7. Noise and Vibration

Executive Summary

This chapter presents an assessment of the noise and vibration impacts on human receptors that may arise as a result of the construction and operational phases of the proposed development, as well as identifying proportionate mitigation to minimise noise and vibration effects.

Noise sensitive receptors in the vicinity of the application site, including residential, non-residential and Public Right of Way uses, have been identified following a review of publicly available mapping, resources and site investigations. Subsequently, the baseline environmental noise conditions have been determined following the completion of an extended noise survey at locations around the application site representative of the identified noise sensitive receptors. Details of the baseline noise survey, including results and observations, are presented in Appendix 7.2.

Assessments of noise and vibration impacts have then been undertaken in accordance with relevant national and professional design guidance and following consultation with Pembrokeshire County Council.

Construction noise, traffic, and vibration impacts have been determined primarily with reference to British Standard BS 5228:2009+A1:2014 Parts 1 & 2 and Design Manual for Roads and Bridges LA 111 Revision 2. Details of the construction noise sources, phasing and equipment used to inform this assessment, along with receptor specific LOAELs, SOAELs and construction noise predictions, are provided in Appendix 7.3.

Operational noise impacts have been determined primarily with reference to BS 4142:2014+A1:2019 for each of the operational conditions for the site (comprising the normal operations, and three temporary and short-term conditions). Due to the low background sound levels in the vicinity, and following Pembrokeshire County Council consultation, consideration has also been given the levels described as *"very low"* in the now superseded BS 4124:1997. Details of the operational noise sources proposed at the application site have been provided by the project team. This includes in-situ measured noise emission data for the proposed antenna captured both at DARC Site 1 (Australia) and at a US test facility. Refer to the operational assessment section of this chapter for details and to Appendix 7.4 for receptor specific noise assessments.

Consideration has also been given throughout to the potential impacts resulting from the micro siting of the antenna equipment. The assessment of micro siting presented in this chapter takes an approach similar to that used for windfarms, wherein the change in noise emissions is evaluated on the worst-case basis that the equipment was to move homogenously in any cardinal direction.

The initial assessment of construction impacts finds that no significant effects are anticipated as a result of construction traffic, noise, or vibration, with the exception of a potential significant noise effect at the on-site Cawdor Barracks residential units during months 8-9 of the works.

The initial assessment of operational noise impacts finds that significant effects are expected at several of the identified receptors, including Public Right of Way, in each of the operational conditions. These effects were determined in accordance with BS 4142:2014+A1:2019 including subjective character corrections for tonality and intermittency. The applied character corrections were determined utilising the test results and observations made during the DARC Site 1 and US test facility witnessing.

The assessment of micro siting finds that there will be no change to the conclusions of the construction noise, traffic or vibration assessments; however, micro siting may result in an

increased number of receptors at which significant effects may be expected in the unmitigated operational scenarios.

Accordingly, guidance on appropriate construction noise mitigation has been presented including Best Practicable Means, local acoustic barriers, careful programming, and community engagement. With this mitigation implemented, no residual significant construction noise, traffic, or vibration effects are anticipated for the proposed development.

With regard to operational noise, mitigation requirements have been presented in the form of the minimum broadband noise reductions that will be achieved for each component part of the site (i.e. Tx array, Rx array, chillers, etc), including the influence of micro siting. A commentary on typical engineering solutions has been provided where appropriate, however it is noted that the detailed design and implementation of the operational mitigation will be undertaken by the responsible Contractor and is beyond the scope of this chapter. Notwithstanding, with this mitigation implemented no residual significant operational noise effects are anticipated.

On the basis of the assessments presented in this chapter, no residual significant noise or vibration effects are expected as a result of the proposed development.

7.1. Introduction

7.1.1. This chapter presents information required by the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017[77]. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter reports the potential significant effects for noise and vibration as a result of the proposed development. This assessment includes a review of the existing baseline conditions, consideration of the potential impacts and identification of proportionate mitigation for likely significant adverse effects resulting from the proposed development.

7.1.2. The approach to this assessment follows that set out in the EIA Scoping Report (March 2023) submitted to the Pembrokeshire County Council (PCC) and has been prepared in accordance with the EIA Scoping Opinion (May 2023) for the proposed development from PCC and subsequent consultation as described in Section 7.3.

7.1.3. Chapter 3 (Proposed Development) contains a detailed description of the proposed development. This chapter is supported by the following appendices and figures, and includes cross-references to other chapters and figures where appropriate:

- Appendix 7.1 (Legislation, Policy and Guidance);
- Appendix 7.2 (Environmental Noise Survey);
- Appendix 7.3 (Construction Noise Assessment);
- Appendix 7.4 (Operational Noise Assessment);
- Figure 7.1 (Noise Location Plan and Study Areas);
- Figure 7.2 (Operational Noise Contours – Normal Condition);
- Figure 7.3 (Operational Noise Contours – Bowtie/Scan High Condition);
- Figure 7.4 (Operational Noise Contours – Normal + Back Up Power Condition);
- Figure 7.5 (Operational Noise Contours – Bowtie/Scan High + Back Up Power Condition);
- Figure 7.6 (Construction Noise Contours – Month 1);
- Figure 7.7 (Construction Noise Contours – Month 4);
- Figure 7.8 (Construction Noise Contours – Months 8 – 9);
- Figure 7.9 (Construction Noise Contours – Month 16 – 18);
- Figure 7.10 (Construction Noise Contours – Night-Works).

7.2. Legislation and Policy

7.2.1. The national legislation and regulatory frameworks applicable in this assessment for noise and vibration are summarised in this section and described in further detail in Appendix 7.1.

[77] Welsh Government (2017) The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. Available at: The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

Legislation

Control of Pollution Act 1974 (COPA) [78]

7.2.2. The Control of Pollution Act 1974 offers protection against disturbance to residents that might be affected by construction activity. Much of the Act has now been replaced and extended by the Environmental Protection Act 1990. However, Sections 60 and 61, which relate to noise and vibration from construction sites, remain relevant.

7.2.3. Section 60 of the Act enables a local authority to serve a notice specifying its noise control requirements covering plant or machinery hours of operation, and levels of noise that can be emitted.

7.2.4. Section 61 relates to prior consent in which the contractor consults with the local authority and provides an application prior to construction works commencing to obtain approval for the methods to be used and the steps proposed to minimize noise resulting from the works.

Environmental Noise (Wales) Regulations 2006 [79]

7.2.5. The Environmental Noise (Wales) Regulations (2006) implement European legislation (Environmental Noise Directive 2002/49/EC) requiring the National Assembly for Wales to develop noise action plans on a five-year rolling programme. Action plans have to be developed for the major noise sources (including road surfaces) and areas for which maps have been produced and that identified 'Important Areas' for future mitigation. The action plans seek to manage noise issues and effects including noise reduction, if necessary, based on the results obtained through the mapping process.

Environmental Protection Act 1990 [80]

7.2.6. Part III, Section 79, of the Environmental Protection Act 1990 (EPA) defines what activities may constitute a statutory nuisance, and what activities are specifically exempt. The EPA does not apply to road traffic noise but does apply to construction noise.

7.2.7. EPA sections 79 and 80 places a duty on local authorities to serve abatement notices where noise from premises, vehicles and machinery are judged to constitute a statutory nuisance. Section 82 EPA allows any individual to apply to the magistrate's court for a noise abatement notice to be served if the court is convinced that a statutory nuisance exists. Compliance with these controls is required, although the requirements fall outside of the planning system. The use of best practicable means (BPM) to control emissions can constitute a ground of defence against charges that such a nuisance arises.

Environment (Air Quality and Soundscapes) (Wales) Act 2024 [81]

7.2.8. The provisions in this act place a duty on Welsh Ministers to prepare and publish a national strategy on soundscapes which can incorporate the strategic noise maps and noise actions plans required under regulations 7 and 17 of the Environmental Noise (Wales) Regulations 2006.

[78] Control of Pollution Act 1974, c.40. Available at: https://www.legislation.gov.uk/ukpga/1974/40 (Accessed: 6 June 2025).

[79] Environmental Noise (Wales) Regulations 2006, SI 2006/2629 (W.225). Available at: https://www.legislation.gov.uk/wsi/2006/2629 (Accessed: 20 October 2025).

[80] Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43 (Accessed: 20 October 2025).

[81] Environment (Air Quality and Soundscapes) (Wales) Act 2024. Available at: https://www.legislation.gov.uk/asc/2024/2 (Accessed 20/10/2025).

National Policy

Future Wales: The National Plan 2040, 2021 [82]

7.2.9. Future Wales: The National Plan 2040 is the development plan for Wales. It influences all levels of the planning system in Wales and is intended to help to shape Strategic and Local Development Plans prepared by councils and national park authorities.

Planning Policy Wales Edition 12, 2024 (PPW) [83]

7.2.10. Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. Noise and the acoustic environment is referenced regularly as a determining factor in the decision making process.

Technical Advice Note 11: Noise, 1997 (TAN 11) [84]

7.2.11. TAN 11 provides guidance on the technical standards and approaches that shall be used when assessing noise impacts for noise sensitive developments and noise generating developments, including during the construction phases.

CL-01-15 Updates to TAN 11 Noise – Noise Action Plan (2013-18) Commitments, 2015 [85]

7.2.12. CL-01-15 provides updates to TAN 11 to bring the guidance in line with current design standards. In particular, reference is made to the environmental permitting regime and the publication of BS 4142:2014.

Noise and Soundscape Action Plan (2018 – 2023), 2018 [86]

7.2.13. The noise and soundscape action plan presents a consolidated five-year noise action plan for Wales, with reference to the Environmental Noise (Wales) Regulations 2006 and guidance on country-wide policies relating to the forms of noise not covered by the Regulations. This version is an update to the original that was published in 2013.

Noise and Soundscape Plan for Wales, 2024 [87]

7.2.14. The Noise and Soundscape Plan 2023-2028 is Wales's national strategy on soundscapes, meaning the sound environment as perceived or experienced and/or understood by a person or people, in context. Amongst wider guidance, the plan sets out a generalised decision-making framework for determining the appropriate level of noise control for proposed developments, involving the comparison of "noise risk" against the potential for "better outcomes through soundscape interventions".

Local Policy

7.2.15. Local policy is provided by the following documents of relevance to the noise and vibration assessment and are described in further detail in Appendix 7.1.

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[82] Welsh Government (2021). Future Wales: The National Plan 2040. Welsh Government

[83] Welsh Government (2024). Planning Policy Wales. Welsh Government.

[84] Welsh Government (1997). Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise. Welsh Government

[85] Minister for Natural Resources (2015). CL-01-15 Updates to Tan 11 Noise – Noise Action Plan (2013-18) Commitments. Welsh Government.

[86] Welsh Government (2018). Noise and Soundscape action plan. Welsh Government.

[87] Welsh Government (2024). Noise and Soundscape Plan for Wales. Welsh Government.

Pembrokeshire County Council Local Development Plan, 2013 [88]

7.2.16. The adopted local development plan provides the framework for decisions to be made up until 2021 on how land is used and developed. However, clarifications published by Pembrokeshire County Council [89] advise that this local development plan will remain in force until a replacement local development plan is adopted.

7.2.17. Policy GN.1 of the current local development plan states:

> "Development will be permitted where the following criteria are met: [...] It would not result in a significant detrimental impact on local amenity in terms of visual impact, loss of light or privacy, odours, smoke, fumes, dust, air quality or an increase in noise or vibration levels."
>
> A new local plan is due to be adopted by PCC in May 2026. Review of the published 'Focussed Changes'[90] documentation indicates that policy GN.1 will remain with a wording clarification of *"[Developments] would not cause an unacceptable adverse impact on local amenity that cannot be mitigated, in terms of […] noise or vibration levels".* Accordingly, this future requirement has been considered in this chapter where appropriate.
>
> This chapter makes reference to the current LDP and the planning statement for the proposed development considers emerging policies and therefore considers the LDP Review which is currently being developed.

Pembrokeshire Coast National Park Local Development Plan 2, 2020 [91]

7.2.18. The application site is neighboured to the south and east by the Pembrokeshire Cost National Park. Therefore, consideration has been given to the planning policy of this adjacent Planning Authority. Policy 30 'Amenity' of the Local Development Plan states:

> *"*Development *will not be permitted where it has an unacceptable adverse effect on amenity, particularly where: a) the development would have a detrimental impact on the quality of the environment currently enjoyed by people living, working or visiting the Park; and/or […] c) the development leads to an increase in traffic or noise or odour or light which has a significant adverse effect".*

7.2.19. Noise impacts at the National Park as a result of the proposed development have been considered through the identification of Public Rights of Way (PRoW) within the study area and the determination of resultant noise impacts on these areas of public amenity.

7.3. Methodology

7.3.1. The following section describes the methodology used to determine the likely significant effects on noise and vibration as a result of the proposed development.

Study Area

7.3.2. The location of the application site and key environmental constraints can be found in ES Figure 3.3 (General Constraints Plan).

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[88] Pembrokeshire County Council (2013). Local Development Plan Planning Pembrokeshire's Future (up to 2021). Pembrokeshire County Council.

