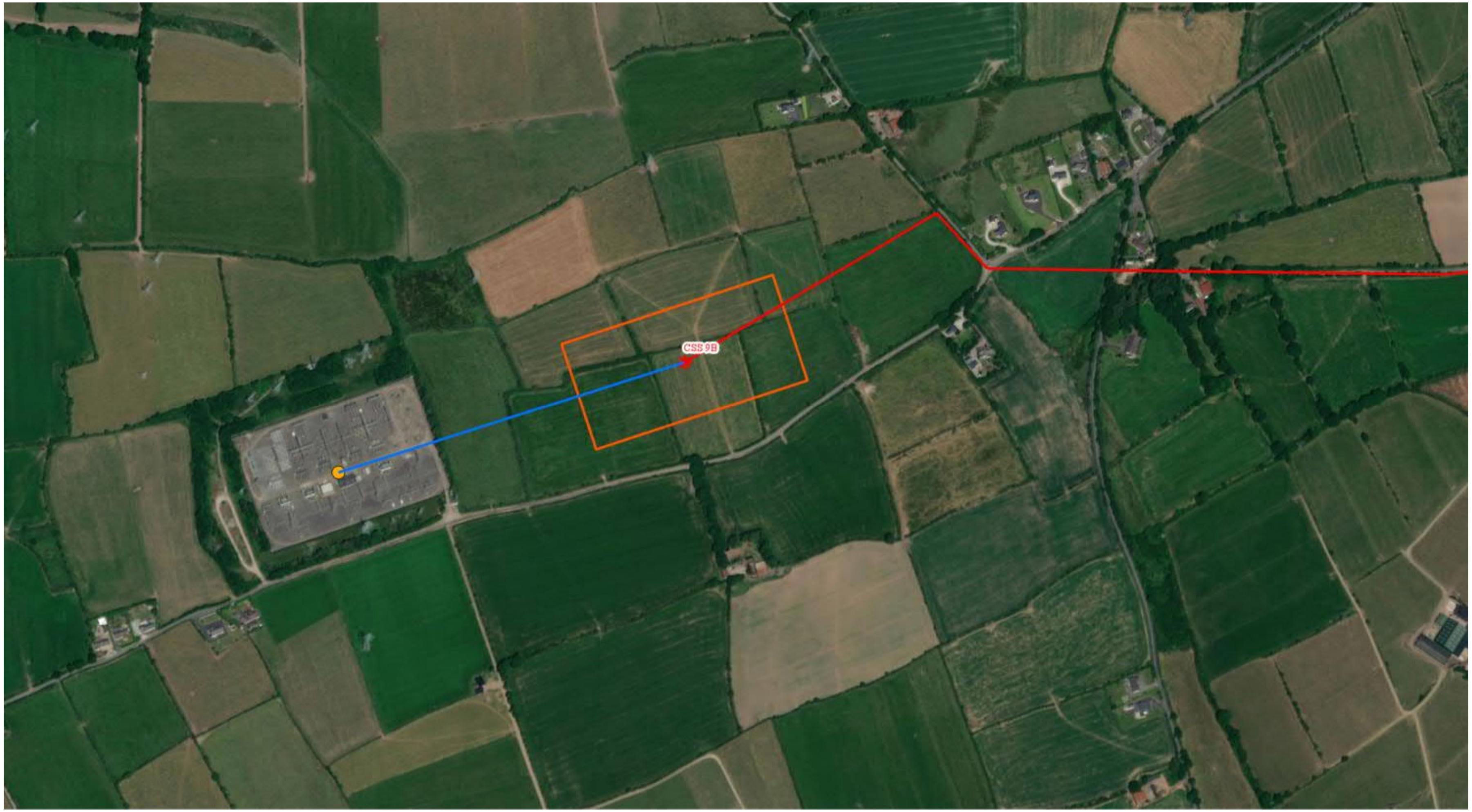
A-1 Ballyadam modelled site location



A-2 Meeleen modelled site location



A-3 Knockraha modelled site location



Appendix B

NOISE GUIDANCE

This Section presents further details of the four-step procedure set out in NG4 for setting noise limits.

STEP 1 – QUIET AREA SCREENING OF THE DEVELOPMENT LOCATION

The first step requires the assessor to establish whether the location of the proposed development satisfies the criteria for a 'Quiet Area' set out in the EPA publication Environmental Quality Objectives - Noise in Quiet Areas3. These criteria are as follows:

- At least 3 km from urban areas with a population >1,000 people;
- At least 10 km from any urban areas with a population >5,000 people;
- At least 15 km from any urban areas with a population >10,000 people;
- At least 3 km from any local industry;
- At least 10 km from any major industry centre;
- At least 5 km from any National Primary Route, and;
- At least 7.5 km from any Motorway or Dual Carriageway.

Where the location satisfies these criteria, Table 1 of NG4 indicates that a noise limit should be set no greater than 10 dB below the average daytime background noise level measured during the baseline noise survey in Step 2. This limit applies to day, evening and night time periods.

STEP 2 – BASELINE ENVIRONMENTAL NOISE SURVEY

Whether or not the location satisfies the criteria in Step 1, a baseline noise survey should be undertaken in Step 2 to establish the background noise level at NSLs or locations which are considered representative. The resulting background noise level is used to set the noise limit for designated Quiet Areas (Step 1), or to establish areas of low background noise (Step 3).

STEP 3 – SCREEN FOR AREAS OF LOW BACKGROUND NOISE

Using the results of the baseline noise survey in Step 2, the assessor should establish whether the background noise levels at the measurement locations meet the following criteria:

- Average Daytime Background Noise Level ≤40 dB L_{AF90}; and
- Average Evening Background Noise Level ≤35 dB L_{AF90}, and
- Average Night time Background Noise Level ≤30 dB L_{AF90}

If *all three* criteria are met, the location is deemed to be an area of low background noise and limits of 45 dB during the daytime, 40 dB during the evening and 35 dB during the night time are to be imposed at NSLs, in accordance with Table 1 of NG4.

STEP 4 - DETERMINE APPROPRIATE NOISE CRITERIA

Where all three of the criteria in Step 3 are not met at an NSL, then NG4 proposes a set of general noise limits 55 dB during the daytime, 50 dB during the evening and 45 dB during the night time and which are presented in the summary Table 3.1, below.

[3] Environmental Quality Objectives Noise in Quiet Areas (2000-MS-14-M1), 2003

Table B-1 – Summary of criteria in NG4

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night Noise Criterion, dB $L_{Ar,T}$ (23:00 to 07:00hrs)
Quiet Area	Noise from the licensed site to be at least 10 dB below the average daytime background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10 dB below the average daytime background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10 dB below the average daytime background noise level measured during the baseline noise survey.
Areas of low background noise	45	40	35
All other areas	55	50	45

TONALITY

With respect to the potential for tonal acoustic character of noise perceptible from the proposed development, NG4 states that a 5 dB penalty should be applied during the day and evening periods where significant differences between adjacent third octave band levels are noted for sources of noise. These differences are as follows:

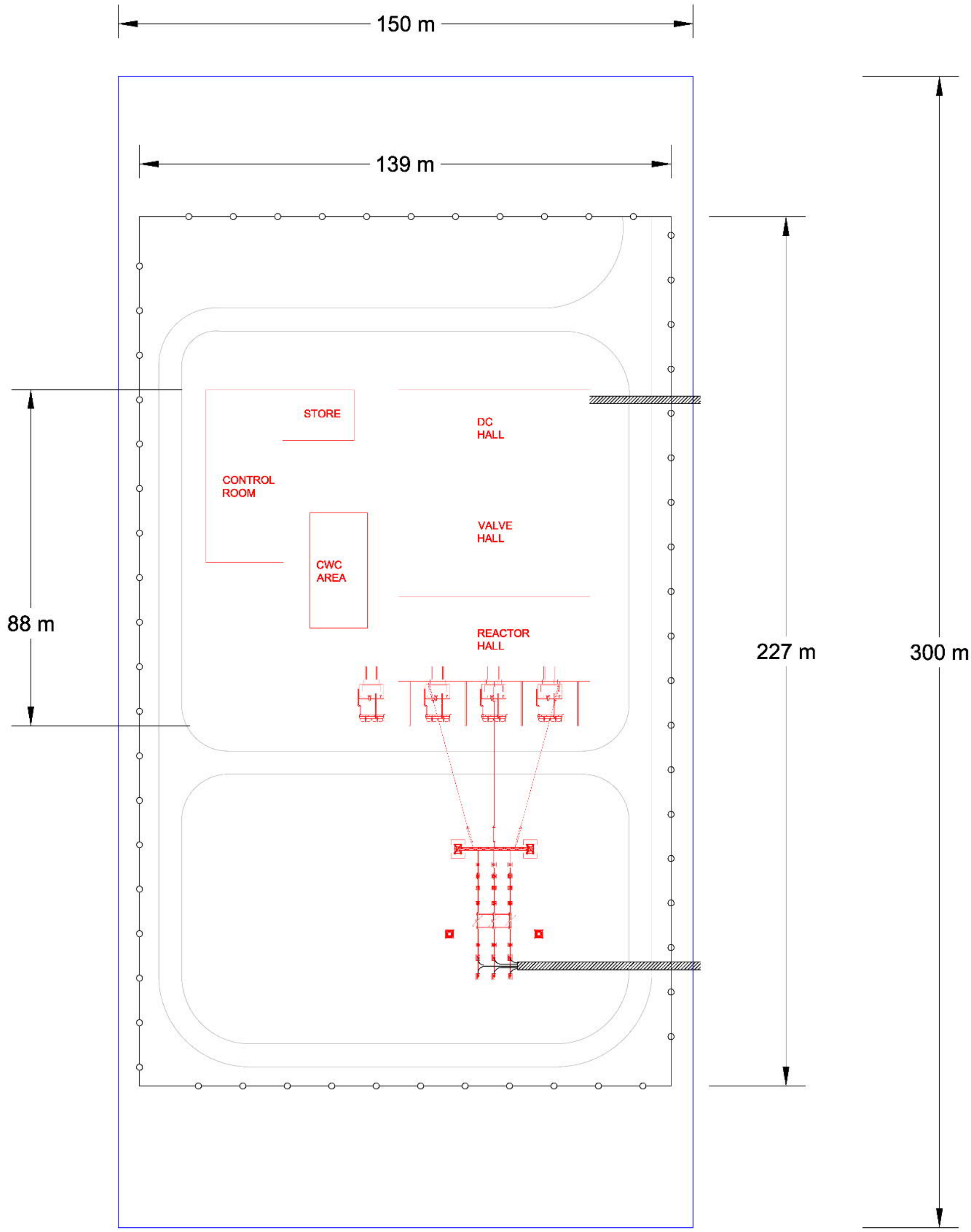
- 15 dB in low-frequency one-third-octave bands (25Hz to 125Hz);
- 8 dB in middle-frequency bands (160Hz to 400Hz), and;
- 5 dB in high-frequency bands (500Hz to 10,000Hz).

