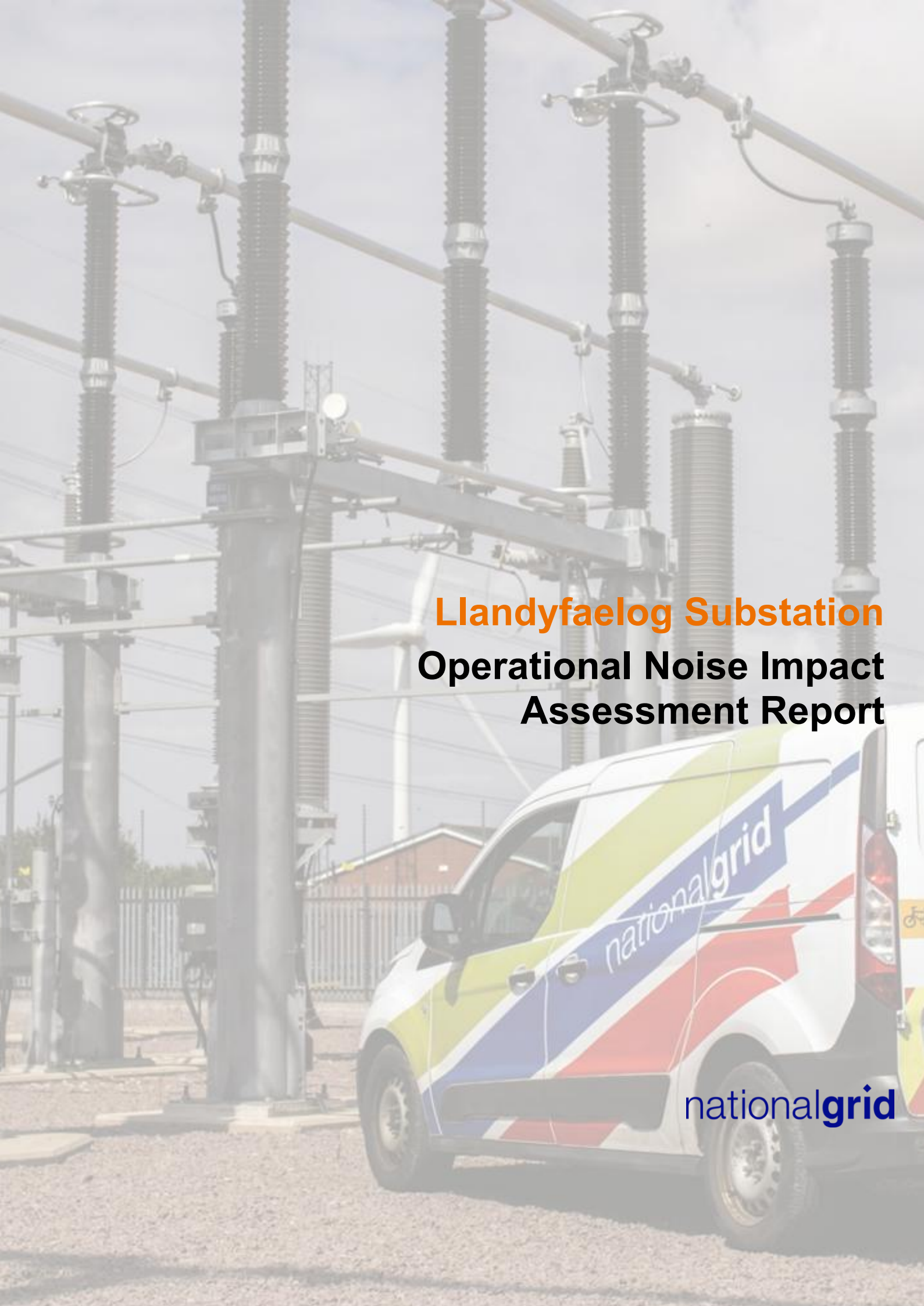