[89] Pembrokeshire County Council (2025). Adopted Local Development Plan. Available at: https://www.pembrokeshire.gov.uk/adopted-local-development-plan (Accessed:18/12/2025)

90 Pembrokeshire County Council (2025). Pembrokeshire Local Development Plan 2 Deposit 2 Focussed Changes Part 1. Pembrokeshire County Council. Available at: https://www.pembrokeshire.gov.uk/local-development-plan-review/focused-changes (accessed 13/01/2026)

[91] Pembrokeshire Coast National Park Authority (2020). Local Development Plan 2. Authority (end date 2031). Pembrokeshire Coast National Park Authority

7.3.3. The noise and vibration assessment study areas are set out in Table 7.1 and are indicated in Figure 7.1. The study areas were determined in accordance with current guidance and standards and were deemed "satisfactory" within the EIA Scoping Opinion.

Table 7.1: Study area definitions

Assessment Condition	Study Area Definition
Construction Noise	The study area for construction noise comprises the area within 300 m of the existing site boundary. The effects of construction noise resulting from the proposed development have been assessed within this study area at all affected noise sensitive receptors.
Construction Vibration	The study area for construction vibration comprises the area within 100 m of the existing site boundary. The effects of construction vibration from the activities most likely to generate perceptible levels of vibration (such as compaction and piling) have been assessed at noise sensitive receptors within this study area.
Construction Traffic Noise	The study area for construction traffic noise comprises an area of 50 m from the kerb line of public roads used by construction vehicles during the construction of the development where there is the potential for an increase in Basic Noise Level of more than 1.0 decibel, A-weighted (dBA), due to construction traffic. Details of baseline and construction traffic flows have been provided by the project team and are discussed in the construction traffic noise assessment section of this chapter.
Operational Noise (Equipment)	The study area for operational noise comprises the area within 600 m of the existing site boundary. The effects of operational noise, resulting from the proposed development itself, have been assessed at all noise sensitive receptors within this study area.

Baseline

7.3.4. The baseline data used to inform the technical assessments presented in this chapter have been determined from the following sources:

- Desktop studies of the site and surrounding area using publicly available resources such as Ordnance Survey mapping[92] and topography[93], and aerial photography (courtesy of Google Maps 2025). The primary aim of these desktop studies was to identify noise sensitive receptors in the vicinity, including residential uses and public amenity uses such as the National Park and PRoW. Accordingly, the general principles of receptor sensitivity to noise and vibration used to inform the identification of receptors are presented in Table 7.2 (taken from TAN 2011[94]).

Table 7.2: General principles of receptors sensitivity

Sensitivity	Descriptor	Example of receptor
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios

[92] https://osdatahub.os.uk/downloads/open (Accessed 27/01/2025)

[93] https://www.ordnancesurvey.co.uk/products/os-terrain-50 (Accessed 27/01/2025)

[94] Scottish Government (2011). Assessment of noise: technical advice note. Scottish Government

Sensitivity	Descriptor	Example of receptor
		Schools during the daytime
		Hospitals/residential care homes
		Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices
		Bars/Cafes/Restaurants where external noise may be intrusive.
		Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours
		Factories and working environments with existing high noise levels
		Sports grounds when spectator noise is a normal part of the event
		Night Clubs

- Consultation with the Environmental Health Officers (EHO) at PCC (refer to Table 7.3).
- Environmental noise monitoring at several locations across the site and surrounding area (refer to Appendix 7.3 and Section 7.4 ‘Baseline Conditions’ of this chapter).
- Construction equipment noise and vibration levels were determined in accordance with British Standard (BS) 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise [95] and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration [96] using details provided by the project team regarding the expected equipment schedules, layouts and operational hours.
- Operational equipment noise levels were determined following consultation with the project team and comprise a combination of manufacturer’s published data, measured in-situ conditions from DARC Site 1 (Australia), and engineering estimates of unmitigated operational equipment noise emissions based on the professional experience of the project team. Supplementary information regarding operational conditions and acoustic characteristics have been gained by the Author of this chapter following in-person attendance to the antenna manufacturing facility. Refer to the Operational Noise assessment section of this chapter for further details.

Guidance and standards

7.3.5. The following documents provide guidance and standards that are of relevance to the assessment of noise and vibration, which do not form an integral part of Welsh National Legislation or Local Policy.

[95] British Standards Institution (2014). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. British Standards Institution.

[96] British Standards Institution (2014). BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. British Standards Institution.

Noise Policy Statement for England, 2010 (NPSE) [97]

7.3.6. The NPSE seeks to promote good health and good quality of life through effective management of noise with the context of government policy on sustainable development by avoiding significant adverse impacts on health and quality of life, mitigating and minimising adverse impacts on health and quality of life and, where possible, contributing to the improvement of health and quality of life.

7.3.7. It is recognised that the NPSE is an English policy document and that no direct Welsh equivalent exists. However, reference to the NPSE is necessary in this instance in order to introduce the concepts of Lowest Observable Adverse Effect Level (LOAEL) and Significant Observable Adverse Effect Level (SOAEL) which form the fundamental basis of determining significance in the assessments of construction noise and vibration.

World Health Organisation (WHO) Night Noise Guidelines for Europe, 2009 [98]

7.3.8. The WHO Night Noise Guidelines for Europe was published for the development of future legislation and policy action in the area of assessment and control of night noise exposure. They also set noise levels at which adverse health effects are observed.

WHO Environmental Noise Guidelines for the European Region, 2018 [99]

7.3.9. The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources, including transportation noise. The current guidelines complement the Night Noise Guidelines from 2009.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (BS 4142:2014+A1:2019) [100]

7.3.10. This standard describes methods for rating and assessing sound of an industrial or commercial nature. The methods described in BS 4142:2014+A1:2019 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, allowing for subjective, objective and contextual modifiers.

British Standard 4142:1997 Methods for rating and assessing industrial and commercial sound (BS 4142:1997) [101]

7.3.11. This standard describes methods for rating and assessing sound of an industrial or commercial nature. BS 4142:1997 describes background sound levels and rating levels below 30 dB and 35 dB respectively as *"very low"*.

7.3.12. The use of BS 4142:1997 is introduced as a result of consultation with PPC (refer to Table 7.2) as an agreed assessment approach. As such, the guidance of both BS 4142:1997 and BS 4142:2014+A1:2019 are considered as appropriate in this chapter.

[97] Department for Environment Food and Rural Affairs (2010). Noise Policy Statement for England. DEFRA.

[98] World Health Organization (2009). Night Noise Guidelines for Europe. WHO Regional Office for Europe.

[99] World Health Organization (2018). Environmental Noise Guidelines for the European Region. WHO Regional Office for Europe.

[100] British Standards Institution (2019). BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound. British Standards Institution.

[101] British Standards Institution (1997). BS 4142:1997 Method for rating industrial noise affecting mixed residential and industrial areas. British Standards Institution.

British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (BS 5228-1:2009+A1:2014)

7.3.13. Part 1 of the standard provides a methodology for predicting and assessing noise levels generated by fixed and mobile plant used for a range of typical construction operations.

British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS 5228-2:2009+A1:2014)

7.3.14. Part 2 of the standard provides guidance on the effect of vibration and the likelihood it will cause complaint and cosmetic damage to buildings and gives recommendations for methods of vibration control.

British Standard 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration (BS 7385-2:1993) [102]

7.3.15. BS 7385-2 gives guidance on the assessment of the possibility of vibration-induced damage in buildings due to a variety of sources and identifies the factors which influence the vibration response of buildings.

British Standard 7445-1:2003 Description and measurement of environmental noise. Guide to quantities and procedures (BS 7445-1:2003)[103]

7.3.16. BS 7445-1:2003 defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

Design Manual for Roads and Bridges LA 111 Noise and vibration. Revision 2, 2020 (DMRB LA 111) [104]

7.3.17. DMRB LA 111 sets out the requirements for noise and vibration assessments for road projects, applying a proportionate and consistent approach using best practice and ensuring compliance with relevant legislation.

Calculation of Road Traffic Noise, 1988 (CRTN) [105]

7.3.18. CRTN provides procedures for predicting the level of road traffic noise accounting for the traffic parameters and sound propagation effects to nearby sensitive screening receptors such as the absorption of sound by the ground and the screening and reflective effects of intervening or nearby structures and buildings.

Transport Research Laboratory (TRL), Groundborne vibration caused by mechanised construction works (TRL Report 429), 2000 [106]

7.3.19. This TRL study presents a review of current knowledge of ground vibration transmission and adds new information specific to construction works. The report presents methods of predicting

[102] British Standards Institution (1993). BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration. British Standards Institution.

[103] British Standards Institution (2003). BS 7445-1:2003 Description and measurement of environmental noise. Guide to quantities and procedures. British Standards Institution.

[104] Highways England (2020). Design Manual for Roads and Bridges LA 111 Noise and vibration Revision 2. Available at: LA 111 - Noise and vibration (Accessed: 27 November 2024).

[105] Department of Transport Welsh Office (1988). Calculation of Road Traffic Noise. HMSO.

[106] D M Hiller, G I Crabb (2000) Groundborne vibration caused by mechanised construction works TRL Report 429. Transport Research Laboratory.

vibration levels from all different mechanised construction activities, accounting for the characteristics on the plant and site conditions.

Institute of Environmental Management and Assessment (IEMA), Guidelines for Noise Impact Assessment, 2014 [107]

7.3.20. These IEMA guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. The guidelines provide specific support on how noise impact assessment fits within the EIA process.

Consultation

7.3.21. An EIA Scoping Report was submitted to PCC in March 2023. A Scoping Opinion was received in response to the EIA Scoping Report (May 2023). The applicant's responses to the Scoping Opinion are contained in the Scoping Opinion Response, Appendix 2.1 (Scoping Opinion Response).

7.3.22. Table 7.3 summarises the consultation that has been undertaken since the receipt of the Scoping Opinion.

Table 7.3: Summary of Consultation

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Public Protection – Noise, PCC	Telecon and summary email dated 16 May 2023	Due to the low background noise levels measured in the area, operational noise emissions from site operations are to be limited to the levels defined as "very low" in accordance with BS 4142:1997; 30 dB $L_{Aeq,T}$ and 35 dB $L_{Ar,Tr.}$ Regarding noise generated in the temporary auxiliary and routine testing conditions (such as from the auxiliary compound or antenna during emergency search functions), the above noise limits can be relaxed by 10 dBA on the basis that these are temporary and short-term.
Public Protection – Noise at PCC. Planning Officer at PCC.	Telecon on 20 February 2025	EIA Scoping Report and Scoping Opinion confirmed as still being valid. Discussed noise survey results, proposed design elements, micro-siting approach, assessment methodology and mitigated modelling outputs. PCC continued to be supportive of the use of BS 4142:1997 and "very low" noise levels for determining impact and significance as a pragmatic and proportionate approach and confirmed to be an acceptable methodology for EIA. PCC recognised that construction effects were inherently temporary.

Assessment Criteria

7.3.23. This assessment gives due regard to TAN 11, and the subsequent CL-01-15 updates. Consideration is also given to the generalised decision-making frameworks presented in the Noise and Soundscapes Plan for Wales.

[107] Institute of Environmental Management & Assessment (2014). Guidelines for Environmental Noise Impact Assessment version 1.2. IEMA.

7.3.24. Assessments of significance of effect have been presented herein primarily with consideration of the IEMA Guidelines for Environmental Noise Impact Assessment and the NPSE. These documents introduce the established toxicology concepts of LOAEL and SOAEL into the assessment and determination of noise impacts, which form the fundamental basis of determining significance in this chapter. Accordingly, the LOAEL is defined as *"the level above which adverse effects on health and quality of life can be detected"*; the SOAEL is defined as the level *"above which significant adverse effects on health and quality of life occur"* for noise effects.

7.3.25. The LOAEL and SOAEL vary for different noise sources, receptor sensitivities, and assessment types, and are defined below for each potential noise or vibration impact in accordance with the assessment-specific guidance and receptor sensitivity. As such, receptor sensitivity is already accounted for upon the determination of noise impacts and significance in line with the assessment-specific guidance. Notwithstanding, all of the identified noise sensitive receptors are either residential or educational in nature or are valued for their amenity (e.g. PRoW and National Park), and so are considered as having a high sensitivity to noise. Refer to Section 7.4 Baseline Conditions for further details.

7.3.26. Where absolute noise limits are presented for an assessment (such as is the case for operational noise following PCC consultation), significance of effect has been assessed at all identified receptors by comparing predicted noise levels to the maximum allowable criterion.

Construction Noise (including Construction Traffic Assessment)

7.3.27. For construction noise, determination of significance is made with reference to the LOAEL and SOAEL. The LOAEL and SOAEL for the identified residential receptors have been determined in accordance with BS 5228-1:2009+A1:2014 Section E3.2 and Table E.1 (the 'ABC' method).

7.3.28. This method allows the SOAEL to be defined in the context of the existing ambient noise level in that location; the LOAEL is defined as being the existing ambient noise level, determined following an on-site environmental noise survey.

7.3.29. The construction noise thresholds for the 'ABC' method are set out in Table 7.4 (from (BS 5228-1:2009+A1:2014 Table E.1).

Table 7.4: Example construction noise threshold at dwellings (BS 5228-1:2009+A1:2014 Table E.1)

Assessment category & threshold period	**Definition** **Category A[A])**	**Category B[B])**	**Category C[C])**
Daytime (07:00 – 19:00) & Saturdays (07:00 – 13:00)	65	70	75
Evening & Weekends (19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays & 07:00 – 23:00 Sundays)	55	60	65
Night-time (23:00 – 07:00)	45	50	55

Note 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

Note 3: Applied to residential receptors only.