However, during the night time period, NG4 states that *'tonal noise from the facility should not be audible at any NSL'*.

Appendix C

SITE LAYOUT

C-1 – Preliminary site layout



Appendix D

INPUT DATA FOR MODELLED SITE EQUIPMENT

D-1 – input data used in the acoustic models

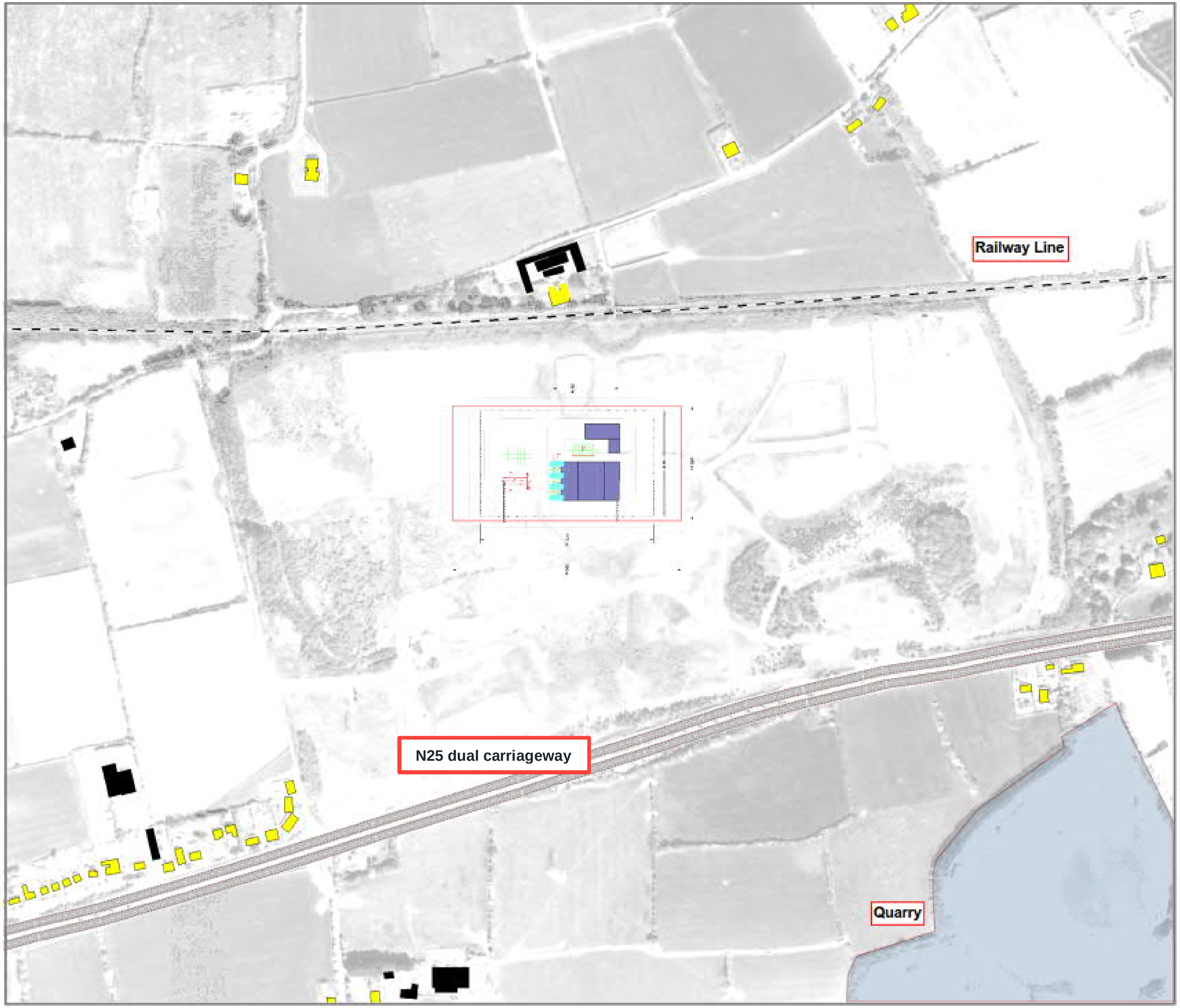
Plant	Equipment quantity	Modelled source height	Data type	Octave-band frequency data (Hz)									Sound Power Level (Lw) (dBA)	Details
				31	63	125	250	500	1000	2000	4000	8000		
Converter transformer (Tx)	3 (1 per phase)	5	Lw	89	89	106	103	102	84	79	83	75	101	Source:EWIC
			SRI of mitigation	21	21	25	31	41	50	56	61	60		Acoustic enclosure around aux transformer. Data source: dB Attenuation Ltd (Standard Panels) Overall performance: 33dBA
			Lw mitigated	68	68	81	72	61	34	23	22	15	68	
Converter transformer fans	12 (per Tx)	5	Lw	79	96	92	89	89	84	82	72	62	90	Source: NE Clean Power Link Project / Qunatity based on EWIC
			SRI of mitigation	4	4	7	13	19	23	23	16	13		Based on rectangular silencer 900mm in length with 40% free area. Overall performance: 16dBA. Source: WSP's generic library for a typical silencer.
			Lw mitigated	75	92	85	76	70	61	59	56	49	74	
Valve cooling fan bank	10	3	Lw	78	96	91	88	88	84	81	72	62	89	Source: NE Clean Power Link Project
			SRI of mitigation											
			Lw mitigated											
AC Filter capacitor	3 (1 per phase)	7	Lw	68	68	85	82	81	63	58	62	54	80	Source: NE Clean Power Link Project
			SRI of mitigation	7	7	7	7	7	7	7	7	7		7dB attenuation from noise enclosures on AC filter capacitors. Source: WSP's estimation of mitigation based on previous projects
			Lw mitigated	61	61	78	75	74	56	51	55	47	73	
AC Filter reactor	3 (1 per phase)	5	Lw	68	68	85	82	81	63	58	62	54	80	Source: NE Clean Power Link Project (based on AC valve reactor)
			SRI of mitigation	10	10	10	10	10	10	10	10	10		10dB attenuation from noise enclosures with top hats on compensation reactors. Source: WSP's estimation of mitigation based on previous projects
			Lw mitigated	58	58	75	72	71	53	48	52	44	70	
Compensation reactor	1 (3 phase reactor)	3.7	Lw	68	68	85	82	81	63	58	62	54	85	Source: Cige TB202
			SRI of mitigation	10	10	10	10	10	10	10	10	10		10dB attenuation from noise enclosures with top hats on AC filter reactors. Source: WSP's estimation of mitigation based on previous projects
			Lw mitigated	58	58	75	72	71	53	48	52	44	75	