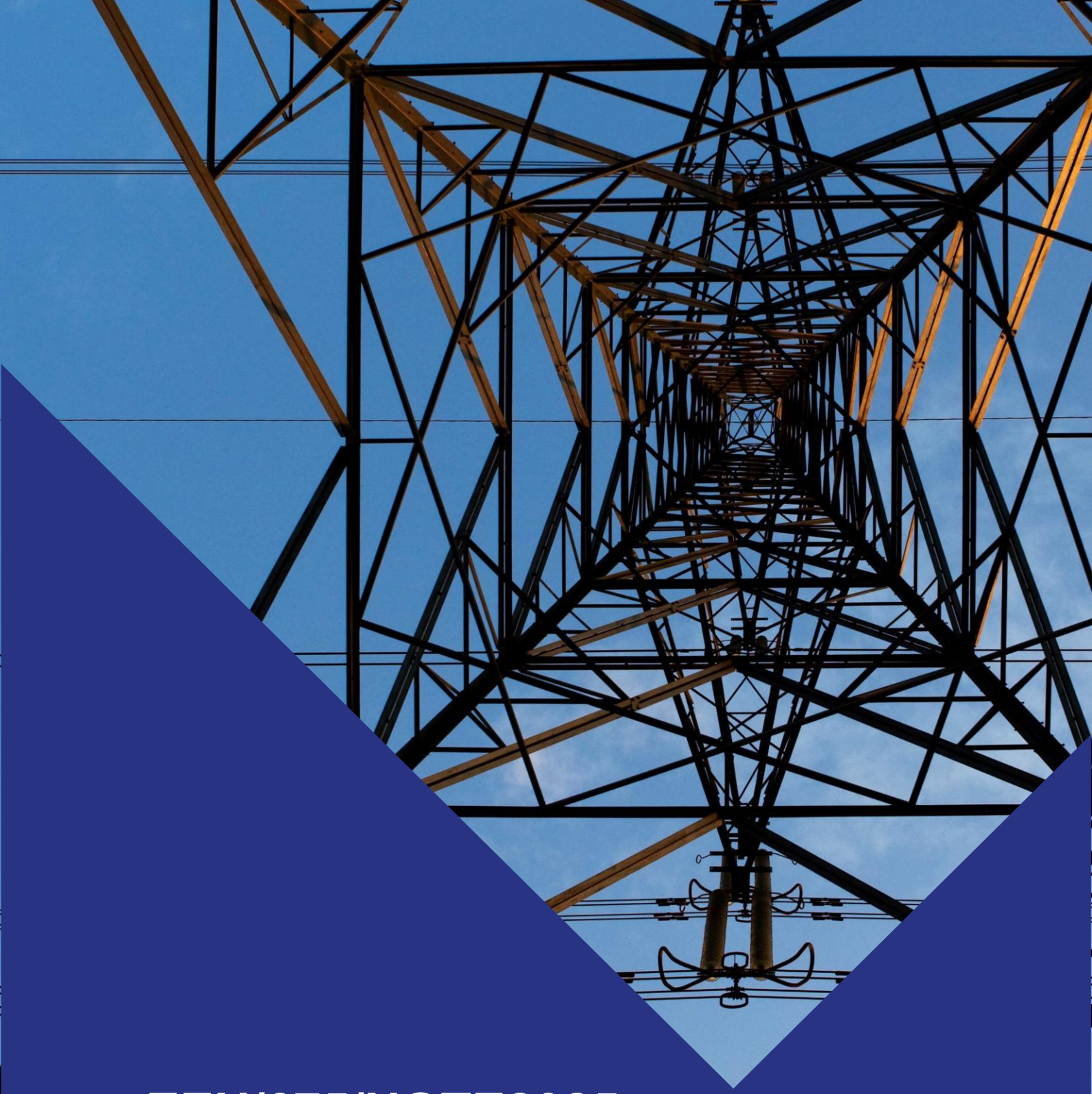