Assessment category & threshold period	Definition Category A[A])	Category B[B])	Category C[C])
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

7.3.30. Accordingly, Table 7.5 sets out the LOAEL and SOAEL threshold noise levels for residential uses that have a high sensitivity to noise as adopted in this chapter.

Table 7.5: Construction Noise LOAELs and SOAELs for residential uses

Time Period	LOAEL	SOAEL
Daytime (07:00 – 19:00) & Saturdays (07:00 – 13:00)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 (Replicated as Table 7.4)
Evening & Weekends (19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays & 07:00 – 23:00 Sundays)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 (Replicated as Table 7.4)
Night-time (23:00 – 07:00)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 (Replicated as Table 7.4)

7.3.31. It is recognised that the 'ABC' method is applicable for residential buildings only. For non-residential uses that are also highly sensitive to noise, consideration has been given to the '5 dB(A) Change' method described in BS 5228-1:2009+A1:2014 Section E.3.3. This method advises that potentially significant effects may occur where the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise level by 5 dB or more, *"subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively".*

7.3.32. The Standard advises that the '5 dB(A) Change' method is also applicable for use when assessing noise impacts over public open spaces valued for their amenity, clarifying that *"the extent of the area impacted relative to the total available area also needs to be taken into account in determining whether the impact causes a significant effect"*.

7.3.33. Given the low ambient noise levels measured at the site (refer to Section 7.4 'Baseline Conditions of this chapter), the lower cut-off values will apply in this instance to all non-residential receptors identified, including PRoW.

7.3.34. Accordingly, the LOAEL and SOAEL for construction noise impacts on non-residential uses with a high sensitivity to noise is as follows.

Table 7.6: Construction Noise LOAELs and SOAELs for non-residential uses

Time Period	LOAEL	SOAEL
Daytime (07:00 – 19:00) & Saturdays (07:00 – 13:00)	Baseline noise levels ($L_{Aeq,T}$)	Total noise level (baseline + site noise) exceeding 5 dB over the baseline

Time Period	LOAEL	SOAEL
		(lower cut-off of 65 dB $L_{Aeq,T}$ for site noise)
Evening & Weekends (19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays & 07:00 – 23:00 Sundays)	Baseline noise levels ($L_{Aeq,T}$)	Total noise level (baseline + site noise) exceeding 5 dB over the baseline (lower cut-off of 55 dB $L_{Aeq,T}$ for site noise)
Night-time (23:00 – 07:00)	Baseline noise levels ($L_{Aeq,T}$)	Total noise level (baseline + site noise) exceeding 5 dB over the baseline (lower cut-off of 45 dB $L_{Aeq,T}$ for site noise)

7.3.35. Predictions of construction noise levels at the nearest noise sensitive receptors have been undertaken in general accordance with BS 5228-1:2009+A1:2014, based on information provided regarding the typical activities, plant equipment schedules, site layouts, and working hours that are expected to be required to deliver the proposed development (refer to Appendix 7.3). Applicable construction equipment noise data has been taken from BS 5228-1:2009+A1:2014. Assumptions and limitations for the construction noise assessment are set out in Table 7.13 of this chapter.

7.3.36. The magnitude of impact of construction noise has been determined using Table 7.7 below, derived from Table 3.16 of DMRB LA 111. Where the predicted construction noise level equals or exceeds the receptor-specific SOAEL, as determined from the appropriate 'ABC' category value presented in Table 7.3, this is an indication of a moderate or major magnitude of impact and a potentially significant effect.

Table 7.7: Construction Noise Impact Magnitude

Construction Noise Level, dB $L_{Aeq,T}$	Magnitude of Construction Noise Impact
Below LOAEL	Negligible
Above or equal to LOAEL and below SOAEL	Minor
Above or equal to SOAEL and below SOAEL +5 dB	Moderate
Above or equal to SOAEL +5 dB	Major

7.3.37. Additionally, an assessment of the likely temporary change in road traffic noise on roads which are to be used by construction traffic has been undertaken. In accordance with DMRB LA 111, the study area for the construction traffic noise assessment has been defined as the area within 50 m of public roads with the potential for an increase in baseline noise level of 1 dBA or more as a result of the addition of construction traffic.

7.3.38. The approach for the construction traffic assessment has been to identify the change in Basic Noise Level (BNL) on the existing road network due to additional heavy vehicle movements, in accordance with CRTN calculation procedures.

7.3.39. The BNL calculation produces a road traffic noise level (dB $L_{A10,18hr}$) for each road link at a notional receptor located 10 m from the road edge, accounting for the road speed (km/h), total traffic flow, and percentage of heavy goods vehicles. Noise level change has been determined by comparing the baseline and 'with construction traffic' BNLs calculated for the roads that will be used by construction traffic.

7.3.40. The impact magnitude of the change in road traffic noise due to construction traffic has been determined with reference to DMRB LA 111 as follows in Table 7.8.

Table 7.8: Construction Traffic Noise Increase Magnitude (DMRB LA 111 Table 3.17)

BNL Increase due to Construction Traffic, dB $L_{A10,18hr}$	**Magnitude of Construction Noise Impact**
Less than 1.0	Negligible
1.0 to 2.9	Minor
3.0 to 4.9	Moderate
Greater than or equal to 5.0	Major

7.3.41. In line with the assessment methodology defined in DMRB LA 111, construction noise and construction traffic noise shall constitute a significant effect at receptors with a high sensitivity to noise where it is determined that a major or moderate magnitude of impact will occur (i.e. the defined SOAEL is exceeded) for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or,
- a total number of days exceeding 40 in any six consecutive months.

7.3.42. Due to the nature of construction activities, all construction noise and construction traffic effects are considered to be local, temporary and adverse.

7.3.43. It is noted that a key consideration of the proposed development is the potential for micro-siting of the antenna following detailed ground investigation works. Accordingly, the assessment of micro siting impacts on construction noise emissions presented in this chapter has adopted an approach similar to that undertaken for windfarm developments, wherein the proposed layout has undergone detailed assessment followed by a review of the worst-case noise change that may occur were the site to shift by the maximum allowable distances. This is considered a reasonable and proportionate methodology for assessing micro siting impacts.

Construction Vibration Assessment

7.3.44. The magnitude of vibration impacts due to the construction of the proposed development has been determined with reference to BS 5228-2:2009+A1:2014. This standard presents a method of predicting and assessing vibration from distinct construction activities such as piling or compaction.

7.3.45. The level of vibration from typical construction activities has been estimated at receptors within the study area that are closest to the application site. Receptors located further from the site will be subject to greater propagation losses and as such lower vibration levels and impacts. Predictions of vibration have been carried out for relevant activities where a prediction method or historic empirical data is available. In this instance, the construction vibration assessment considers primarily excavation and compaction. Construction vibration assumptions are presented in Table 7.13 of this chapter

7.3.46. Table B.1 of BS 5228-2:2009+A1:2014 advises that vibration levels equal to or below 0.3 mm/s Peak Particle Velocity (PPV) would be *"just perceptible in residential environments"*; accordingly, 0.3 mm/s PPV is considered to be the LOAEL for construction vibration when assessed to human receptors. Table B.1 of BS 5228-2:2009+A1:2014 also advises that vibration levels equal to or greater than 1.0 mm/s PPV are likely to cause complaint; as such, 1.0 mm/s PPV is considered to be the SOAEL for construction vibration at human receptors.

7.3.47. Consideration has also been given to the potential impacts of construction vibration on the built environment. Accordingly, reference is made to Section B.3 of BS 5228-2:2009+A1:2014 which sets out structural responses to vibration.

7.3.48. Table B.2 of the Standard (replicated below as Table 7.9) provides guidance on the levels of transient vibration that would be necessary to cause cosmetic damage to different types of buildings.

Table 7.9: Transient Vibration Guide Values for Cosmetic Damage (Table B.2 of BS 5228-1:2014)

	Peak component particle velocity in frequency range of predominant pulse	
Type of Building	**4 Hz – 15 Hz**	**15 Hz and above**
Reinforced or framed structures		
Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures		
Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Values referred to are at the base of the building.

Note 2: For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded).

7.3.49. BS 5228-2:2009+A1:2014 states:

> *"Minor damage is possible at vibration magnitudes which are greater than twice those given in Table B.2, and major damage to a building structure can occur at values greater than four times the tabulated values."*

7.3.50. Where vibration could be considered continuous (giving rise to dynamic magnification due to resonance), the guide values presented in Table B.2 of the standard (replicated as Table 7.9) are reduced by up to 50%.

7.3.51. However, BS 5228-2:2009+A1:2014 notes that the probability of damage tends towards zero at 12.5 mm/s PPV.

7.3.52. Accordingly, for residential/other occupied receptors, the magnitude of impact of construction vibration has been set based upon the levels at which there is a likelihood of complaint (refer to table 7.10), these being considerably lower than those at which cosmetic building damage may occur.

7.3.53. The magnitude of impact for construction vibration on human receptors with a high sensitivity to vibration has been determined using table 7.10, derived from Table 3.33 of DMRB LA 111. Where the predicted construction vibration level equals or exceeds the SOAEL, as defined above, this is an indication of a moderate or major magnitude of impact and a potential significant effect.

Table 7.10: Magnitude of Impact due to Construction Vibration

Construction Vibration Level (PPV, mm/s)	**Magnitude of Construction Vibration Impact**
Below the LOAEL (0 to 0.2)	Negligible

Construction Vibration Level (PPV, mm/s)	Magnitude of Construction Vibration Impact
Above or equal to the LOAEL and below the SOAEL (0.3 to 0.9)	Minor
Above or equal to SOAEL (1.0) and below 10 mm/s	Moderate
Above or equal to 10 mm/s	Major

7.3.54. In line with the assessment methodology defined in DMRB LA 111, construction vibration shall constitute a likely significant effect at receptors with a high sensitivity to vibration where it is determined that a major or moderate magnitude of impact will occur (i.e. the defined SOAEL is exceeded) for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or,
- a total number of days exceeding 40 in any six consecutive months.

7.3.55. Due to the nature of construction activities, all construction vibration effects are considered to be local, temporary and adverse.

Operational Noise Assessment

7.3.56. Permanent equipment installations which form part of the proposed development are described in Chapter 3 (Proposed Development) of this ES. Those which will generate operational noise include the new radar antenna (both the transmit (Tx) and receive (Rx) arrays), chillers, auxiliary power compound and wider ancillary equipment. Operational noise from fixed installations has been assessed in line with the guidance of BS 4142:2014+A1:2019. Following PCC consultation, consideration has also been given to the guidance of BS 4142:1997.

7.3.57. The approach within BS 4142:2014+A1:2019 is the usual method of assessing sound of an industrial or commercial nature within the UK and is referenced within TAN 11 (via the CL-01-15 updates) as an appropriate methodology. The standard provides a method of determining rating levels for sources of industrial or commercial sound for the purposes of determining the noise impact from new, modified, or additional sources of sound, and assessing sound at noise sensitive receptors.

7.3.58. The BS 4142:2014+A1:2019 assessment approach, in summary, involves the following:

- The specific sound level, dB $L_{Aeq,T}$, (of commercial/industrial sound) is determined by measurement at each assessment (receptor) location during time intervals that are representative of the period of interest. For daytime (07:00 – 23:00) periods, a 1-hour reference period is used; for night-time (23:00 – 07:00) periods, a 15-minute reference period is used. For a noise source that is not yet operating, BS 4142:2014+A1:2019 advises that the specific sound level should be determined by calculation.

- The background sound level, dB $L_{A90,T}$, is measured at locations that are representative of the acoustic environment at the assessment (receptor) locations. A representative value of the background sound level is then determined for each period of interest. Section 8.1 of the standard states: *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."* Observations and a description of the acoustic environment are required to understand the context in which the specific sound source is being assessed.

- The rating level, dB $L_{Ar,Tr}$, of commercial/industrial sound is determined at each assessment (receptor) location accounting for the expected characteristics of the specific sound. Character corrections may be applied for tonality, intermittency and

impulsivity, where these are likely to be prominent and/or attract attention at the receptor locations when compared to the pre-existing ambient (residual) sound level. BS 4142:2014+A1:2019 advises that for equipment that is not yet operational, character corrections should be applied using the described subjective method.

- The impact of the commercial/industrial noise source is then determined by comparing the rating level to the pre-existing representative background sound level. BS 4142:2014+A1:2019 states:

"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs."

An estimation of the impact can be obtained by the difference of the rating noise level and the background noise level and considering the following:

- "Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is 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."

- The level and potential effects of uncertainty in the assessment are then reported.

7.3.59. Following the identification of the baseline conditions (refer to section 7.4), consultation was undertaken with PCC to determine appropriate operational noise criteria for the proposed development. The measured background noise levels across the site were found to be near to, or below, the levels described in BS 4142:1997 as *"very low"*. Therefore, the consultation determined that strict adherence to the assessment methodology of BS 4142:2014+A1:2019 would trigger disproportionate assessment and would result in unreasonably onerous and impractical design requirements.

7.3.60. Section 11, bullet "1)" second paragraph of BS 4142:2014+A1:2019 states:

"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."

7.3.61. On this basis, an alternative approach was agreed with PCC for normally operating plant adopting the guidance of BS 4142:1997 (as set out in Table 7.3 and described in Section 7.2 of this chapter). Section 1 of this guidance states:

"For the purposes of this standard, background noise levels below 30 dB and rating levels below about 35 dB are considered to be very low."