Appendix E

NOISE MODEL OUTPUTS

PUBLIC

E-1 – Ballyadam modelled site



KEY

- NSL
- NON-SENSITIVE BUILDING
- BLAST WALLS

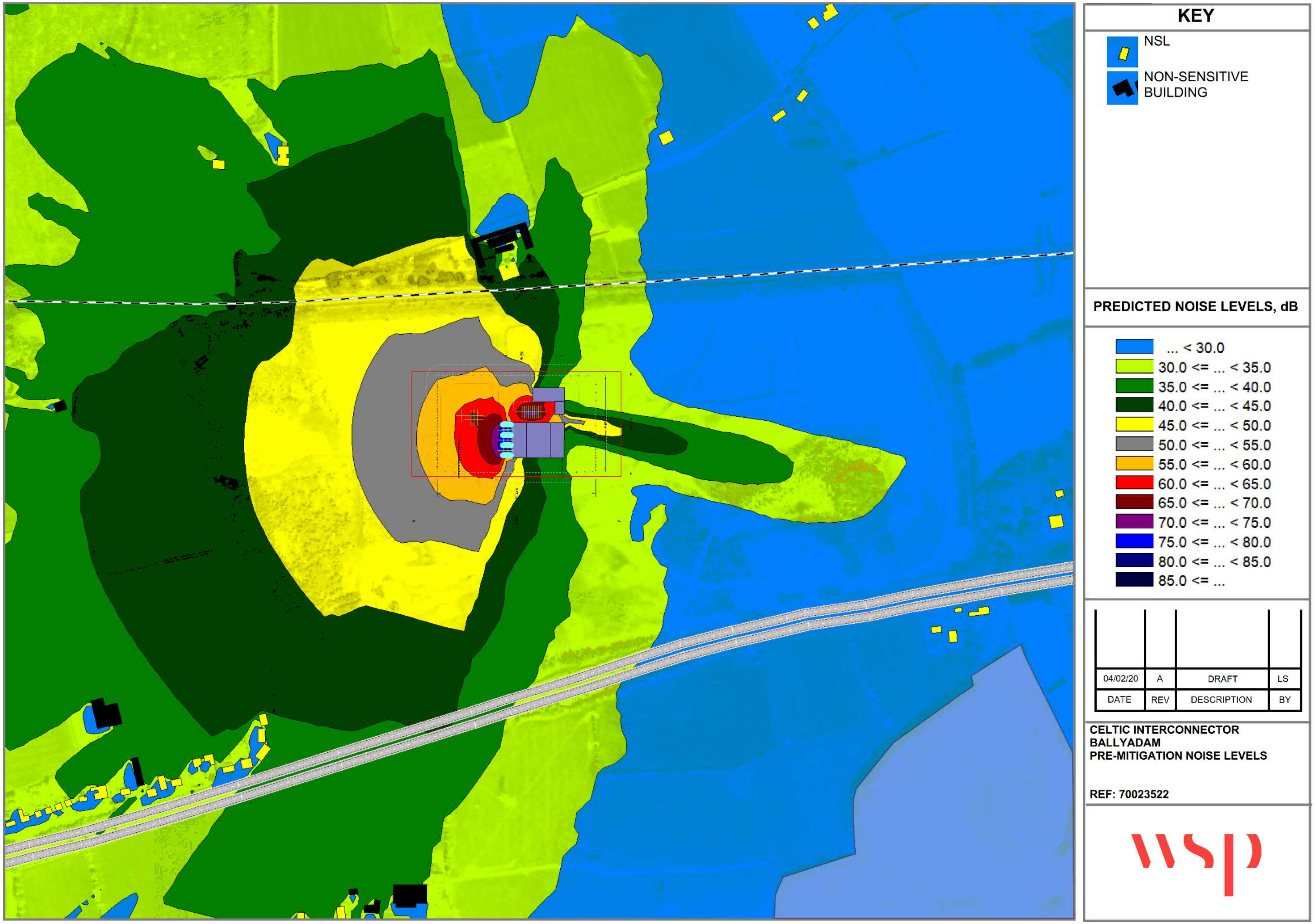
DATE	REV	DESCRIPTION	BY
04/02/20	A	DRAFT	LS

CELTIC INTERCONNECTOR
BALLYADAM
MODELLED SITE

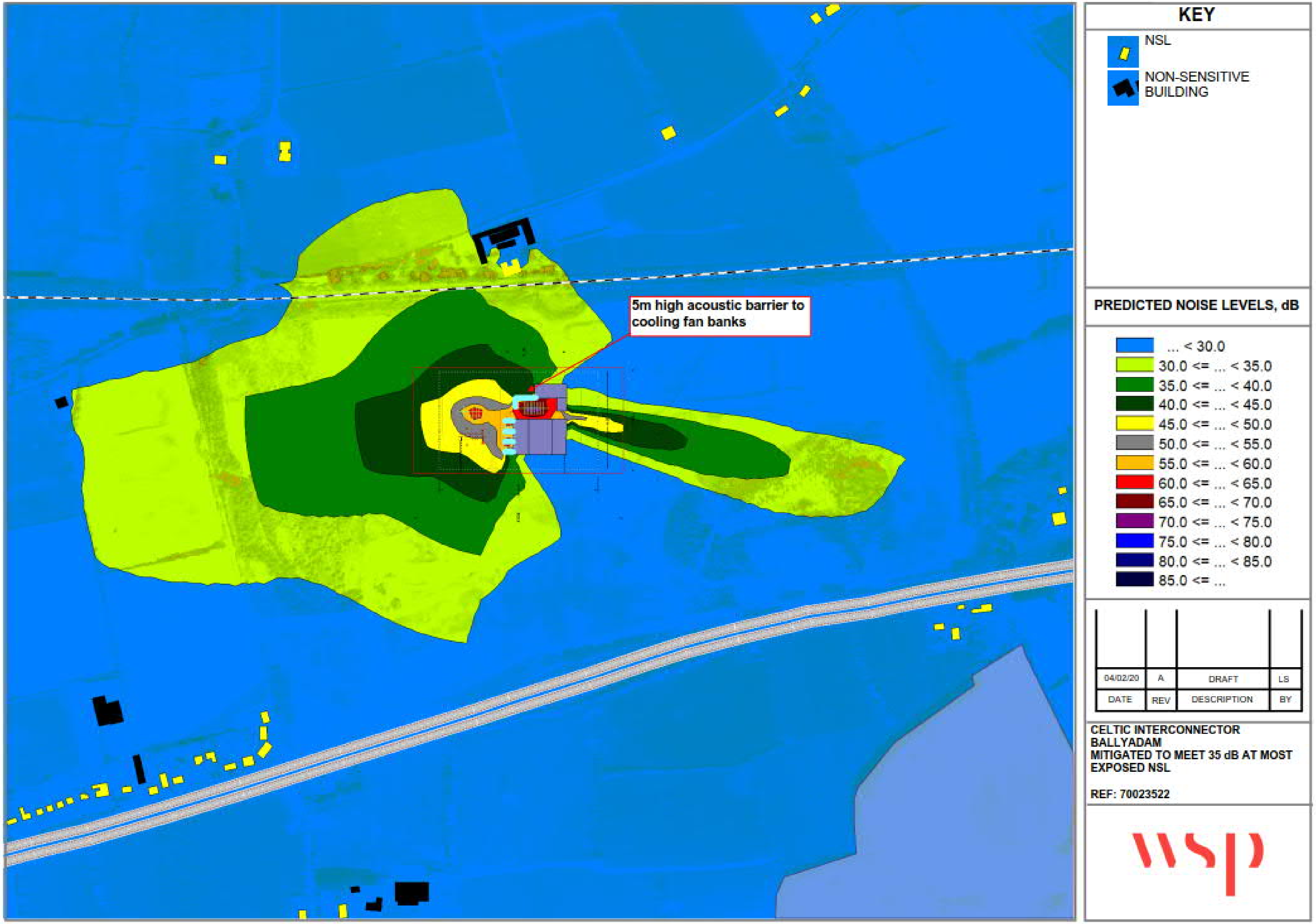
REF: 70023522

wsp

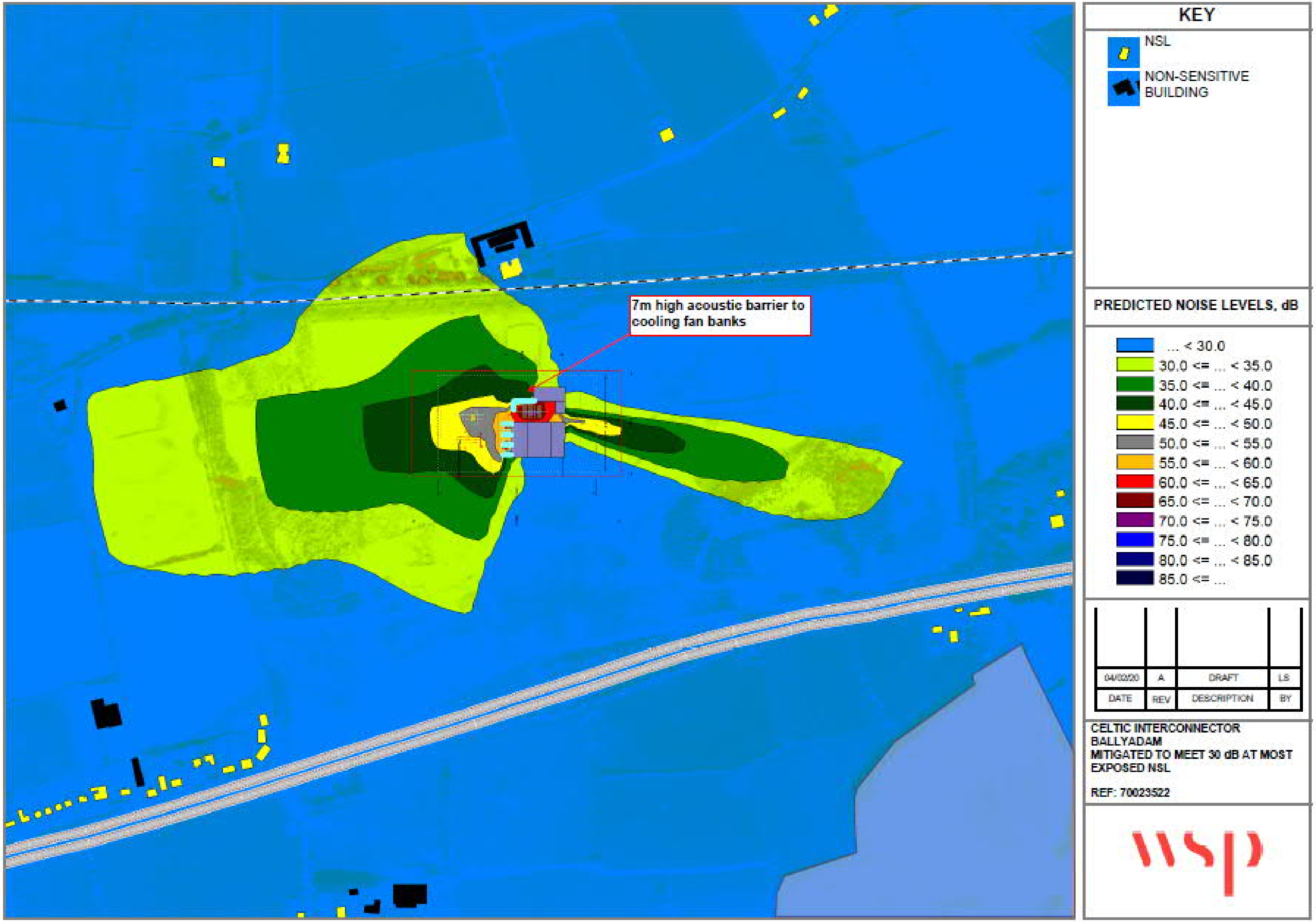
E-2 – Ballyadam predicted noise levels pre-mitigation