Llandyfaelog Substation

Operational Noise Impact Assessment Report

nationalgrid



EEN/675/NOTE2025

Noise Impact Assessment

Llandyfaelog 400kV Substation

13th November 2025

nationalgrid

Report Information

Report Information	
Operational Noise Impact Assessment Report	
Report Reference	EEN/675/NOTE2025
Version	V1
Date Issued	13th November 2025
Title	Llandyfaelog 400kV Substation
Description	Creation of a new National Grid 400 kV Substation including the installation of 8 x Super Grid Transformers, 2 x Shunt Reactors and ancillary equipment
Location	Llandyfaelog Substation centred on E:241868 N:213542, c.6 km South of Carmarthen

Version Report Control

Report Reference	Version	Date	Report prepared by:	Report reviewed by:	Report authorised by:
EEN/675/NOTE 2025	V1	13/11/2025	William Lowe BA (Hons), MIOA	Robert Bungay, BEng (Hons), MIOA	Robert Bungay, BEng (Hons), MIOA

Contents

1. Introduction

1.1. Purpose of the Statement

1.1.1. This acoustic report has been prepared by National Grid Electricity Transmission's Environmental Engineering Team to accompany a full planning application for the development of the proposed new substation located south of Carmarthen, hereon after referred to as 'The Proposed Development'.

1.1.2. The requirement for the proposed development has been trigged to meet an increase in electricity demand resulting from customer connections required to come onto the National Grid Electricity Transmission (NGET) network, due to limited capacity at existing substations in South Wales.

1.1.3. The proposed development has the potential to create adverse noise impacts to nearby sensitive receptors (NSRs), this Noise Impact Assessment (NIA) has therefore been completed to identify, address, and consider any mitigation measures (if required) to assess the potential adverse impact to surrounding NSRs.

1.2. Site and Surrounding Environment Description

1.2.1. The site is centred on E:241868 N:213542, approximately 6km south of Carmarthen. The site covers a total area of approximately 52 hectares (ha) and comprises of several agricultural fields.

1.2.2. Two existing 400 kV National Grid high voltage overhead lines (OHLs) (known as the '4YW' and '4YV' routes) run parallel to one another and intersect the site. The proposed development will connect to both circuits of the 4YV OHL at tower 4YV165.

1.2.3. The site is located in a rural area, surrounded by agricultural fields, with scattered residential properties and farmland in its vicinity.

1.2.4. A single-track road passes north of the site and connects to the A484, a single carriageway, adjacently located west of the proposed site boundary. Additional unnamed single carriageway roads are also located to the south, near Llandyfaelog, and east of the proposed development.

1.2.5. **Figure 1** below, shows aerial imagery of the local area with the proposed red line boundary.

Figure 1: Aerial view showing location of the Proposed Development red line boundary - Source © Google Earth

1.3. Development Proposals

1.3.1. The proposed development seeks to create a new 400 kV substation to aid in fulfilling customer connections to the National Grid Electricity Transmission network.

1.3.2. The proposed substation would be an Air Insulated Substation (AIS) design in a compound within an area of approximately 255m x 530m, and will include the following:

- Up to eight (8) new Super Grid Transformers (SGTs) comprising four (4) x 400/132 kV, 240MVA SGTs and four (4) x 400/132 kV, 450MVA SGTs;
- Up to 2 x 200 MVAr Shunt Reactors (SHRs);
- Diesel generators for backup power supply;
- Other ancillary substation equipment such as, switchgear (circuit breakers, disconnectors, switches), cooling systems, and busbars;
- Control buildings; and
- Substation access from public highway, main gate and pedestrian gate;

1.3.3. As part of the project, works will also include modification works to the existing OHL cabling to connect the proposed development to the grid. Including the installation of up to two new additional, and one replacement, 400 kV towers circa 45 – 55m tall to connect into the existing 4YV OHL);

1.3.4. **Figure 2** below presents the proposed site layout.