7.3.62. These absolute noise levels and the subjective impression of "*very low"* are supported by WHO guidance; Table 3 of the Night Noise Guidelines for Europe, 2009, states:

"Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed. $L_{night,outside}$ of 30 dB is equivalent to the no observed effect level (NOEL) for night noise."

7.3.63. As such, the absolute noise levels described in BS 4142:1997 as "very low" have been adopted as key criteria for the operational noise assessment.

7.3.64. The impact magnitude for normally operating plant (i.e. radar antenna and chillers) has been determined as presented in Table 7.11.

Table 7.11: Industrial and Commercial Sound Magnitude of Impact – Normally Operating Plant

Commercial and Industrial Sound Level (BS 4142 Rating Level)	Description of Human Perception	Magnitude of Commercial and Industrial Sound
Below 30 dB $L_{Aeq,T}$ and 35 dB $L_{Ar,Tr}$	Below "very low" noise levels and below the NOEL for night noise (WHO, 2009). Unlikely to result in measurable adverse impacts.	Negligible
Equal to 30 dB $L_{Aeq,T}$ or 35 dB $L_{Ar,Tr}$ (whichever is lower)	Equal to "very low" noise levels. Unlikely to result in adverse effects but may be audible.	Minor
Below 35 dB $L_{Aeq,t}$ or 40 dB $L_{Ar,Tr}$ (whichever is lower)	Noise levels higher than the level which would be considered "very low".	Moderate
Greater than 35 dB $L_{Aeq,T}$ or 40 dB $L_{Ar,Tr}$	Noise levels are significantly higher than the level which would be considered "very low".	Major

7.3.65. Table 7.11 applies only to noise emissions from fixed items of plant that operate under normal conditions to facilitate the core functionality of the site as agreed in consultation with PCC (such as antenna, chillers, etc). With regard to plant that operates occasionally for short-periods such as routine testing, the temporary auxiliary power compounds or the antenna arrays during the emergency search function, a relaxation of 10 dB has been agreed with PCC.

7.3.66. The various operational conditions for the site are described in paragraph 7.6.33.

7.3.67. This 10 dB relaxation is also supported by WHO guidance, with Table 3 of the Night Noise Guidelines for Europe 2009 stating:

> "A number of effects on sleep are observed from this range [30 – 40 dB]: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill and the elderly) are more susceptible. However, even in the worst cases the effects seem modest. $L_{night,outside}$ of 40 dB is equivalent to the lowest observed adverse effect level (LOAEL) for night noise."

7.3.68. The impact magnitude for noise emissions arising during the temporary auxiliary power or routine testing operational conditions has accordingly been determined as presented in Table 7.12.

Table 7.12: Industrial and Commercial Sound Magnitude of Impact – Temporary Auxiliary Operations & Routine Testing

Commercial and Industrial Sound Level (BS 4142 Rating Level)	Description of Human Perception	Magnitude of Commercial and Industrial Sound
Below 40 dB $L_{Aeq,T}$ and 45 dB $L_{Ar,Tr}$	Noise levels in this magnitude may result in modest adverse effects, being equivalent to the LOAEL for night noise (WHO, 2009). However, noise levels are likely to be acceptable for short periods.	Negligible
Equal to 40 dB $L_{Aeq,T}$ or 45 dB $L_{Ar,Tr}$ (whichever is lower)		Minor Adverse
Below 45 dB $L_{Aeq,t}$ or 50 dB $L_{Ar,Tr}$ (whichever is lower)	Noise levels are noticeably louder than the WHO LOAEL for night noise and adverse effects may be observed.	Moderate Adverse

Commercial and Industrial Sound Level (BS 4142 Rating Level)	Description of Human Perception	Magnitude of Commercial and Industrial Sound
Greater than 45 dB $L_{Aeq,T}$ or 50 dB $L_{Ar,Tr}$		Major Adverse

7.3.69. Noise emissions from normally operating plant and during the temporary auxiliary/routine testing conditions have the potential to result in a significant effect at receptors with a high sensitivity to noise where a moderate or major magnitude of impact is predicted; i.e. where the absolute noise criteria agreed with PCC are exceeded.

7.3.70. Effects arising from the 'normal' operational condition would be considered local, permanent and adverse. Effects arising during the temporary auxiliary power and routine testing condition would be considered local, temporary and adverse.

7.3.71. Noise emissions from the normally operating plant (proposed radar antenna and chillers) and auxiliary power compound have been assessed using the noise modelling software CadnaA by Datakustik in accordance with the International Organization for Standardization (ISO) 9613-2:2024 [108] prediction methodology using the provided details regarding site layouts and operational noise emissions.

7.3.72. An assessment of micro siting impacts on operational noise emissions has then been undertaken, adopting an approach similar to that undertaken for windfarm developments, wherein the proposed layout has undergone detailed assessment followed by a review of the worst-case noise change that may occur were the site to shift by the maximum allowable distances. This is considered a reasonable and proportionate methodology for assessing operational micro siting impacts.

Assumptions & Limitations

7.3.73. The construction phase and operational phase assessments have been based on the proposed development description presented in Chapter 3 (Proposed Development) to establish a realistic worst-case assessment scenario.

7.3.74. Data used to compile the assessment consists of information derived from a variety of sources, only some of which can be directly examined and validated for the purposes of the assessment. The assumption is made that this data, as well as that derived from other secondary sources, is suitably accurate.

Construction Noise and Vibration

7.3.75. Outline information regarding construction programme, schedule, construction compounds, works phasing, and construction plant has been provided by the project team to inform the construction noise and vibration assessments. The assessments presented herein have been undertaken based on the available information using industry and professional best practice, and the assumptions set out in Table 7.13 below.

Table 7.13: Construction noise and vibration model assumptions and limitations

Model Element	Assumptions and Limitations
Construction tasks and equipment	Equipment assumptions for each primary construction task have been provided by the project team and are presented in Appendix 7.3. Noise levels for each plant

[108] ISO (2024). ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors. International Organization for Standardization.

Model Element	Assumptions and Limitations
	item and construction task have been derived in accordance with BS 5228-1:2009+A1:2014. Where the works phasing indicates that multiple construction tasks will occur simultaneously in any given month, it is assumed that the plant indicated in Appendix 7.3 will be representative of each individual works area.
Piling	It is understood that no piling works are proposed.
Working hours	It is expected that the proposed development will be delivered primarily with works undertaken during daytime hours only (07:00 – 19:00 weekdays, 07:00 – 13:00 Saturdays). Some limited night-time works are required for the assembly of the antenna; the plant associated with this task is set out in Appendix 7.3. Night-time works that generate noise will occur within the temporary antenna assembly building only.
Programme	It is expected that the works will take approximately 24 months to complete. An indicative monthly programme/phasing is presented in Appendix 7.3, and the programme is described further in Chapter 3: (Proposed Development) of this ES. Antenna foundations will be formed (excavated and concrete-poured) on a basis of one per week, beginning in month 3 of the programme.
Works areas	It is understood that site preparation and earthworks will occur within 2 m of any proposed structures or civil works. Other construction activities will be localised to the antenna foundations and wider proposed constructions. Construction vehicle movements within the proposed development site boundary will utilise the existing hard standings only.
Construction traffic and access	Construction traffic will access the site primarily from the south-east using the A487, before entering the site via a new construction access area off the C3010, immediately east of the site boundary. Based on details provided, it is understood that daily construction traffic movements to and from the site will comprise a maximum of 80 light vehicles (cars) and 15 heavy goods vehicles (HGV).
Road closures and diversion route	It is understood that the works will not result in any road closures or diversions.
Noise model	The expected level of construction noise resulting from a typical day in each primary construction phase has been predicted using Datakustik CadnaA® (build version 2024 MR1) noise modelling software. Works such as site preparation and civils have been modelled as an area source covering the relevant works area for that task, with sound power levels calculated in accordance with BS 5228-1:2009+A1:2014 for each construction task. Vehicle movements within the proposed development site boundary have been modelled as a line source, with noise levels derived in accordance with BS 5228-1:2009+A1:2014 accounting for the worst-case number of vehicles expected in each modelled scenario. For efficacy, modelling and noise contours have been produced for each month of the programme where the site noise emissions may vary, i.e. where the phasing indicates several months will contain identical construction activities, only one of these has been modelled. Monthly groupings are described in Appendix 7.3. The specific order of construction for the antenna is not currently known, however it is understood the foundations will be constructed one per week. Therefore, the modelling of monthly noise emissions assumes a worst-case that antenna will be

Model Element	Assumptions and Limitations
	constructed in groups of four, and that the Tx and Rx arrays may both be constructed at the same time.
Receptors	Construction noise levels at the identified noise sensitive premises have been calculated in façade conditions. To determine noise impacts on public amenity, including the Pembrokeshire National Park, construction noise levels have been calculated in free-field conditions at 10 m intervals along the alignment of each identified PRoW within the defined study area, with the average noise level along the alignment assessed. The above approach is considered to align with the requirements of both Pembrokeshire County Council Local Plan Policy GN.1 and Pembrokeshire Coast National Park Local Plan Policy 30. Receptors included in the assessment are summarised in the Table 7.16 of this chapter.

Operational Noise

7.3.76. Table 7.14 describes the assumptions and limitations associated with the noise model and operational noise assessment.

Table 7.14: Operational noise model assumptions and limitations

Model Element	Assumptions and Limitations
Topography	The topography for the site and surrounding area has been modelled based on 50 metre Digital Terrain Model (DTM) obtained from the Ordnance Survey OS Terrain 50 data package. The contours created from the DTM are at 10 metre intervals (vertical resolution). It is understood there will be no significant topography changes as a result of the proposed development.
Buildings	Buildings have been modelled based on OS MasterMap data. Building heights have been derived from eave height data from the above dataset (where available) and combined with Google Maps data. No noise barriers or other close boarded fences or walls at property boundaries have been included in the model, unless identified specifically as part of the embedded mitigation measures.
Ground cover	The site and surroundings comprise a mixture of hard and soft ground. As such, the noise model has been configured with a ground absorption coefficient of 0.5 as a reasonable worst-case.
Receptor data	Address and receptor sensitivity data has been defined from interrogation of mapping available for the area (including Ordnance Survey and Google), with further information taken from the Council Tax checker provided by GOV.UK109. Operational noise levels have been calculated across each façade of the identified receptors with the exception of the Park Hall Village campsite. The campsite has been modelled using a single receptor point at the boundary closest to Cawdor

[109] https://www.tax.service.gov.uk/check-council-tax-band/search? (Accessed 27/01/2025)

Model Element	Assumptions and Limitations
	Barracks to present the worst-case noise change at these transient occupancy receptors. This approach is considered to align with the requirements of Pembrokeshire County Council Local Plan Policy GN.1.
National Park / Public Right of Way (PRoW)	PRoW data (including locations, extents and names/references) was obtained from the Pembrokeshire County Council Definitive Map[110]. Some PRoW span over a considerable area/length and their use is of a transient nature. The assessment of the potential noise impacts has been undertaken across the total area/length of these Noise Sensitive Receptors (NSRs) to provide a balanced approach, considering the impact at the majority of the path rather than at a specific single location. Operational noise levels have been calculated at 10 m intervals along the alignment of each PRoW. This approach is considered to align with the requirements of Pembrokeshire Coast National Park Local Plan Policy 30.
Baseline noise survey	Environmental noise surveying was undertaken as part of initial site investigations. Considering the physical extent of the proposed development, survey positions were selected to provide representative data for the key residential areas within the study area. The results and methodology of the surveying is set out in Appendix 7.2 and summarised in Section 7.4 'Baseline Conditions' of this chapter.
Operational Noise Source Data	Due to ongoing design development which falls beyond the scope of this chapter, operational noise data for the noise generating equipment proposed on the site has been provided based on representative plant or equipment. Therefore, minor changes in equipment selections may occur prior to installation of the scheme. However, all noise generating equipment selections will be made in accordance with the assessment outcomes and mitigation presented herein to ensure no material changes to the predicted impacts occurs. Where octave or 1/3 octave spectral data is available for operational noise sources, this has been included within the modelling. Where only broadband noise emission levels are available, these have been modelled accounting for the propagation losses expected within the 500Hz octave band in accordance with ISO 9613-2.

7.4. Baseline Conditions

7.4.1. In order to establish the baseline environmental noise conditions in and around the proposed development site, noise monitoring was undertaken at four locations covering a typical week-long period in January 2023. The results of this monitoring have been discussed in consultation with PCC and form the basis of the adopted design criteria for both construction and operational noise assessments.

7.4.2. The noise monitoring positions are described in Appendix 7.2 and identified in Figure 7.1. The monitoring locations were chosen to be representative of the existing environmental noise conditions (ambient $L_{Aeq,T}$ and background $L_{A90,T}$) at the identified noise sensitive receptors. The noise monitoring locations utilised were considered *"satisfactory"* in the Scoping Opinion.

7.4.3. The noise monitoring results, against which the assessments presented in this chapter are based, are summarised in Table 7.15 . Full details of the environmental noise survey method

[110] https://www.pembrokeshire.gov.uk/definitive-map (Accessed 27/01/2025)

(including observations, noise sources, weather conditions, etc.) and results are provided in Appendix 7.2.