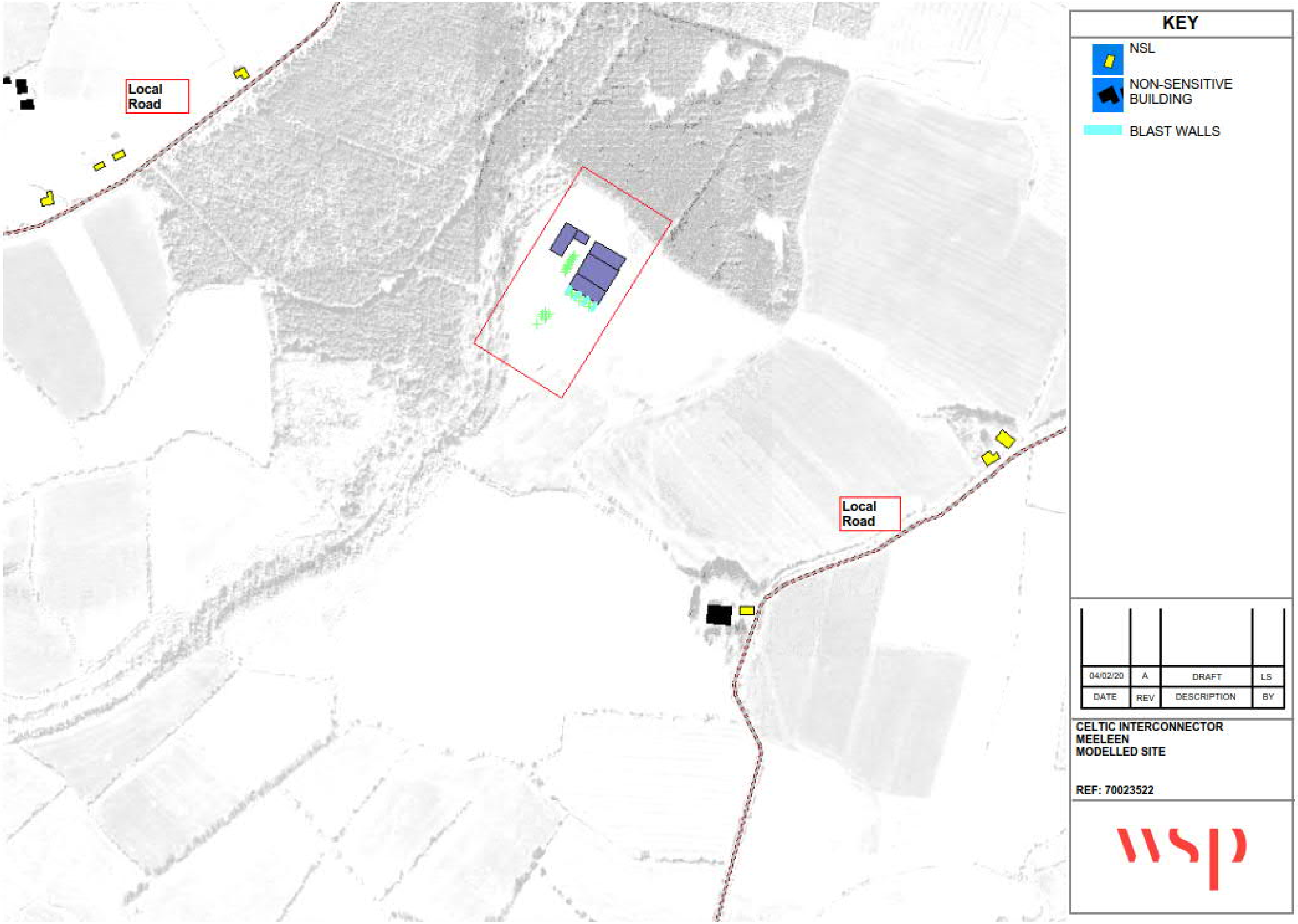
E-3 – Ballyadam mitigated to meet 35 dB at the most exposed NSL



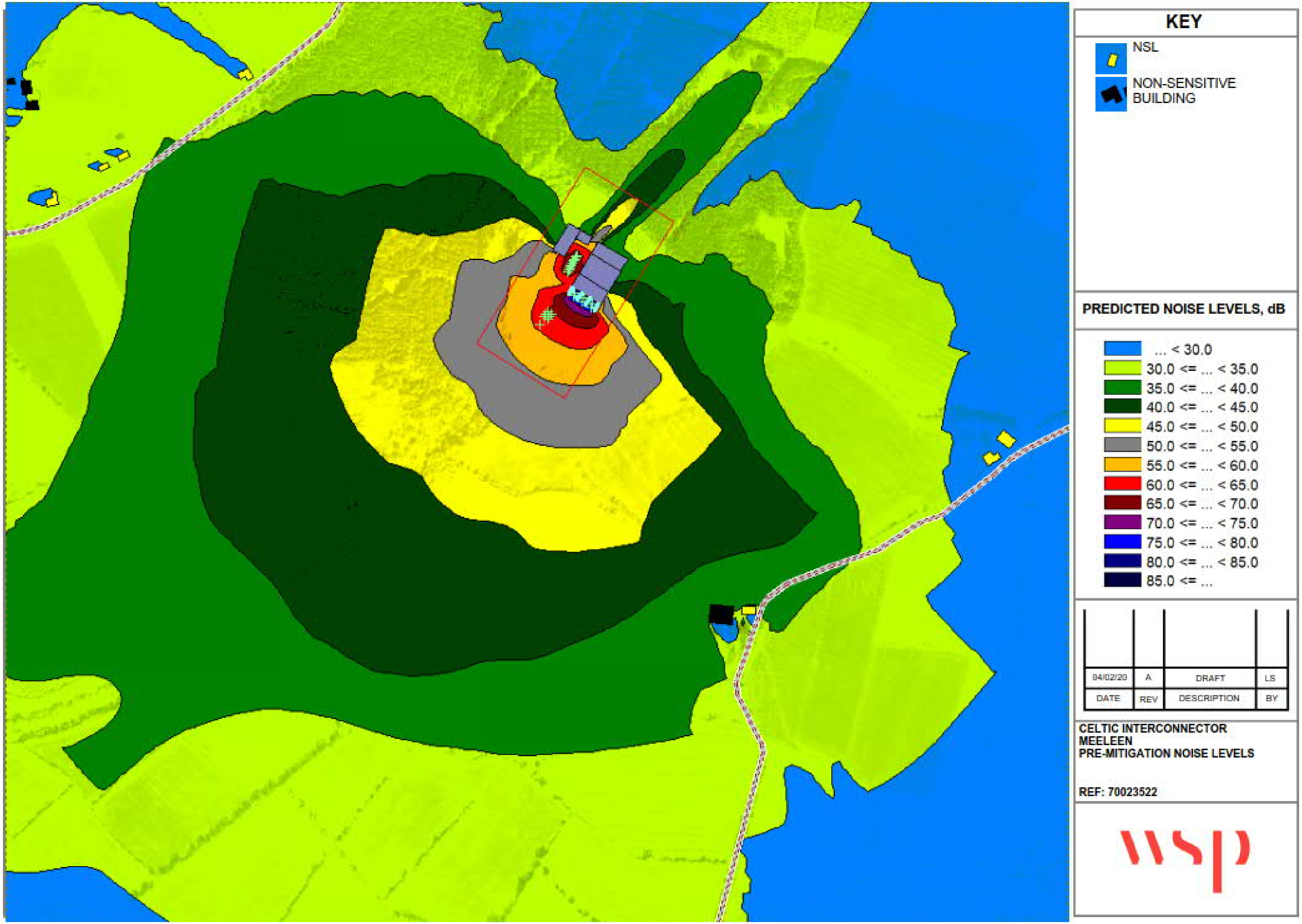
E-4 – Ballyadam mitigated to meet 30 dB at the most exposed NSL



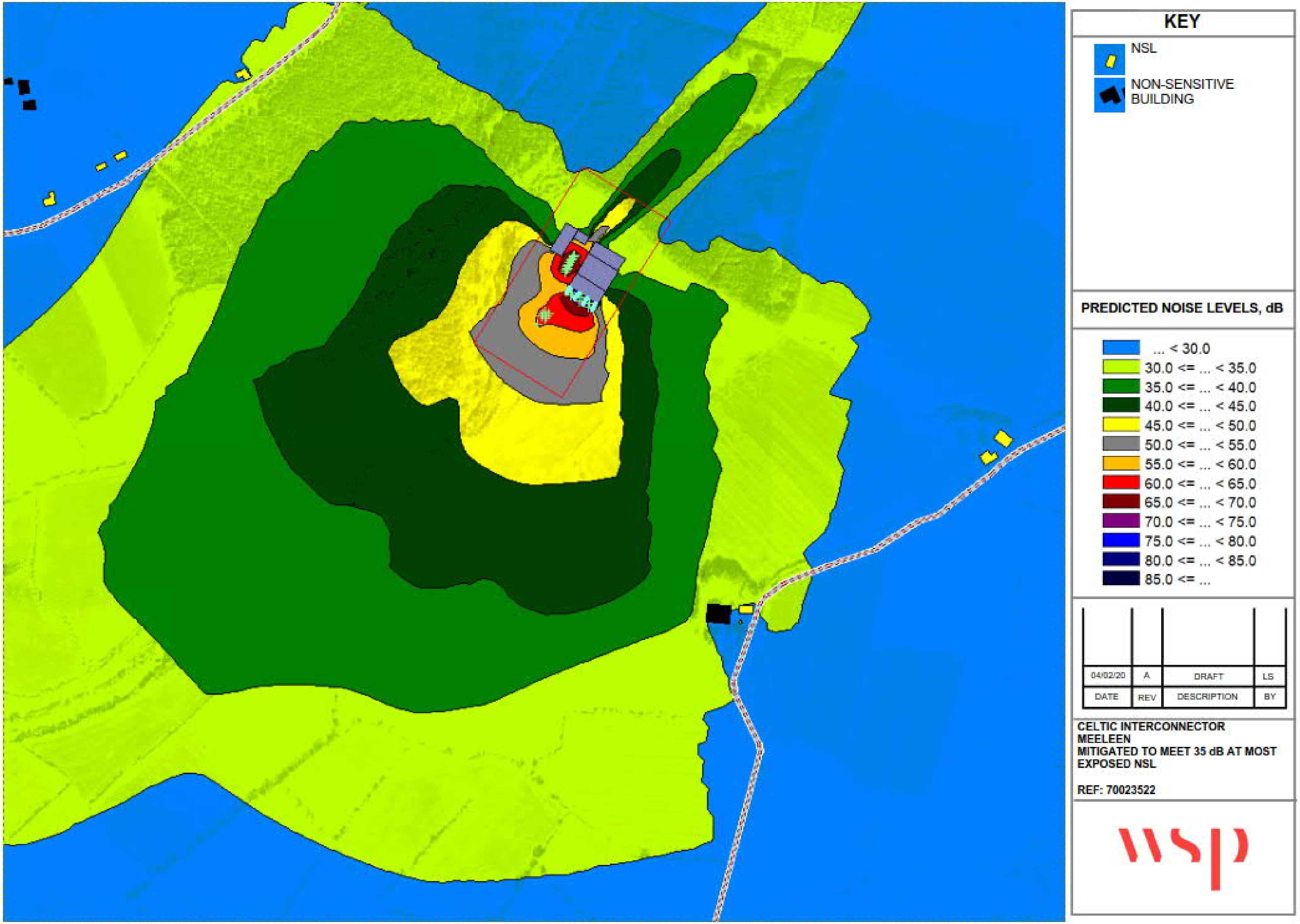
E-5 – Meeleen modelled site



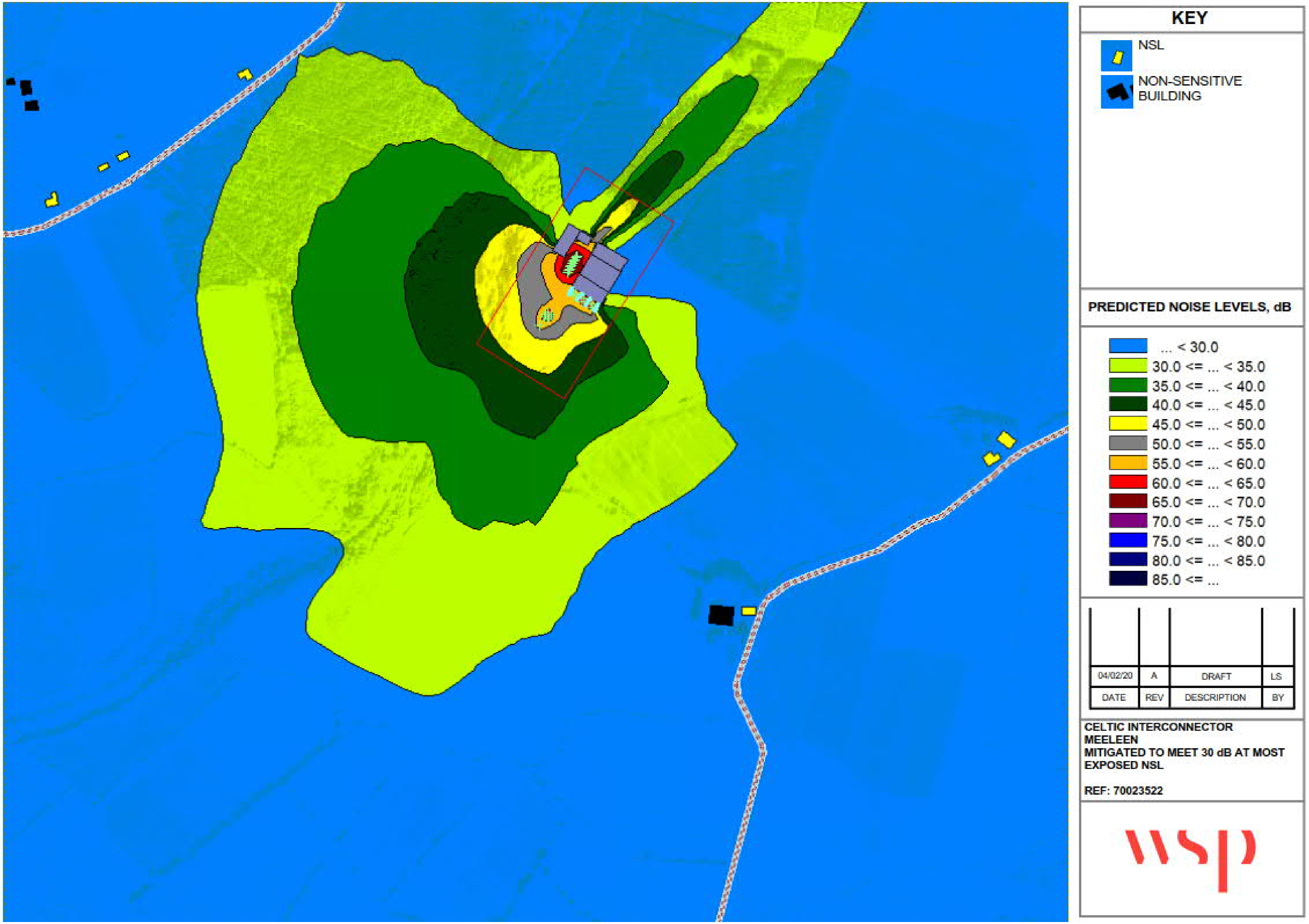
E-6 – Meeleen predicted noise levels pre-mitigation



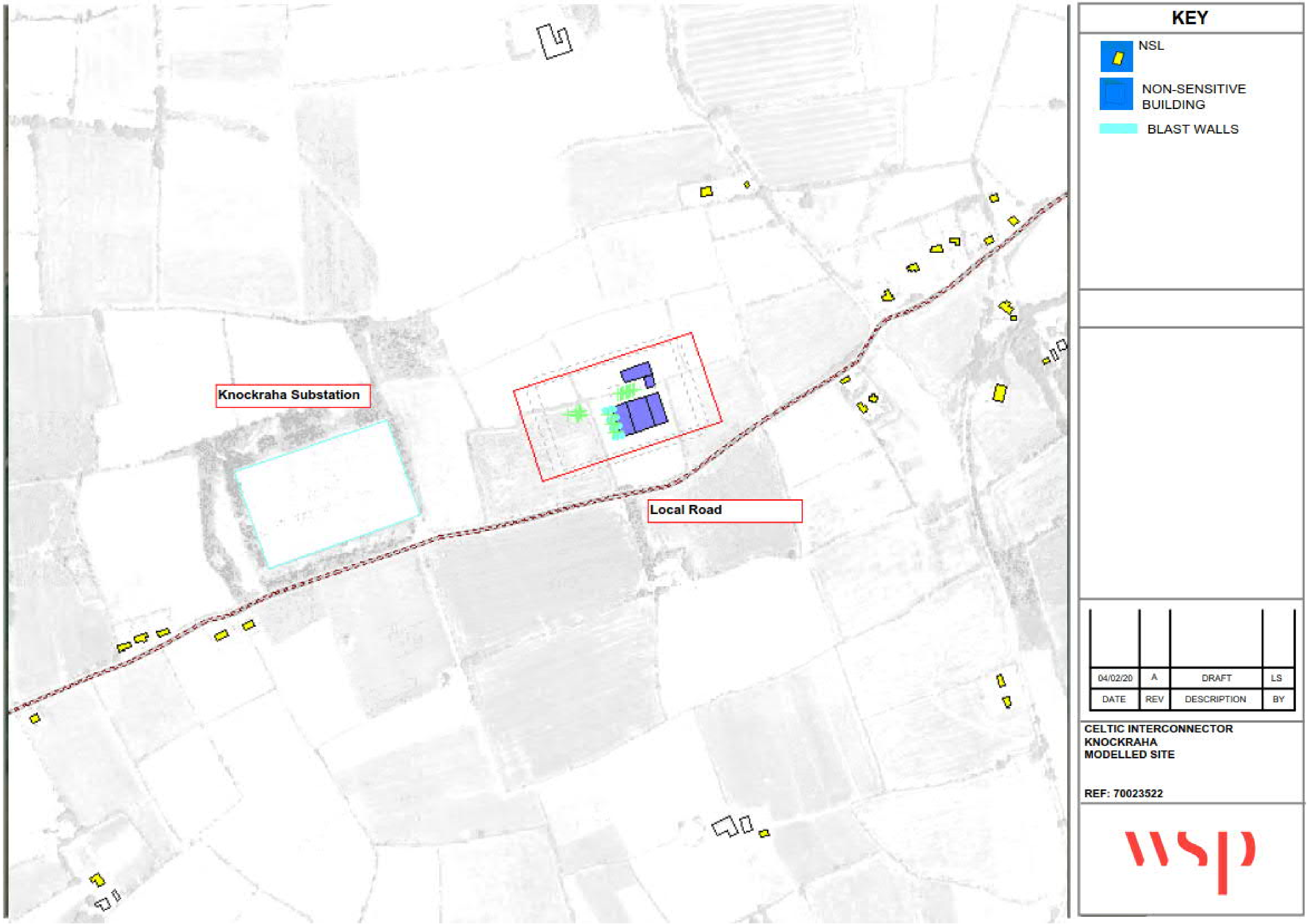
E-7 – Meeleen mitigated to meet 35 dB at the most exposed NSL