Table 7.15: Summary Results of Environmental Noise Monitoring

Monitoring Position Reference	Period, T	dB $L_{Aeq,T}$	dB $L_{A90,15\ min}$	dB $L_{AFMax,T}$
MP1	Day (07:00 – 23:00)	37	24	62
	Night (23:00 – 07:00)	33	18	59
MP2	Day (07:00 – 23:00)	42	25	66
	Night (23:00 – 07:00)	41	19	67
MP3	Day (07:00 – 23:00)	38	28	62
	Night (23:00 – 07:00)	34	17	50
MP4	Day (07:00 – 23:00)	44	35	65
	Night (23:00 – 07:00)	41	23	61

7.4.4. The presented dB $L_{Aeq,T}$ is the measured residual noise level over the full survey period, with periods of poor weather removed.

7.4.5. In accordance with BS 4142:2014+A1:2019, the reported background sound level, dB $L_{A90,15min}$, has been determined following statistical analysis of the full survey measurement results and site context (excluding periods of rain or high wind).

7.4.6. The presented dB $L_{AFMax,T}$ is the 90th percentile maximum noise event measured during the day (07:00 – 23:00) and night-time (23:00 – 07:00) period of each measurement (excluding periods of poor weather). This is considered representative of the existing maximum noise level that is not regularly exceeded.

7.4.7. Given the predominately rural nature of the area surrounding the proposed development, no substantial changes in baseline conditions are expected to occur when considering the notional 'Future Baseline' condition. Notwithstanding, any future development in the vicinity of the proposed development would be likely to increase ambient sound levels rather than reduce them and as such the adoption of the measurements results presented above is considered representative of a reasonable worst-case when considering the 'Future Baseline' conditions.

Observations

7.4.8. The sources of noise that contributed to environmental noise climate were noted during each measurement. The observations are summarised as follows:

- The dominant source of noise during the daytime was light local road traffic using the various roads in the vicinity of the measurement positions and around the barracks.

- Other noise sources include birdsong and the rustling of foliage in nearby trees.
- It was noted during the survey that noise levels at position MP4 included contributions from the coast to the south-west (i.e. wind and ocean noise) and low-level plant noise from nearby Brawdy Business Park.

Receptors

7.4.9. The application site is located to the north-west of the Swansea Agglomeration (as defined within the Environmental Noise Directive 16). No Candidate Noise Management Areas (CNMA) or Candidate Quiet Areas (CQA) have been identified within 1 km of the proposed development site.

7.4.10. Twenty-three (23) noise sensitive receptor locations/areas were identified within the operational noise study area (an increase from the nine stated in the EIA Scoping Report due to design development and subsequent investigation), the majority of which are residential in nature. The location of these are indicated in Figure 7.1 and are described in Table 7.16.

Table 7.16: Noise sensitive receptor locations

Receptor ID	Description and location relative to the proposed development site	Approximate distance from the application site boundary (m)
R1	'The Old Post Office' dwelling to the south	110
R2	Dwellings of Penycwm to the south	150
R3	Dwellings of Llethr to the south-east	300
R4	Dwellings of Brawdy to the south-east	600
R5	Dwellings of Rhydgele to the east	500
R6	Troed Y Rhlw Farmhouse to the east	650
R7	Hillcroft Escapes (dwelling) to the east	600
R8	Newgale Lodge (dwelling) to the east	100
R9	Caldey House (dwelling) to the east	60
R10	Farmhouse east of Llandeloy to the north-east	500
R11	Dwellings of Llandeloy to the north	500
R12	Rhosfawr (dwelling) to the north	430
R13	Trefaner Farmhouse (dwelling) to the north	280
R14	Trevia (dwelling) to the north	350
R15	Persche (dwelling) to the north-west	380
R16	Paran House (dwelling) to the west	530
R17	Cherry Tree and Gwytndy Farmhouse to the west.	250
R18	Yr Hen Gof Forge (Ricketson Hall)) to the west	60

Receptor ID	Description and location relative to the proposed development site	Approximate distance from the application site boundary (m)
R19	Maerdy Lodge (dwelling) to the west	440
R20	Park Hall Village (Campsite) to the west	130
R21	147 Castleway (dwelling) to the south-west	252
R22	Marlowe St Davids School to the south-west	450
R23	Cawdor Barracks (on-site residential units)	20

7.4.11. Where multiple individual receivers (i.e. dwellings) are qualified under a single receptor reference (such as R5 and R7), noise impacts have been calculated and presented at the worst-affected facade of these.

7.4.12. Of the identified receptors, receptor R23 has been identified as the existing residential accommodation buildings within the Cawdor Barracks site boundary, understood to be occupied (at the time of writing) by the 14th Signal Regiment. It is understood that the occupation and operations of the 14th Signal Regiment are wholly separate to that of the proposed development and as such it is considered prudent to consider these military accommodation buildings within the assessment of noise impact. It is recognised however that the existing barracks are due to be decommissioned *"no earlier than 2028"*[111]; accordingly, whilst the future baseline at this receptor may experience a reduction in sensitivity post 2028, the assessment presented in this chapter reflects a worst-case that the barracks will remain occupied.

7.4.13. The proposed development site is closely flanked to the south and east by Pembrokeshire Coast National Park; approximately 160 m south, and 500 m east, of the site boundary. There is however a minimum 450 m separation between Pembrokeshire Coast National Park and the nearest infrastructure elements of the proposed development. Review of the PCC Consolidated Definitive Map indicates that there are 24 PRoW (footpaths) within the operational study area, many of which fall within the National Park. PRoW reference PP5/29 reportedly runs through the centre of Cawdor Barracks at the proposed Rx antenna array; this particular PRoW is understood to be no longer accessible so is not assessed further herein. PRoW alignments are shown in Figure 7.1 along with the associated designation.

7.4.14. The identification of PRoWs and subsequent assessment of noise impacts over these areas of public amenity is considered to be a reasonable and robust approach for demonstrating compliance with both Policy 30 of the Pembrokeshire Coast National Park Local Development Plan 2 and the requirements of the Noise and Soundscape Action Plan for Wales.

7.4.15. In line with the general principles of receptor sensitivity presented in Table 7.2, all identified receptors (including PRoW) are considered as having a high sensitivity to noise and vibration.

7.4.16. There are no sites of special scientific interest (SSSI) within the noise and vibration construction or operational study areas (see Table 7.1), with the nearest (St. David's Peninsula Cost (LERC SSSI ID 1088)) being approximately 1 km south of the proposed development site.

[111] Ministry of Defence (MOD), 2024. *Plans announced to redevelop Cawdor Barracks for landmark radar initiative*. MOD. Available at: https://www.gov.uk/government/news/plans-announced-to-redevelop-cawdor-barracks-for-landmark-radar-initiative (accessed 18/11/2025).

7.4.17. Ecological receptors/features which are sensitive to noise are considered in Chapter 8 (Biodiversity).

7.5. Design Interventions and Controls

Design Interventions

7.5.1. The development of the proposed development design has been an iterative process. The environment team has worked in close collaboration with the design team to avoid or reduce environmental impacts through the proposed development design. This is referred to as design interventions. This approach follows EIA best practice and the principles set out in the mitigation hierarchy; the first principle being to avoid potential adverse effects, where feasible, before seeking to minimise or mitigate for impacts. Compensation for effects (for example offsite enhancement and/or remediation of effects) are considered if it is not reasonably possible to avoid or reduce adverse effects.

7.5.2. Chapter 3 (Proposed Development) details the proposed design elements. This section of this chapter provides more detail and background on the design iterations made relevant to this environmental topic.

7.5.3. Chapter 4 (Alternatives and Design Evolution) details the design alternatives that have been considered, including the environmental factors which have influenced the decision-making.

Operational noise

7.5.4. Given the low levels of background noise measured during the baseline survey, the potential for adverse impacts due to noise generated by the proposed development has been considered throughout the design process and has informed several of the design interventions undertaken to produce the final design assessed herein.

7.5.5. This includes reviewing multiple site layouts to ensure that the greatest practicable separation is achieved between the equipment and the nearest noise sensitive receptors whilst avoiding, insofar as was practicable, exacerbation of other environmental effects of the proposed development.

7.5.6. Further works and investigations have been undertaken to provide technical insight into the noise generated by the proposed antennas. This includes:

- Measurements undertaken at DARC Site 1 (DS1) in Australia by a third-party acoustic consultant on behalf of the United States Space Force (USSF). It is understood that DS1 achieved practical, or partial, completion in Q3 2025. The findings of these measurements, including observations on operational conditions and acoustic characteristics are discussed in the operational noise assessment section of this chapter.

- In-situ measurements and witnessing of noise emissions from an identical antenna installation located in Los Angeles, US, at a USSF contractor test facility by the Author of this chapter. Measurements and observations of noise emissions were undertaken in accordance with BS 7445 and BS 3744 [112], with due consideration for BS 4142:2014+A1:2019 in order to quantify the absolute noise emissions and prominence of acoustic characteristics including tonality, intermittency and impulsivity. The findings of these measurements are also discussed in the operational noise assessment section of this chapter.

[112] British Standards Institution (2010). BS EN ISO 3744:2010 Acoustics. Determination of sound power levels and sound energy levels of noise sources using sound pressure. Engineering methods for an essentially free field over a reflecting plane. British Standards Institution.

Controls

7.5.7. Controls are included in the Environmental Management Measures Table contained within Appendix A of the Framework Construction Environmental Management Plan (CEMP) (Appendix 3.1). The Framework CEMP has been produced in support of the planning application to present the controls and mitigation identified in this assessment. The controls include best practice measures for noise and vibration to achieve compliance with any relevant legislation. The Framework CEMP will be developed into the Detailed CEMP for implementation during construction and will be secured by an appropriately worded planning condition. Further information on the Framework CEMP is provided in Chapter 3 (Proposed Development).

Construction noise and vibration

7.5.8. To facilitate the assessment of construction noise and vibration, an outline works programme/phasing schedule has been provided by the project team indicating the key dates and works activities. Construction plant associated with the primary construction tasks are provided in Appendix 7.3. Based on the information available and given the outline nature of the works programme and equipment schedules, specific mitigation that will be implemented during the construction works cannot readily be defined. However, all construction works will be undertaken in accordance with BPM as described in the Framework CEMP (Appendix 3.1).

7.5.9. Typical BPM measures which comprise of both physical and management measures where deemed necessary include:

- Restrictions on working hours;
- Scheduling of noisy works to the least sensitive working hours;
- Adopting quiet working methods, using plant with lower noise emission levels;
- Adopting working methods that minimise vibration generating activities;
- Use of plant conforming with the relevant EU directives relating to noise and vibration;
- Ensuring that all plant is properly maintained, (mechanisms properly lubricated, faulty silencers replaced, worn bearings replaced, cutting tools sharpened etc.);
- Closing acoustic covers to engines when in use or idling;
- Use of electrically powered equipment in preference to internal combustion powered equipment;
- Hydraulic equipment in preference to pneumatic equipment;
- Wheeled plant in preference to tracked plant;
- Locating plant as far away from noise and vibration sensitive receptors as practicable;
- Plant with highly directional sound emissions shall be angled so that the direction of highest sound emissions does not face towards receptors where possible;
- Installation of site hoardings or perimeter noise barriers;
- Use of temporary acoustic enclosures or screens around specific noisy static plant;
- Use of large fully enclosed acoustic buildings to surround activities and/or worksites;
- Avoiding the unnecessary revving of engines and switch off equipment when not in use;

- Starting-up plant and vehicles sequentially rather than at the same time;
- Keeping internal haul routes well maintained to minimise impulsive noise and vibration from vehicles running over discontinuities in the running surfaces;
- Fitting rubber linings to chutes, hoppers and dumper vehicles to reduce impact noise from material transfer;
- Avoiding impact piling methods in favour of vibratory, rotary or 'push in' methods where local ground conditions allow. Utilise acoustic shrouds and resilient pads to impact piling rigs where possible;
- Minimising drop heights of materials;
- Setting of noise and vibration limits at boundary or at other locations together with associated monitoring during the works;
- Carrying out regular inspections of mitigation measures (or BPM audits) to ensure compliance with noise and vibration commitments;
- Providing regular briefings for all site-based personnel so that noise and vibration issues (including the requirement to employ BPM at all locations at all times) are understood and that generic and site-specific mitigation measures are explained and adhered to;
- Ensuring that unloading is carried out within the worksite rather than on adjacent roads or laybys;
- Phasing of materials deliveries to be controlled on a 'just in time' basis to minimise noise and congestion on roads around the site; and
- Setting out the stakeholder engagement initiatives to be undertaken, including the provision of information to local residents about noisy works and/or works planned to take place outside of core working hours.

7.6. Potential Significant Effects

7.6.1. This section considers the potential impacts on receptors from noise and vibration with design interventions and controls considered. Where the impact of the proposed development on a receptor will result in a significant effect, this has been identified below. This assessment is based on the design elements provided in Chapter 3 (Proposed Development). The assessment of impacts has been considered as a reasonable worst-case approach.

Construction noise

7.6.2. Construction noise generated by the proposed development has the potential to adversely affect noise sensitive receptors in the vicinity of the site. Whilst a notional study area of 300 m from the site is defined and presented in Figure 7.1, the construction assessment in this instance covers a larger geographic area to ensure that all receptors identified in this chapter are adequately assessed.

7.6.3. The greatest impacts from construction noise are likely to occur at the closest receptors to the proposed development site boundary. However, adverse noise impacts may also extend along sections of the existing road network, depending on haul routes and the quantity of construction-related traffic.

7.6.4. Factors which have the potential to affect construction phase noise and vibration impacts include:

- Construction plant inventory and utilisation;
- The programme and the duration of activities with noise and vibration impacts exceeding relevant thresholds;
- Hours of work;
- Proximity of the works to noise sensitive receptors;
- Frequency and routing of the movement of construction vehicles; and
- The location of construction compounds.

7.6.5. Noise modelling and assessments have been undertaken for each month of the 24-month programme based on the available information provided for the proposed development; where the programme indicates consecutive months have identical site activities, only one of these has been modelled. This equated to a total of 14 construction noise scenarios being modelled (including night-time working); refer to Appendix 7.3 for further details. Note: based on the provided details it is understood that no substantial levels of construction activity will occur in months 19, 20, 21, 23 or 24 of the programme as works will primarily consist of the commissioning and testing of installed equipment (such as antenna) and facilities. As such, these months have not been assessed for construction noise impacts.

7.6.6. This approach is considered representative of the typical worst-case construction noise conditions that may be expected in each month of the programme. Daily levels may vary slightly from those predicted subject to the specific locations of construction plant and given the mobile nature of many of the plant being used.

7.6.7. Table 7.17 and Table 7.18 present the noise sensitive receptors identified in this chapter (including PRoW) at which the SOAEL is expected to be exceeded, resulting in moderate or major magnitudes of construction noise impact and a potentially significant adverse effect in accordance with the assessment-specific guidance. All receptors (including PRoW) that are not specifically listed below are anticipated to experience a worst-case minor impact which would be considered not significant.

7.6.8. Receptor specific LOAEL and SOAEL thresholds, as well as the predicted noise levels and impact magnitudes during each modelled construction period are presented in Appendix 7.3 for all receptors including PRoW.

7.6.9. Noise contours for a sample of months, including those wherein significant effects are expected to occur, are provided in Figures 7.6 to 7.10 (Construction Noise Contours) for illustrative purposes. Contours are produced at 4.5 m above ground level, representative of a first-floor window. Noise contours are presented without the consideration of the effects of any mitigation measures other than BPM as set out in the Controls section of this chapter.

7.6.10. The activities listed in Table 7.17 and Table 7.18 in each assessment month/scenario are not an exhaustive list of activities that could occur during the works programme but are considered to be the construction activities most likely to generate noise indicated in the phasing (refer to Appendix 7.3 for a detailed summary of the construction equipment and activities used to inform this assessment and resultant receptor noise levels).

Table 7.17: Receptors at which moderate and major magnitudes of construction noise impact will occur during daytime construction (0700 – 1900 weekdays, 0700 – 1300 Saturdays, without mitigation)

		Receptors (including PRoW) expected to experience moderate or major impacts	
Programme month	**Primary construction phase**	**Moderate**	**Major**
Month 1	Site establishment, temporary fencing	-	-
Month 2	Antenna integration shelter, construct buildings, RX antenna construction, permanent fencing	-	-
Month 3	Antenna integration shelter, construct buildings, RX antenna construction, utilities, permanent fencing	-	-
Month 4	Antenna integration shelter, construct buildings, RX antenna construction, utilities, antenna assembly, permanent fencing	-	-
Month 5	Construct buildings, RX antenna construction, utilities, antenna assembly, permanent fencing, antenna site acceptance testing	-	-
Months 6 – 7	Construct buildings, standby power infrastructure, RX antenna construction, utilities, antenna assembly, permanent fencing, antenna site acceptance testing	-	-
Months 8 – 9	Construct buildings, standby power infrastructure, RX antenna construction, TX antenna construction, utilities, antenna assembly, permanent fencing, antenna site acceptance testing	R23; Cawdor Barracks	-
Month 10	Construct buildings, RX antenna construction, TX antenna construction, antenna assembly, permanent fencing, antenna site acceptance testing	-	-
Month 11 - 13	RX antenna construction, TX antenna construction, antenna assembly, permanent fencing, equipment commissioning, antenna site acceptance testing	-	-
Months 14 – 15	TX antenna construction, antenna assembly, equipment commissioning, antenna site acceptance testing	-	-
Months 16 – 18	Antenna assembly, equipment commissioning, antenna site acceptance testing	-	-
Month 22	Antenna site acceptance testing, demobilisation	-	-

Table 7.18: Receptors at which moderate and major magnitudes of construction noise impact will occur during night-time construction (23:00 – 07:00, without mitigation)

		Receptors (including PRoW) expected to experience moderate or major impacts	
Programme month	**Primary construction phase**	**Moderate**	**Major**
Months 4 - 18	Antenna assembly	-	-

7.6.11. Table 7.17 indicates that only one receptor is expected to experience daytime construction noise levels over the defined SOAEL, resulting impact magnitudes of moderate or major, being R23 (Cawdor Barracks). A moderate impact magnitude is expected during months 8 – 9 of the programme based on the details provided to inform this assessment. When considering the residential use of receptor R23 (resulting in high sensitivity to noise), and indicated duration of this phase of the works, the predicted moderate impact would be considered a **significant effect** when assessed according to the assessment specific guidance.

7.6.12. All other receptors, including PRoW, are expected to experience a worst-case minor impact magnitude during daytime construction works which would be considered **not significant.**

7.6.13. Table 7.18 indicates that no receptors (residential or PRoW) are expected to experience moderate or major impacts due to night-time construction works. As such, night-time construction noise impacts are considered **not significant.**

7.6.14. With regard to the potential impacts micro siting during antenna installations, further review has been undertaken to determine how this may influence construction noise levels and impacts at the identified receptors. It is understood that micro siting will apply to the antenna only, with a maximum 40 m tolerance against the proposed layout. The on-site barracks are the closest receptors to the antenna and are the most likely to be influenced by micro-siting, with a separation of ≈ 300 m. When considering spherical propagation losses over this distance, compared to the potential minimum allowing for micro siting, construction noise levels resulting from antenna construction works are expected to increase by no more than 1.2 dB at the worst-affected receptors. An increase of this magnitude has no material impact on the predicted significance summarised above or in Appendix 7.3 and so the effect of micro siting on construction noise impacts is considered **not significant.**

7.6.15. Section 7.7 presents guidance on noise mitigation measures and best practice techniques that are expected to reduce the potential for significant effects due to construction noise during daytime working hours.

Construction vibration

7.6.16. Table 7.19 sets out indicative distances, based on historical field measurements and current guidance, at which certain construction activities proposed are expected to result in a level of vibration below the SOAEL of 1 mm/s PPV.

Table 7.19: Furthest distance (m) which vibration levels could exceed SOAEL

Construction activity/equipment (source)	Furthest distance (m) which vibration levels could exceed the SOAEL of 1 mm/s PPV
Hoe ram/Hydraulic breaker (FTA 2018) [113]	15

[113] Federal Transit Administration Report No. 0123 Transit Noise and Vibration Impact Manual, 2018, U.S. Department of Transport

Construction activity/equipment (source)	Furthest distance (m) which vibration levels could exceed the SOAEL of 1 mm/s PPV
Excavator (NZ TA 2012) [114]	30
Vibratory compaction - roller (BS 5228-2) [115]	23 – start-up 20 – steady-state
Heavy vehicles on poor surface (TRL Report 429)	<10

7.6.17. Following a review of the layout of the proposed development and its surroundings, it is determined that there are no receptors within 30 m of where vibration intensive works are anticipated to occur. As such, the construction vibration SOAEL for receptors with a high sensitivity to vibration is not expected to be exceeded at any receptor due to excavation, hydraulic breaking, vibratory compaction or heavy vehicle movements, resulting in a worst-case negligible magnitude of impact. As such, significant effects are considered unlikely to occur.

7.6.18. In all instances, vibration levels at receptors are expected to be far below the levels at which cosmetic damage may occur (as per BS 7385-2:2003).

7.6.19. On this basis, it is considered that construction vibration effects are **not significant** when assessed in accordance with BS 5228-2:2014+A1:2019, based on the construction works and programme as is currently outlined.

7.6.20. With regard to micro siting, the maximum 40 m tolerance for this development will not result in any receptors being within the distances from works presented in Table 7.19 where moderate or major adverse impacts could be expected. As such, the effect of micro siting on construction vibration is considered **not significant.**

Construction traffic

7.6.21. The change in road traffic noise due to the additional traffic flows associated with the construction of the proposed development has the potential to affect noise sensitive receptors located along existing roads that will be used by construction vehicles. The potential for construction traffic noise impact is dependent on the types and volumes of construction traffic and the routing.

7.6.22. Construction vehicle movements within the site boundary are accounted for in the construction noise assessment presented in Table 7.17 and Table 7.18 above.

7.6.23. Offsite construction traffic is expected to access the site predominantly from the A487, arriving at the site from the south-east (from the direction of Haverfordwest). Construction traffic will enter the site from a newly created works access located off the C3010 immediately east of the site.

7.6.24. Given the predominantly residential and/or rural nature of the local area surrounding the works, construction related traffic is not expected to use any roads other than these to access site.

[114] PD Cenak and AJ Sutherland, 2012. Ground vibration from road construction New Zealand Transport Agency research report 485. New Zealand Transport Agency (NZ TA).

[115] Based on a typical manufacturer's specification (in this case a Cat CB10 Tandem Vibratory Roller, with two drums of 1.7 m wide, and a nominal minimum amplitude of vibration of 0.34 mm). Modelling has been undertaken on the basis of minimum roller amplitude in line with the BPM with a 95% confidence factor

7.6.25. Based on the information provided to inform this assessment, it is understood that the worst-case daily construction vehicle movements associated with the proposed development will not exceed 80 cars and 15 HGVs.

7.6.26. Table 7.20 presents the baseline traffic flows on each road used for the proposed construction traffic route and the change in road traffic noise that is expected due to the addition of the worst-case construction vehicle movements. Noise level change for each road has been determined by comparing the baseline and 'with construction traffic' BNL for each road link, calculated in accordance with the CRTN procedures.

Table 7.20: Predicted BNL noise increases due to construction traffic during the daytime

Route	Baseline traffic flow (18-hour AAWT)	Baseline traffic speed (mph)	Baseline traffic HGV count	Expected BNL increase with construction traffic, dB, and magnitude of impact. Worst-Case Day
A487 Main Street (West of site)	4110	50	36	0.2, negligible
A487 Newgale Hill (South of site)	5096	38	97	0.2, negligible
C3010 (immediately east of site)	582	45	8	1.2, minor

7.6.27. Table 7.20 demonstrates that, during the worst-case days of the construction works, a minor impact is expected on the C3010 and a negligible impact expected on the A487. During all other periods of construction activity, noise impacts on the local road network will be lower than this.

7.6.28. DMRB LA 111 advises that significant effects could occur where a moderate or major magnitude of impact is expected for more than 10 days in 15, or 40 in any consecutive 6 months. As such, when considering the assessment specific guidance of DMRB LA 111 and the high sensitivity of receptors within the construction traffic study area, **no significant** effects are expected as a result of construction traffic movements on the local road network.

Operational Noise

7.6.29. Details have been provided by the project team regarding the sources of operational noise that are expected within the completed development. Operational noise sources range from small, localised equipment (such heat exchange and ventilation plant serving occupied or temperature sensitive rooms) to larger industrial equipment such generators and chillers.

7.6.30. The expected operational noise emissions for these items of fixed plant have been provided from a range of sources including manufacturer's data, in-situ observations and measurements at DS1, and the professional engineering experience of the project team. The operational noise emissions for each identified noise source are summarised below in Table 7.21.

7.6.31. Regarding the antenna, operational noise emissions have been determined following in-situ testing undertaken at the recently completed DS1 complex in Australia, with results summarised in Project Document reference 250610318-01A[116]. Supplementary information on noise emissions and characteristics have been derived following in-person attendance by

[116] Lloyd George Acoustics (2025). Environmental Noise Assessment – DARC Site #1. Lloyd George Acoustics Pty Ltd

the Author of this chapter to witness the operation of the antenna at a US test facility in June 2024.

7.6.32. The results of the DS1 measurements are also presented below for the range of antenna operational conditions.

Table 7.21: Proposed operational noise sources, quantity, and noise emission level

Location	Operational noise source	Quantity	Operational noise emissions (per unit)	Notes
Tx and Rx Antenna Arrays	Antenna	27	90 dB L_{wA}	DS1 - Normal operation
			94 dB L_{wA}	DS1 – 'Bowtie'/'scan high' operation
	Baird W36A condenser	27	53 dB L_{pA} at 4.5 m	DS1 measurement
	Elevation housing condenser	27	55 dB L_{pA} at 1 m	Engineering estimate
TX Antenna Array	Adiabatic cooler	6	60 dB L_{pA} at 1 m	Manufacturer's data
	Coolant/fluid pump	6	70 dB L_{pA} at 1 m	Engineering estimate
Tx Antenna Array Transmit Equipment Container	Free cooling unit	6	58 dB L_{pA} at 1 m	Engineering estimate
	Container noise breakout	6	50 dB L_{pA} at 1 m	Engineering estimate
Generator compound	Auxiliary power compound	3	80 dB L_{pA} at 1 m	Engineering estimate – temporary auxiliary power and routine testing only
	Load bank	1	75 L_{pA} at 1 m	
	Battery Energy Storage System (BESS) units	2	65 dB L_{pA} at 1 m	Engineering estimate
Switchroom & Transformers Building	Building noise breakout	1	55 dB L_{pA} at 1 m	Engineering estimate
	Ventilation fans	2	65 dB L_{pA} at 1 m	Engineering estimate
NGED Connection Building	Condenser	1	55 dB L_{pA} at 1 m	Engineering estimate
Radar Spares Building	Air Handling Unit (AHU)	2	65 dB L_{pA} at 1 m	Engineering estimate
	Condenser	1	55 dB L_{pA} at 1 m	Engineering estimate
Radar Operations Building	Stultz free cooling units	2	59 dB L_{pA} at 2 m	Engineering estimate

Location	Operational noise source	Quantity	Operational noise emissions (per unit)	Notes
	Variable Refrigerant Flow (VRF) heat pump	2	78 dB L_{wA}	Engineering estimate
	Heat pump	1	74 dB L_{wA}	Engineering estimate
	Building noise breakout	2	60 dB L_{pA} at 1 m	Engineering estimate
Entry Control Point Building	Condenser	3	55 dB L_{pA} at 1 m	Engineering estimate

* dB = Sound Power Level, A-weighted, ref 10^{-12} W. dB L_{pA} = Sound Pressure Level ref 2 x 10^{-5} Pa.