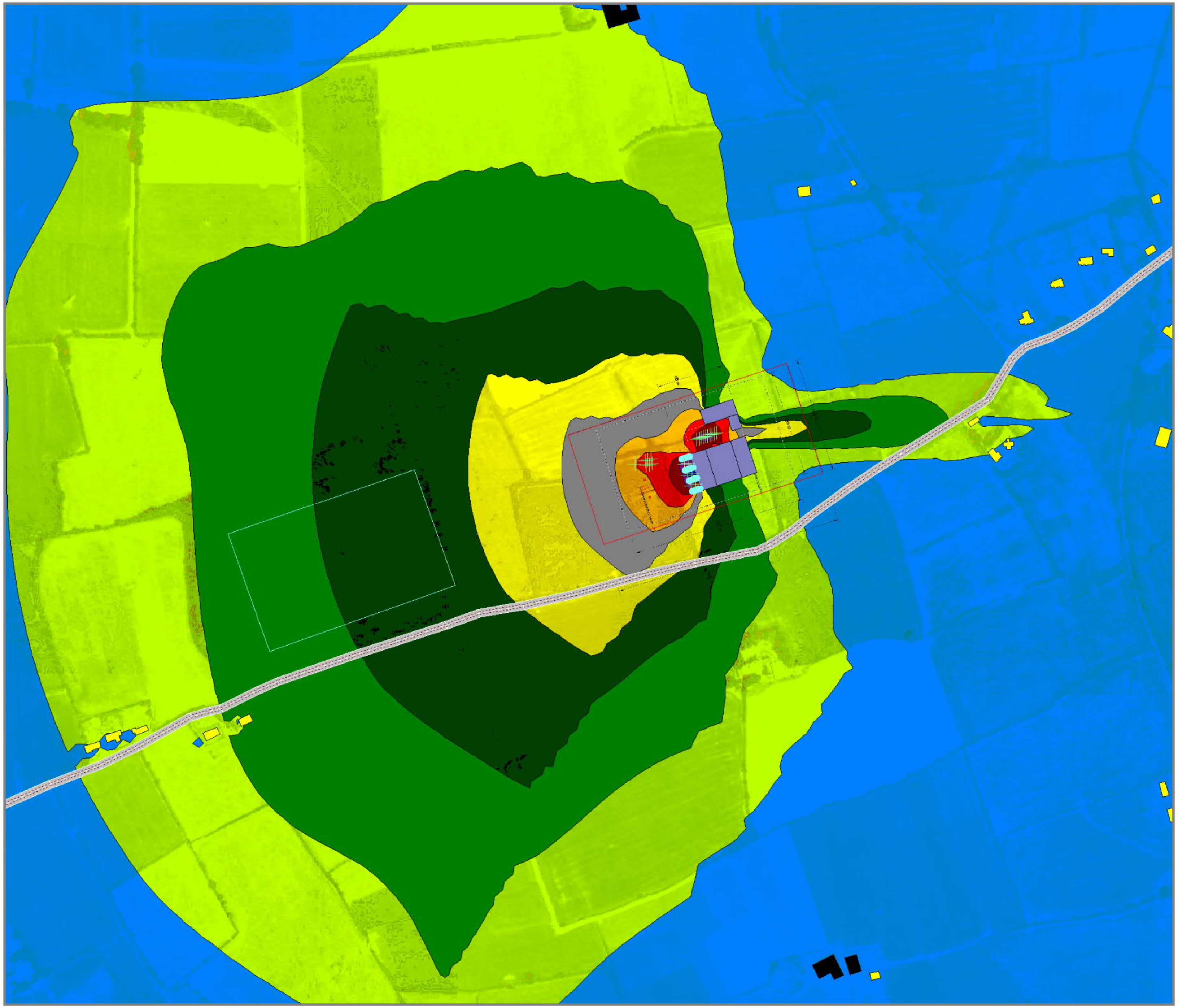
E-8 – Meeleen mitigated to meet 30 dB at the most exposed NSL



E-9 – Knockraha modelled site



E-10 – Knockraha predicted noise levels pre-mitigation



KEY

NSL

NON-SENSITIVE BUILDING

PREDICTED NOISE LEVELS, dB

... < 30.0
30.0 <= ... < 35.0
35.0 <= ... < 40.0
40.0 <= ... < 45.0
45.0 <= ... < 50.0
50.0 <= ... < 55.0
55.0 <= ... < 60.0
60.0 <= ... < 65.0
65.0 <= ... < 70.0
70.0 <= ... < 75.0
75.0 <= ... < 80.0
80.0 <= ... < 85.0
85.0 <= ...

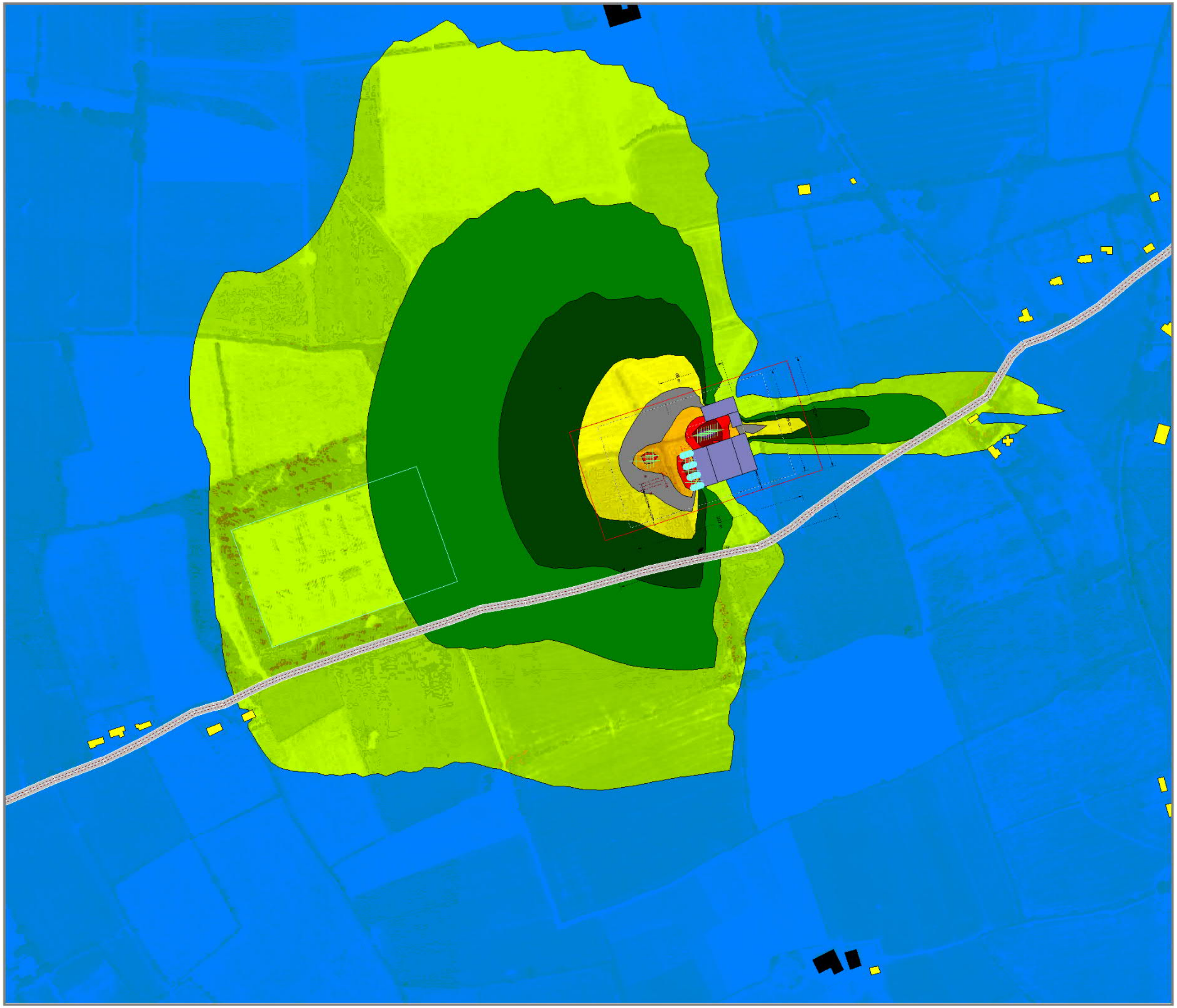
DATE	REV	DESCRIPTION	BY
04/02/20	A	DRAFT	LS

CELTIC INTERCONNECTOR
KNOCKRAHA
PRE-MITIGATION NOISE LEVELS

REF: 70023522

wsp

E-11 – Knockraha mitigated to meet 35 dB at the most exposed NSL



KEY

- NSL
- NON-SENSITIVE BUILDING

PREDICTED NOISE LEVELS, dB

- ... < 30.0
- 30.0 <= ... < 35.0
- 35.0 <= ... < 40.0
- 40.0 <= ... < 45.0
- 45.0 <= ... < 50.0
- 50.0 <= ... < 55.0
- 55.0 <= ... < 60.0
- 60.0 <= ... < 65.0
- 65.0 <= ... < 70.0
- 70.0 <= ... < 75.0
- 75.0 <= ... < 80.0
- 80.0 <= ... < 85.0
- 85.0 <= ...

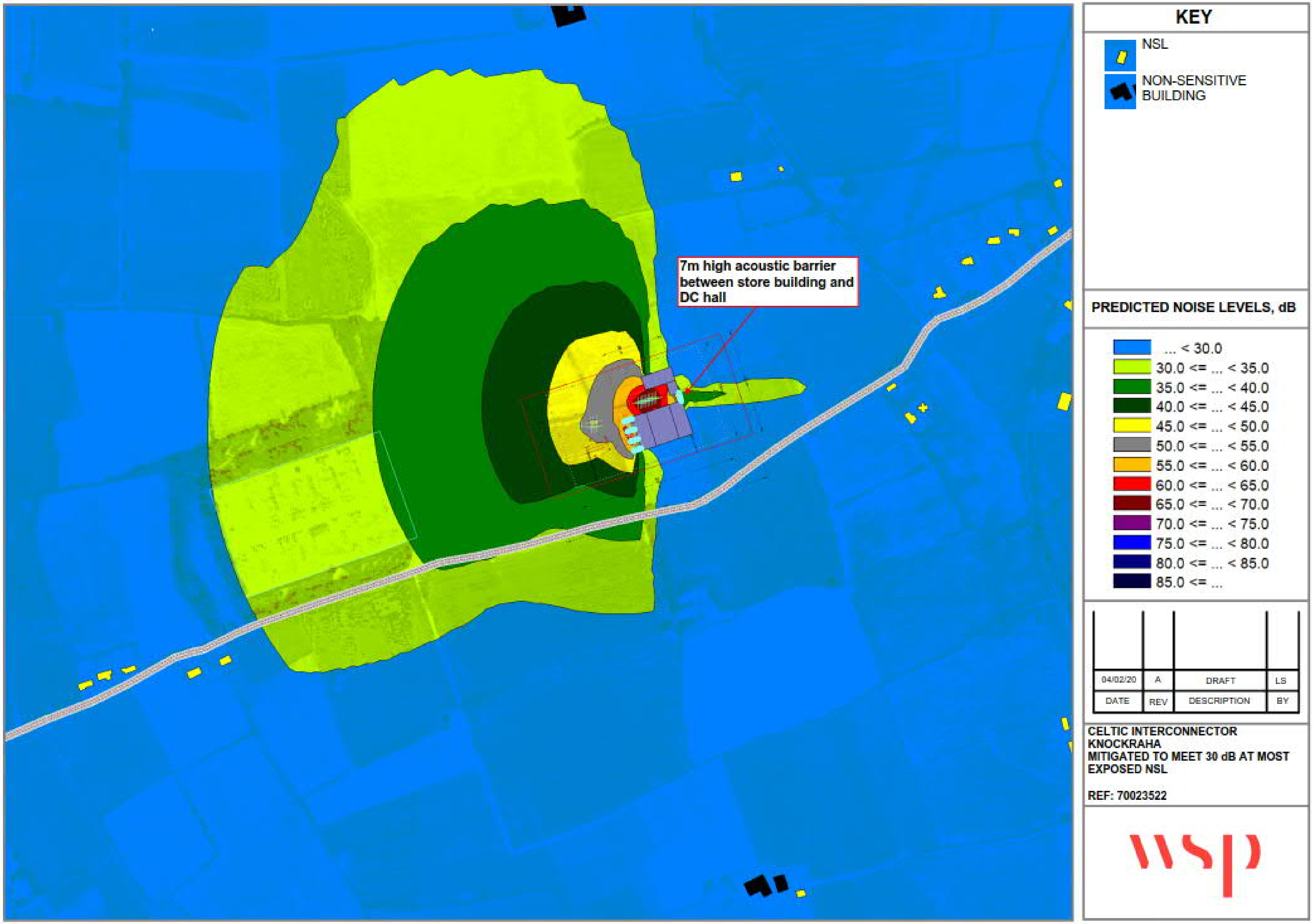
DATE	REV	DESCRIPTION	BY
04/02/20	A	DRAFT	LS

CELTIC INTERCONNECTOR
KNOCKRAHA
MITIGATED TO MEET 35 dB AT MOST EXPOSED NSL

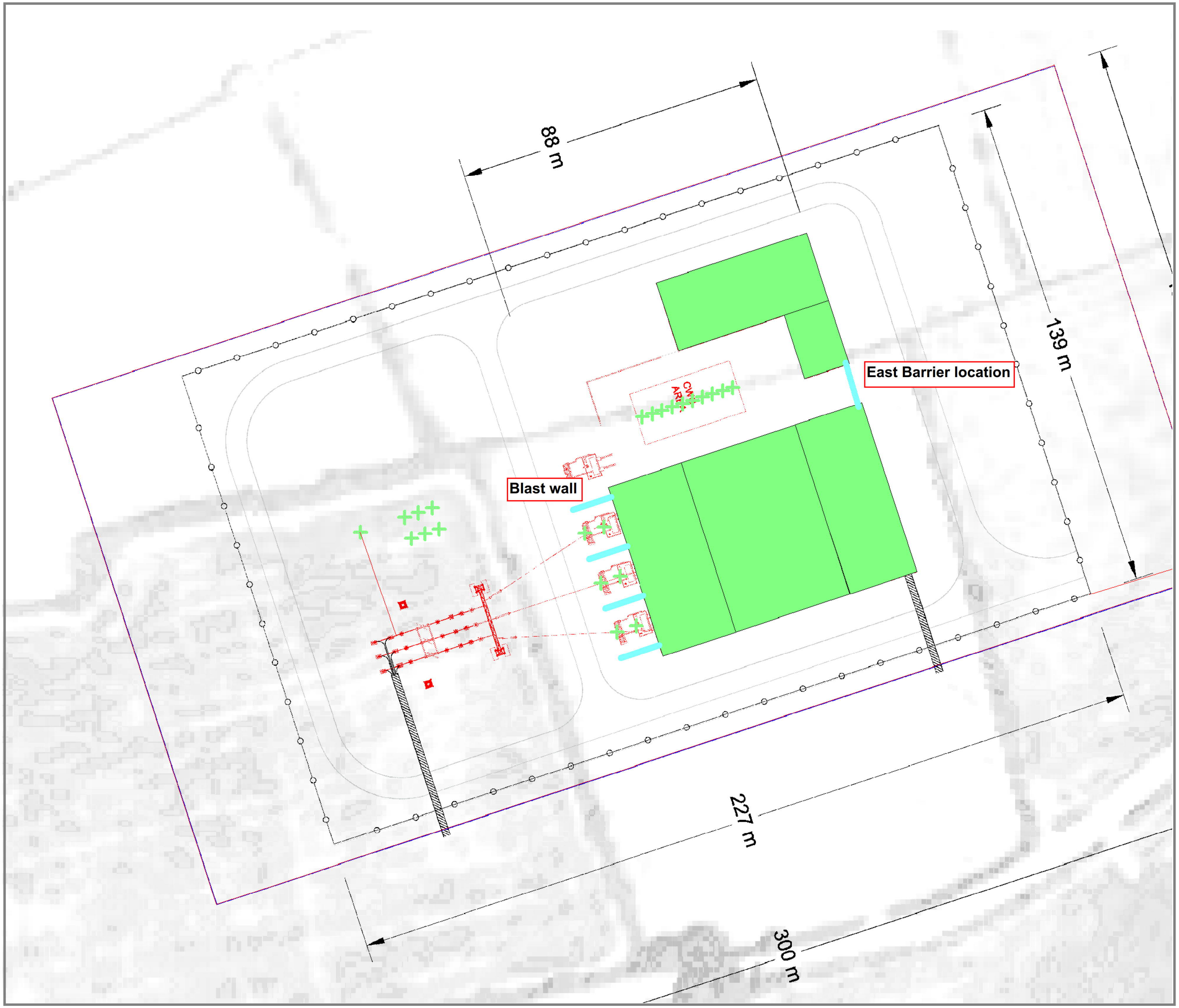
REF: 70023522

wsp

E-12 – Knockraha mitigated to meet 30 dB at the most exposed NSL



E-13 – Location of the valve cooling fan banks barrier between the DC hall and store building