7.6.33. Given the nature of the proposed development, operational noise will be generated continuously over 24-hours, with noise emissions varying based on the operational condition at the time. The proposed operational conditions for the site, as assessed in this chapter, are understood to be as follows:

- **Normal** – all equipment operating with the exception of the generators and load bank. Antenna operating in 'normal' condition. This is understood to represent ≈90% of the operational conditions.
- **Bowtie/Scan High** – all equipment operating with the exception of the generators and load bank. Antenna operating in 'bowtie' or 'scan high' conditions. We understand that this condition will occur for no more than 10 minutes per week during routine testing; or, during 'emergency' search conditions.
- **Normal with temporary auxiliary power** – all equipment operating including generators and load banks. This represents the normal operational condition during routine testing or during power outages.
- **Bowtie/Scan High with temporary auxiliary power** – all equipment operating including generators and load banks. Antenna operating in 'bowtie' or 'scan high' condition. It is understood this condition will rarely occur in practice.

7.6.34. As the 'normal' operational condition represents the typical condition for the site, this has been assessed against the criteria presented in Table 7.11 and the guidance regarding *"very low"* noise levels given in BS 4142:1997. All other conditions are considered to reflect atypical 'emergency' conditions which are inherently temporary and short-term and so have been assessed against the criteria presented in Table 7.12 as agreed in consultation with PCC.

7.6.35. In accordance with BS 4142:2014+A1:2019 requirements, predicted rating levels reflect a 1-hour daytime reference period and 15-minute night-time reference period. In this instance, all equipment is understood to operate continuously at a fixed duty and therefore no on-time corrections have been applied. The exception to this is antenna (Tx and Rx) noise emissions when in 'normal' operations as there is understood to be a ≈50/50% split between slewing (movement) and dwelling (static position), with each occurring multiple times in each reference period.

7.6.36. Operational noise impacts in the above conditions have been determined in accordance with BS 4142:2014+A1:2019, with character corrections applied using the subjective method when considering the site context. Resultant noise impacts and significance are set out in the following sections of the chapter for each condition.

Determination of Character Corrections

7.6.37. In accordance with BS 4142:2014+A1:2019, character corrections have been applied to the predicted specific sound levels in order to determine the resultant rating level of the sound. Character corrections have been applied for intermittency, impulsivity and tonality as appropriate. For the purposes of this assessment, character corrections have been determined and applied on the following basis:

- As the equipment is not yet operating, character corrections have been determined using the subjective method, by comparing the pre-existing baseline acoustic conditions (residual sound level, dB $L_{Aeq,T}$) at each receptor to predicted specific sound level (dB $L_{Aeq,T}$) in order to determine the likely prominence of the noise.

- Character corrections have been applied based on the likely prominence of the specific sound level and the distinctiveness of expected acoustic characteristics. For all items of fixed plant, including the generators, noise emissions are anticipated to be steady-state, with no discernible tonality, impulsivity or intermittency. With regard to the antenna which are expected to be the primary noise generating element, character corrections have been based on the observations and measurements made during the in-person witnessing undertaken at the US test facility, along with observations reported from the DS1 site noise testing. Observations are summarised as follows:

    - During the in-person witnessing, and as reported in the DS1 noise testing, it was observed that the antenna equipment had a clearly identifiable and cyclical on/off condition resulting in audible intermittency.
    - Identified in both the in-person witnessing and the DS1 noise reporting, the antennas were found to have clearly audible tonal characteristics during movement. The dominant frequency was identified as being a function of the elevation/azimuth motor speeds and as such, varied in pitch during periods of acceleration and deceleration. Tonal elements were observed to be primarily in the 500Hz – 1kHz frequency range and as such, are anticipated as being clearly distinguishable in the context of an otherwise ‘natural’ acoustic environment (subject to magnitude).
    - At the commencement of each slew (movement) period, a rapid onset of noise was observed; BS 4142:2014+A1:2019 (Annex E) states that “the sudden onset of a sound is defined as an impulse”, and that “the starting point of an onset is the point where the gradient first exceeds 10 dB/s”. Measurements and observations made during the in-person witnessing identified that the operational noise emissions from the antenna regularly achieve this minimum dB/s criterion and so could be considered impulsive at source. However, subsequent detailed review in accordance with Annex E of the standard, along with observations reported from the DS1 noise testing, indicates that the expected objective prominence of the observed impulsivity will not be sufficient at any receptor to warrant impulsivity character corrections.

Noise impact during ‘Normal’ conditions

7.6.38. Table 7.22 presents a summary of the assessment of operational noise impacts during the ‘normal’ operating condition, presenting the receptors and PRoW wherein a potentially significant moderate or major impact is anticipated. Where receptors are not identified in the tables below, a worst-case minor noise impact is expected which would be considered not significant.

7.6.39. Further details on predicted operational noise levels at all receptors (including PRoW) and the applied character corrections are presented in Appendix 7.4 for reference.

7.6.40. A potentially significant effect is deemed to occur where the noise levels described in BS 4142:1997 as *“very low”* are exceeded at the identified highly sensitive receptors, resulting in moderate or major magnitudes of impact.

Table 7.22: Summary of moderate and major noise impact magnitudes during 'Normal' operations

Period, T	Noise sensitive receptors		PRoW	
	Moderate	Major	Moderate	Major
07:00 – 23:00	R5	R8, R9, R18, R23	-	PP5/30/1
23:00 – 07:00	R3, R4, R5, R6, R7, R13, R19, R20	R8, R9, R18, R23	PP39/8/1, PP39/9/3, PP5/10/1, PP5/17/1	PP5/30/1

7.6.41. Table 7.22 demonstrates that potentially significant moderate and major impacts are anticipated at 13 of the identified noise sensitive receptors and six of the identified PRoWs.

7.6.42. The worst-case operational sound levels in this condition are expected to occur at receptor R18 (Yr Hen Gof Forge), with a predicted specific sound level of 37 dB $L_{Aeq,T}$ and a predicted rating level of 46 dB $L_{Ar,Tr}$. This equates to an 11 dB exceedance over the BS 4142:1997 definition of *"very low"*, as agreed with PCC during consultation.

7.6.43. In this condition, operational noise emissions are controlled by the proposed antenna, with audible character corrections expected at many of the identified receptors when considering the site context and observed operational characteristics.

7.6.44. As such, operational noise emissions in the 'Normal' operating condition are anticipated to result in moderate and major impacts at many of the identified highly sensitive receptors equating to **significant adverse effects** unless sufficient mitigation is implemented.

Noise impact using the temporary auxiliary power compound

7.6.45. Table 7.23, Table 7.24 and Table 7.25 present a summary of the assessments of operational noise impacts during the three operating conditions relating to the operation of the auxiliary power compound and the operation of the antenna in the temporary bowtie/scan high operational condition. The following tables present the receptors and PRoW wherein a potentially significant moderate or major impact is anticipated. Where receptors are not identified in the tables below, a worst-case minor noise impact is expected which would be considered not significant.

7.6.46. Further details on predicted operational noise levels at all identified receptors (including PRoW) and applied character corrections are presented in Appendix 7.4 for reference.

7.6.47. A potentially significant effect is deemed to occur where the noise levels described in BS 4142:1997 as *"very low"* are exceeded by more than 10 dB at the identified highly sensitive receptors, resulting in moderate or major magnitudes of impact.

Table 7.23: Summary of moderate and major noise impact magnitudes during 'Bowtie/Scan High' operations

Period, T	Noise sensitive receptors		PRoW	
	Moderate	Major	Moderate	Major
07:00 – 23:00	R8, R9, R18, R23	-	PP5/30/1	-
23:00 – 07:00	R8, R9, R18, R23	-	PP5/30/1	-

Table 7.24: Summary of moderate and major noise impact magnitudes during 'Normal with temporary auxiliary power' operations

Period, T	Noise sensitive receptors		PRoW	
	Moderate	Major	Moderate	Major
07:00 – 23:00	R5, R8, R9, R18, R23	-	-	-
23:00 – 07:00	R5, R8, R9, R18, R23	-	-	-

Table 7.25: Summary of moderate and major noise impact magnitudes during 'Bowtie/Scan High with temporary auxiliary power' operations

Period, T	Noise sensitive receptors		PRoW	
	Moderate	Major	Moderate	Major
07:00 – 23:00	R5, R23	R8, R9, R18	PP5/30/1	-
23:00 – 07:00	R5	R8, R9, R18, R23	PP5/30/1	-

7.6.48. During the 'Bowtie/Scan High' condition (Table 7.23), potentially significant moderate and major impacts are anticipated at four noise sensitive receptors and one PRoW. Given that this condition does not introduce any new noise sources compared to the 'Normal' condition, R18 (Yr Hen Gof Forge) remains anticipated to be the worst-affected receptor. Resultant operational noise levels of 40 dB $L_{Aeq,T}$ and 49 dB $L_{Ar,Tr}$ have been calculated, equating to an exceedance of 4 dB over the agreed noise emission limit of 45 dB $L_{Ar,Tr}$.

7.6.49. During the 'normal with temporary auxiliary power' condition (Table 7.24), during which the auxiliary generators will be operational, potentially significant moderate and major impacts are anticipated at five receptors; however, noise impacts are not expected to exceed minor (not significant) at any of the identified PRoW. The worst-affected residential receptors in this condition have been identified as R8 (Newgale Lodge) and R9 (Caldey House), with operational noise levels of 40 dB $L_{Aeq,T}$ and 49 dB $L_{Ar,Tr}$ predicted. This equates to a 4 dB exceedance over the noise emission limits agreed with PPC.

7.6.50. During the 'bowtie/scan high with temporary auxiliary power' condition (Table 7.25), during which the auxiliary power compound will be operational, potentially significant moderate and major impacts are expected at five noise sensitive receptors and one PRoW. The worst-affected receptor in this condition is expected to be receptor R9 (Caldey House) with a predicted worst-case specific sound level of 42 dB $L_{Aeq,T}$ and worst-case rating level of 51 dB $L_{Ar,Tr}$. This equates to an exceedance over the agreed operational noise limits of 6 dB.

7.6.51. Interrogation of the modelling indicates that operational noise levels in the temporary auxiliary power operational conditions are controlled in approximately equal magnitude by the proposed antenna and generator equipment.

7.6.52. Accordingly, when considering the high sensitivity of the identified receptors to noise, moderate and major impacts equating to **significant adverse effects** are anticipated as a result of operational noise emissions in the temporary auxiliary power conditions unless sufficient mitigation is implemented.

Effects of micro siting

7.6.53. As part of the detailed design development, ground investigations may result in slight changes to the location of each antenna being necessary, known as micro siting. Subsequently, equipment serving the antenna (particularly the Tx arrays) may also require adjusted positioning compared to the provided layout. A maximum micro siting tolerance of 40 m in any direction is understood to be in place for this scheme. Note – micro siting is not applicable to

the wider fixed plant such as the generators or operational buildings. These shall be located as shown in the proposed development layout drawings.

7.6.54. To review the potential acoustic risks of micro siting on the operational noise assessments, further assessment has been undertaken on the worst-case basis that all antenna (and associated equipment) were to move uniformly in any single cardinal direction.

7.6.55. Table 7.26 presents a summary of the worst-case specific sound level increase expected in each worst-case layout shift.

Table 7.26: Summary of potential significances resulting from micro siting

Micro siting condition	Worst-Case Specific Sound Level Increase from Proposed Layout, dBA, and Affected Receptor
40 m north	0.4, R12 (Rhosfawr) and R13 (Trefaner farmhouse)
40 m east	0.8, R3 (Llethr)
40 m south	1.0, R3 (Llethr)
40 m west	Onsite; 1.2, R23 (Cawdor barracks). Offsite; 0.9, Yr Hen Gof Forge

7.6.56. Table 7.26 demonstrates that the worst-case micro siting conditions will result in a maximum 1.2 dB specific noise level increase at the worst-affected receptors, being the on-site barracks (R23); at the worst-affected off-site receptor, a maximum noise increase of 1.0 dB is expected (occurring at R3, Llethr).

7.6.57. Interrogation of the assessment results summarised above and presented in Appendix 7.4 indicates that micro siting may therefore result in increased impact magnitudes, and therefore significance, at some receptors. Specifically, and during the 'normal' operational condition, micro siting could result in moderate impacts at R17 (Cherry House) due to the western movement of antenna, major impacts at R5 (Rhydgele) due to the eastern movement of antenna, and moderate impacts at PRoW PP5/2/3 due to eastern and southern movement of antenna.

7.6.58. Accordingly, the effects of micro siting on operational noise emissions are considered to be **significant**, and as such will require appropriate mitigation.

Summary of potential significant effects

Table 7.27: Summary of potential significant effects (without mitigation)

Assessment Condition	Predicted Significant Effects
Construction Noise	**Moderate impacts** expected at R23 due to daytime works.
Construction Vibration	No significant effects expected.
Construction Traffic	No significant effects expected.
'Normal' Operational Condition (including micro siting)	**Moderate impacts** expected at R3, R4, R6, R7, R13, R17, R19, R20 and PRoW PP39/8/1, PP39/9/3, PP5/10/1, PP5/17/1 and PP5/2/3 **Major impacts** expected at R5, R8, R9, R18, R23 and PRoW PP5/01/1

Assessment Condition	Predicted Significant Effects
'Bowtie/Scan High Operational Condition (including micro siting)	**Moderate impacts** expected at R8, R9, R18, R23 and PRoW PP5/30/1
'Normal with temporary auxiliary power' Operational Condition (including micro siting)	**Moderate impacts** expected at R5, R8, R9, R18, R23
'Bowtie/scan high with temporary auxiliary power' Operational Condition (including micro siting)	**Moderate impacts** expected at R5 and PRoW PP5/30/1 **Major impacts** expected at R8, R9, R18, R23

7.7. Mitigation & Enhancement

Construction

Construction Noise

7.7.1. Without mitigation, significant effects due to construction noise are expected at receptor R23 (Cawdor Barracks) during months 8 and 9 of the works, based on the information provided to inform this chapter (as summarised in Appendix 7.3).

7.7.2. General mitigation measures utilising BPM have been set out in Section 7.5 of this chapter and are described in the Framework CEMP (Appendix 3.1). BPM will be employed where required.

7.7.3. Further to BPM, BS 5228-1:2009+A1:2014 advises that acoustic barriers (permanent and temporary) are an efficient means of reducing construction noise levels. As a working approximation, barriers will offer a 5 dB reduction of construction noise where the top of the equipment is just visible at the receptor, or 10 dB where the plant is not visible at the receptor (on the basis of a minimum 7kg/m^2 surface mass). Interrogation of the construction noise predictions indicates that the noise reductions provided by appropriately positioned acoustic barriers would be sufficient to mitigate all identified moderate and major construction noise impacts.

7.7.4. Accordingly, construction noise barriers should be installed in the following areas (as a minimum) for the periods of works where significant adverse effects are anticipated unless it can be otherwise demonstrated though on-site monitoring and investigations during the construction works that in the absence of noise barriers impacts would not be significant:

- Between Cawdor Barracks residential accommodation and any active works areas for months 8 to 9 of the programme.

7.7.5. Noise barriers are most effective when positioned close to the noise source or receptor locations. Therefore, temporary noise barriers should be installed around each works area or around receptor R23 (Cawdor Barracks) allowing for access requirements.

7.7.6. The following site-specific mitigation should also be implemented where appropriate in accordance with BPM to minimise disturbance and adverse impacts:

- No HGV movements should be permitted during night working. All vehicle movements will be controlled through the implementation of a Construction Traffic Management Plan / Construction Environmental Management Plan, which will be agreed with PCC prior to construction.

- Piling works are not proposed at this time. However, should ground investigations determine that piling will be required, noise impacts can be minimised through the use of non-percussive methods, such as rotary bore, vibratory or press-in piling rigs. Where impact piling is necessary due to local ground conditions, mitigation methods such as proprietary acoustic shrouds and pile cushions/driving dollies should be used.

- Ensure the proposed plant noise emissions are similar or below the preliminary construction plant noise levels used within this assessment; and that, where practicable, the plant is the quietest available for the proposed use.

- Ensure that works areas (including lay-down and compounds) are as far from receptors as possible, and no closer than those indicated in the construction layout drawings provided by the project team.

- Utilise as much of the existing hard standing as possible for works areas and compounds instead of forming new hard standings.

- Where necessary, alternative reversing warning systems (such as white noise alarms) shall be employed in place of tonal 'squawkers'.

7.7.7. The potential for significant effects may also be further reduced with careful programming. Where possible, noisy works in close proximity to sensitive receptors should be programmed such that works do not take place for more than 10 days in any consecutive 15, or more than 40 days in any consecutive 6 months.

7.7.8. The potential effects of construction noise and vibration on local community receptors can be lessened by effective communication. Good public relations are invaluable in securing public acceptance of construction noise. People are typically more tolerant of construction noise and vibration if they understand the reason for it, the likely duration, start and finish dates, and that measures are being employed to reduce noise and vibration as far as practicable. Letter drops explaining this would typically aid communication with the local community. A dedicated site contact for the public and a complaints-handling procedure should also be put in place.

Operation

Normal Conditions

7.7.9. Potentially significant effects are expected as a result of the 'Normal' site operations. Interrogation of the noise modelling indicates that these effects arise predominately as a result of the proposed Tx and Rx antenna arrays, including contributions from the pedestal condenser units, Tx adiabatic chillers, and Tx fluid/coolant pumps.

7.7.10. As such, mitigation will be required to reduce all predicted impacts to below the operational noise thresholds agreed with PCC. The detailed design of noise mitigation is beyond the scope of this chapter and will be undertaken by the responsible Contractor (Northrop Gruman Corporation) post-consent and prior to operation. The following minimum noise reductions should be achieved; where practicable, guidance has been provided on possible engineering solutions that may be implemented.

- Rx antenna should be designed and specified to not exceed a maximum operational Sound Power Level in 'normal' operational conditions of 75 dB L_{wA}. This is equivalent to a 15 dB reduction to the equipment installed at DS1. Given the mechanical nature of the noise generated by this equipment, it is anticipated that any attenuation achieved for the 'Normal' condition will result in similar attenuation during all other operational conditions.

- Tx antenna should be designed and specified to not exceed a maximum operational Sound Power Level in 'normal' operational conditions of 79 dB $L_{wA.}$ This is equivalent to a 11 dB reduction to the equipment installed at DS1. Given the mechanical nature

of the noise generated by this equipment, it is anticipated that any attenuation achieved for the 'Normal' condition will result in similar attenuation during all other operational conditions.

- All antenna pedestal condenser units (Tx and Rx) should be designed and specified to not exceed a maximum Sound Power Level of 68 dB L_{wA}. This is equivalent to a 6 dB reduction to the equipment installed at DS1. This may be achieved through the selection of alternative equipment or the installation of localised acoustic enclosures.

- All Tx fluid/coolant pumps should be designed and specified to not exceed 60 dB L_{pA} at 1 m (free-field). This is equivalent to a 10 dB reduction to the equipment currently proposed. This may be achieved through the selection of alternative equipment or the installation of localised acoustic enclosures.

- All Tx adiabatic chiller units should be designed and specified to not exceed 55 dB L_{pA} at 1 m (free-field). This is equivalent to a 5 dB reduction to the equipment currently proposed. This may be achieved through the selection of alternative equipment or through the installation of localised acoustic screens. Acoustic screens, if implemented, shall be formed to a height sufficient to remove all direct line of sight between the equipment and nearby noise sensitive receptors; commonly, this requires the barrier to be formed to ≈ 0.5 – 1.0 m taller than the equipment being screened. Acoustic screens shall be either solid and imperforate from ground level with a minimum 15 kg/m^2 superficial mass, or formed from proprietary acoustic louvre modules achieving a minimum 17 dB R_w.

Auxiliary power compound temporary operating conditions

7.7.11. Potentially significant effects are expected during the short-term operational conditions, which include the 'bowtie/scan high' operation of the antenna, and the operation of the auxiliary power generation plant. Interrogation of the noise modelling indicates that these effects arise predominately as a result of the plant identified above (i.e. controlling the 'Normal' condition) with the addition of the proposed auxiliary power compound.

7.7.12. Accordingly, in addition to the mitigation requirements set out above**,** the following mitigation is required:

- All proposed generators should be designed and specified to not exceed 75 dB L_{pA} at 1 m (free-field), inclusive of the flue ductwork and termination. This is equivalent to a 5 dB reduction to the equipment currently specified. This may be achieved through the appropriate specification of equipment and is considered readily achievable for 'packaged' generators installed within acoustic enclosures.

7.7.13. The detailed design of noise mitigation is beyond the scope of this chapter and will be undertaken by the appointed contractor.

7.8. Cumulative Effects

7.8.1. As part of the EIA process, the environment teams have undertaken a coordinated, multidiscipline approach to ensure cumulative effects are considered across disciplines and influenced design where appropriate.

7.8.2. The assessment on cumulative effects is presented in Chapter 17 (Cumulative Effects Assessment).

7.8.3. No significant intra-cumulative or inter-cumulative effects for this environmental topic are anticipated as a result of the proposed development.

7.9. Residual Significant Effects

Construction

7.9.1. The assessment of construction noise resulting from the indicative construction activities associated with the development identified that potentially significant adverse effects would be expected at one receptor (R23) during daytime periods.

7.9.2. Interrogation of the noise predictions indicates that all moderate and major construction noise impacts (resulting in significant effects) can be avoided through the appropriate implementation of temporary acoustic barriers and BPM (including careful programming, and community engagement). Accordingly, following the implementation of mitigation, it is expected that a worst-case minor impact will be observed at the worst-affected receptors (including PRoW) during the construction phase of the proposed development when assessed according to BS 5228-1:2009+A1:2014. When considering the sensitivity of the identified receptors to noise, and the assessment-specific guidance, the resultant negligible and minor impacts would be considered **not significant.**

7.9.3. On the basis of the assessments presented in this chapter and following the implementation of appropriate mitigation, construction noise, vibration and traffic effects are considered **not significant** when assessed according to relevant guidelines and standards including DMRB LA 111, BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014.

Operation

7.9.4. The assessment of noise emissions associated with the operation of the proposed development found that moderate and major impacts were expected in the absence of mitigation for all operational conditions.

7.9.5. Following the implementation of the mitigation specified in this chapter, a worst-case rating level of 35 dB $L_{Ar,Tr}$ is anticipated during the 'Normal' condition (occurring at R18, Yr Hen Gof Forge) and 44 dB $L_{Ar,Tr}$ during the temporary auxiliary power conditions (occurring at R9, Caldey House). This aligns with the maximum noise criteria agreed during consultation with PCC. Therefore, a worst-case minor noise impact is expected at all receptors (including PRoW).

7.9.6. Accordingly, following the implementation of mitigation as specified in this chapter, operational noise is considered to be **not significant** when assessed according to relevant guidelines and standards including BS 4142:2014+A1:2019 and BS 4142:1997.

7.10. Monitoring

7.10.1. The assessments presented herein have shown that impacts from typical construction tasks may result in significant effects (without mitigation). Therefore, it is recommended that targeted noise monitoring be undertaken by the appointed construction contractor to ensure that noise levels do not regularly exceed the thresholds for significant effects, and to provide a means by which construction noise levels will be reviewed and mitigated following complaints or exceedances.

7.10.2. It is recommended that noise monitors are installed for the duration of the construction works at locations representative of R18 Yr Hen Gof Forge (to the west), R9 Caldey House (to the east) and R23 the barracks (on-site), being the receptors closest to the site boundary.

7.10.3. Construction monitoring requirements will be detailed within the CEMP to be developed from the Framework CEMP set out in Appendix 3.1.

7.10.4. There is no need identified for vibration monitoring during the construction phases based on the construction programme and activities outlined.

7.10.5. The assessments demonstrate that significant effects due to operational noise can be avoided with appropriate mitigation. It is recognised that ongoing detailed design may result in minor changes to the proposed development; however, the operational noise limits and mitigation defined in this chapter will be considered at all stages of design to ensure that the findings of this chapter are met and, where possible or practicable, improved upon.

7.11. Summary and Conclusions

7.11.1. This chapter considers the potential noise and vibration impacts of the proposed development on nearby noise sensitive receptors.

7.11.2. The study area for the construction and operational noise assessments has been determined in accordance with current professional and national guidance. Due to the low background noise levels measured across the site, noise modelling has been undertaken to cover an area representative of all noise sensitive properties in the vicinity, including PRoW.

7.11.3. To inform these assessments, a baseline noise survey was undertaken to determine existing noise levels around the proposed development. The approach and results of this baseline noise survey are set out in Appendix 7.2 and have been used to inform the assessments of construction and operational noise impacts.

7.11.4. An outline construction phasing / programme has been provided, including equipment assumptions for the primary construction tasks. Works phasing and equipment assumptions are set out in Appendix 7.3. Noise modelling has been undertaken utilising the phasing, equipment assumptions and site layouts in order to determine the potential construction noise, vibration, and traffic impacts on local receptors.

7.11.5. The initial assessment of construction noise impacts identified that potentially significant effects may be expected at one receptor (R23) in the absence of mitigation, with all other receptors expected to experience a worst-case minor impact (not significant). Mitigation has therefore been presented with regard to BPM, local temporary acoustic barriers, careful programming of works and community engagement. Following the implementation of this mitigation, the assessment finds that significant construction noise effects can be avoided at all receptors. As such, no residual construction noise effects are anticipated for this scheme.

7.11.6. No significant effects are expected to arise as a result of construction vibration, or construction traffic.

7.11.7. The assessment of operational noise identified that significant effects are anticipated at several receptors and PRoW unless sufficient mitigation is implemented, during both the normal and temporary auxiliary power operational conditions. Guidance on appropriate mitigation has been set out which will be adopted in the ongoing detailed design process. With this mitigation being implemented, no residual significant adverse operational noise effects are anticipated for this scheme.