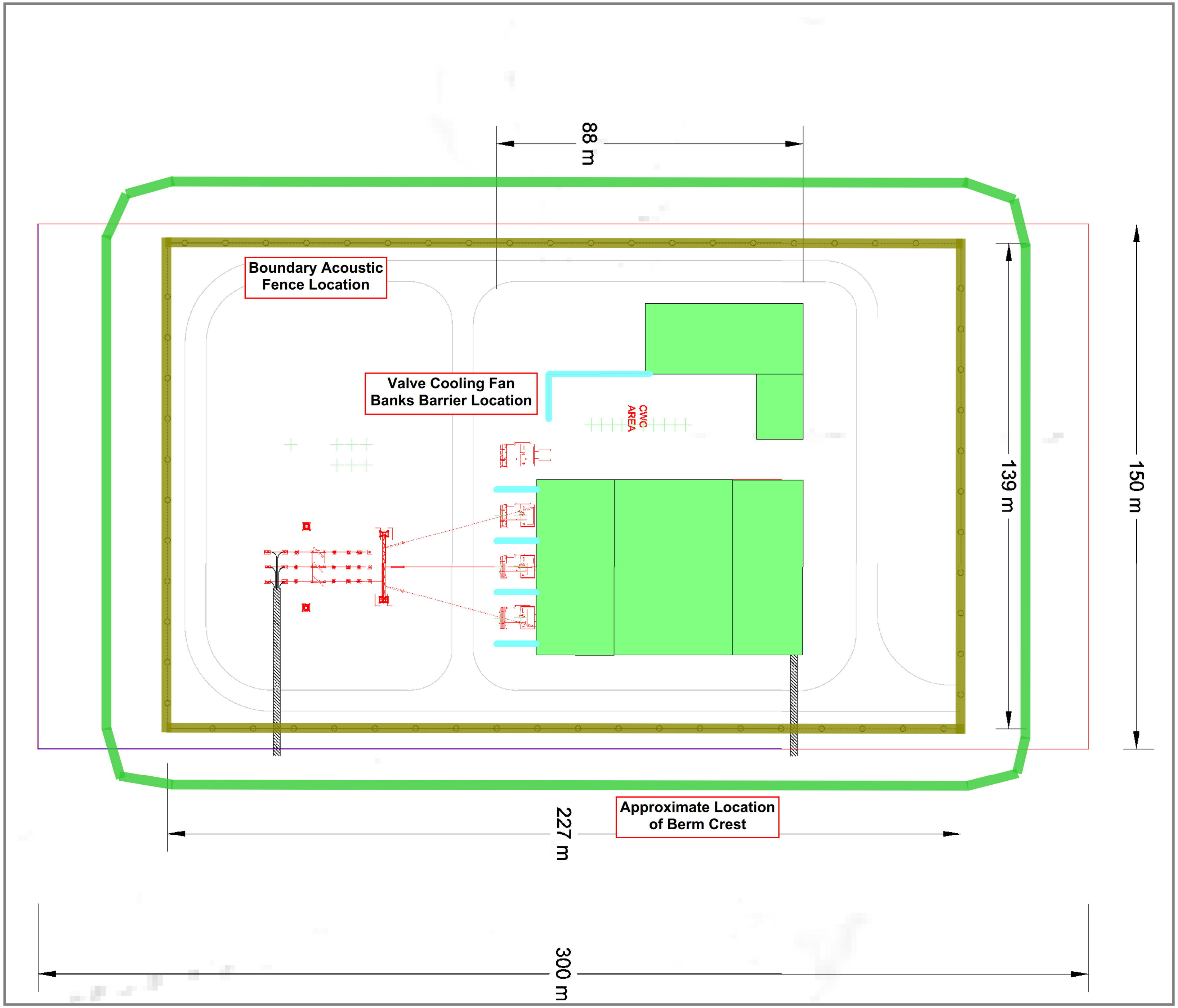
04/02/20	A	DRAFT	LS
DATE	REV	DESCRIPTION	BY

CELTIC INTERCONNECTOR
KNOCKRAHA
BARRIER

REF: 70023522

wsp

E-14 – Location of the L-shaped valve cooling fan banks acoustic barrier, boundary acoustic fence and crest of the boundary berm



04/02/20	A	DRAFT	LS
DATE	REV	DESCRIPTION	BY

CELTIC INTERCONNECTOR
BALLYADAM
BARRIER

REF: 70023522

wsp

Appendix F

LIMITATIONS TO THIS REPORT

REPORT LIMITATIONS

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The findings and opinions expressed are relevant to the dates of the study and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations WSP reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.

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PUBLIC

East Anglia ONE North Offshore Windfarm

Chapter 25

Noise and Vibration

Environmental Statement
Volume 1

Applicant: East Anglia ONE North Limited
Document Reference: 6.1.25
SPR Reference: EA1N-DWF-ENV-REP-IBR-000362 Rev 01
Pursuant to APFP Regulation: 5(2)(a)

Author Royal HaskoningDHV
Date: October 2019
Revision: Version 1

Prepared by:	Checked by:	Approved by:

Revision Summary				
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01	08/10/2019	Paolo Pizzolla	Ian Mackay	Helen Walker

Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	n/a	n/a	Final for Submission

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25.2	Consultation	2
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Chapter 25 Noise and Vibration figures are presented in ***Volume 2: Figures*** and listed in the table below.

Figure number	Title
Figure 25.1	Noise and Vibration Study Area
Figure 25.2	Noise Monitoring Survey Locations

Chapter 25 Noise and Vibration appendices are presented in ***Volume 3: Appendices*** and listed in the table below.

Appendix number	Title
Appendix 25.1	Noise and Vibration Consultation Responses
Appendix 25.2	Noise and Vibration Cumulative Impact Assessment with the Proposed East Anglia TWO Project
Appendix 25.3	Baseline Noise Survey
Appendix 25.4	Construction Phase Assessment
Appendix 25.5	Operational Phase Assessment

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 ONE North 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 ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one offshore 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 ONE North 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 ONE North 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 ONE North project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia ONE North 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 ONE North 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 ONE North 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 ONE North project.

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 ONE North 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 ONE North 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 TWO offshore windfarm project (the proposed East Anglia TWO project) is also in the application stage. The proposed East Anglia TWO project has a separate Development Consent Order (DCO) process which has been submitted at the same time as the proposed East Anglia ONE North project. This assessment considers the cumulative impact of the proposed East Anglia ONE North project with the proposed East Anglia TWO 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 ONE North 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 ONE North 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 ONE North project alone. This includes all onshore infrastructure for the proposed East Anglia ONE North project and the National Grid infrastructure that the proposed East Anglia ONE North 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 ONE North project or the proposed East Anglia TWO project. It should be noted that the draft DCOs for both the proposed East Anglia ONE North and East Anglia TWO 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 ONE North project using the western 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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), 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 SOAE:

- *"…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 Suffolk Coastal District Council (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."
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

Document	Policy / guidance purpose
	(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 vibration study area	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
	2018	Ordnance Survey maps	Onshore Noise and Vibration study area	High
	2018	Construction Phasing Plans	Construction: • Landfall • Onshore Cable Route	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]
			• Onshore Substation • National Grid Infrastructure	
	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 ONE North 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 infrastructure location	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.

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 ONE North Project

Location	Name	No.	Source type	BS5228 Reference	LAeq (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
	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

Location	Name	No.	Source type	BS5228 Reference	LAeq (dB) at 10m	On time correction (%)
	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
	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

Location	Name	No.	Source type	BS5228 Reference	LAeq (dB) at 10m	On time correction (%)
	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 ONE North 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 ONE North 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 ONE North 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 peak particle velocity (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
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 ONE North project was considered at NSRs.

116. To predict the noise from the operational aspects of the proposed East Anglia ONE North 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 ONE North 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 ONE North 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 Observed Adverse Effect	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.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
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 Observed Adverse Effect	Avoid
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 ONE North project.
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 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 ONE North project CIA will initially consider the cumulative impact with only the East Anglia TWO 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

[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		
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
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 ONE North 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
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

Link ID	Description	2023 Baseline flows AAWT		2023 Baseline + Development		Overall Change (%)	
		Total Vehicles	Total HGVs	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
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

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

- 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.

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. At these locations, short-term attended monitoring was conducted. 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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
	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 ONE North 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 ONE North 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 to 15	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
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 ONE North 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 ONE North 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)	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
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

168. The results show that predicted daytime noise levels from construction works during the proposed East Anglia ONE North 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 ONE North 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 ONE North project Traffic

Link ID	Description	Speed (mph)	2023 Baseline BNL, dBA $L_{10,18hr}$	2023 Baseline and the proposed East Anglia ONE North 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
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

Link ID	Description	Speed (mph)	2023 Baseline BNL, dBA $L_{10,18hr}$	2023 Baseline and the proposed East Anglia ONE North project BNL, dBA, $L_{10,18hr}$	Overall Change dBA	Impact Magnitude
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	2	81 per unit		2	1.5

Noise Source	Units	Sound Power Level dB(A)	Sound Pressure Level dB(A)	Drawing Item	Height (m)
Cooling System)					
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
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)		

Fan	Model	Location	Sound Pressure Level dB(A)	Height (m)
		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 SSR5 NEW, 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 ONE North 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 SSR5 NEW (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 ONE North – 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

* 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 ONE North 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 ONE North 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 (eastern) 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 ONE North 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)	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

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)	53.1	Month 7 to 10	No Impact	Negligible
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

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 NSRs.

Table 25.35 Predicted East Anglia ONE North 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	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

25.7 Cumulative Impacts

25.7.1 Cumulative Impact with Proposed East Anglia TWO Project

198. The East Anglia TWO offshore windfarm project (the proposed East Anglia TWO project) is also in the application phase. The proposed East Anglia TWO project has a separate DCO application which has been submitted at the same time as the proposed East Anglia ONE North 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 ONE North project CIA will therefore initially consider the cumulative impact with only the East Anglia TWO project.

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

- Scenario 1 - the proposed East Anglia ONE North project and proposed East Anglia TWO project are built simultaneously; and
- Scenario 2 - the proposed East Anglia ONE North project and the proposed East Anglia TWO 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 TWO 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 TWO project							
Impact 1: Increased operational noise on residential from the substations	Residential	Medium	Medium	No Impact to Minor	Negligible to Minor adverse	Both EA1N and 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**
Cumulative Decommissioning Impacts with the proposed East Anglia TWO 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 ONE North 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 ONE North 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 ONE North 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 same road links as East Anglia ONE North.

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

Project Name	Status	Development Period	[5]Distance from East Anglia ONE North Onshore Development Area	Project Definition	Level of information available	Included in CIA	Rationale
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 ONE North, which will commence in Q3 2023. There is no data presented within the Sizewell B ES for subsequent construction years,

Project Name	Status	Development Period	[5]Distance from East Anglia ONE North Onshore Development Area	Project Definition	Level of information available	Included in CIA	Rationale
							and therefore the cumulative impact with East Anglia ONE North 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 ONE North project works as a result of the simultaneous construction of proposed East Anglia ONE North project, proposed East Anglia TWO 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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

Interactions between Impacts			
Impact 2: Increased noise on residential receptors from off-site construction traffic noise	Yes	-	Yes
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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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 ONE North 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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