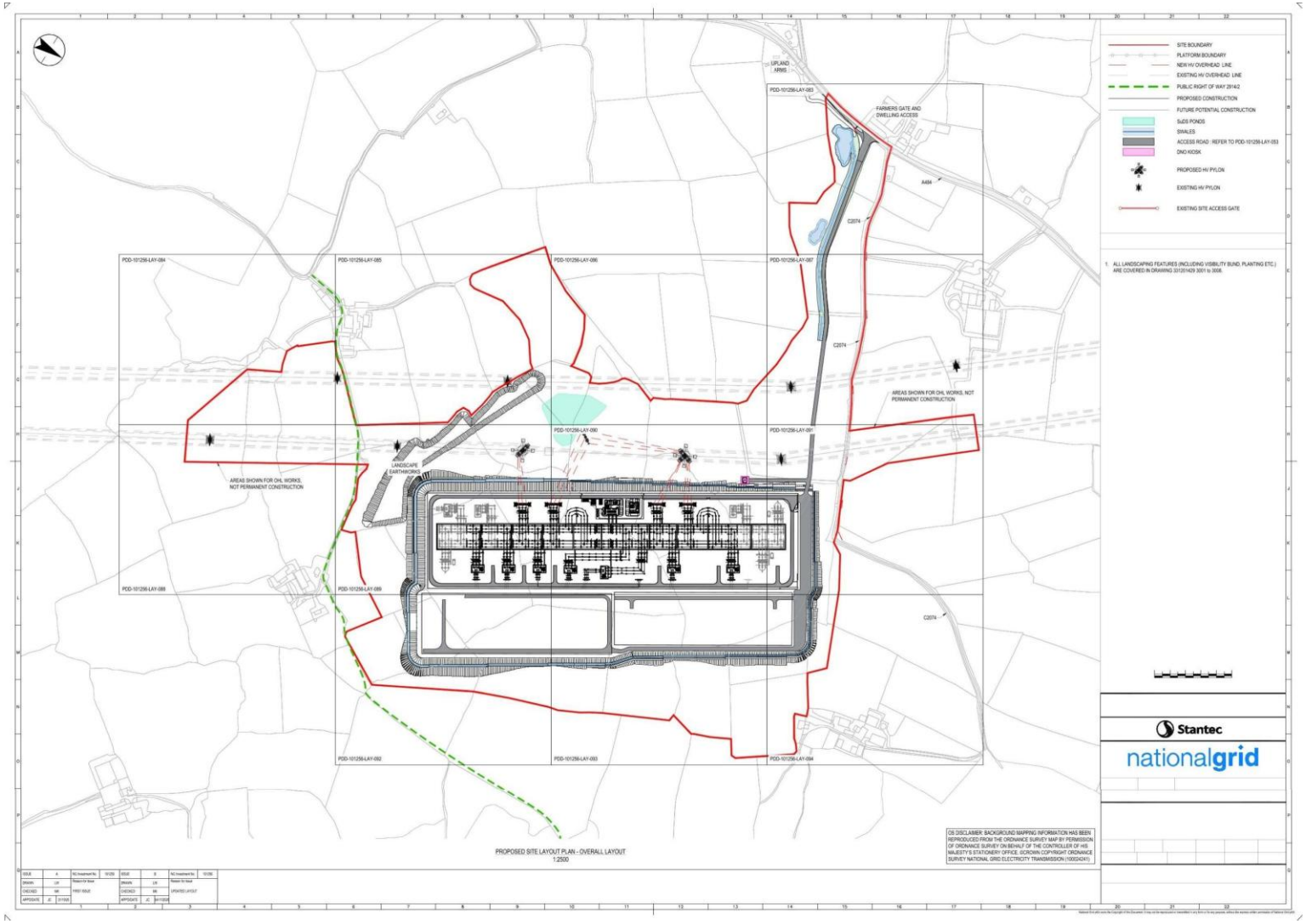


Figure 2: Proposed site layout – Source National Grid

1.4. Proposed Operational Noise Sources Subject to Assessment

1.4.1. The main noise sources of the proposed development are the eight SGTs and two SHRs. Unmitigated noise from SGTs and SHRs is heard as a highly tonal 'hum', consisting of exact acoustic harmonics of the UK electricity supply frequency. The fundamental acoustic frequency is 100 Hz (Hertz or cycles per second) accompanied by higher order harmonics of 200 Hz, 300 Hz and 400 Hz etc. The tonality is considered an 'acoustic feature' according to BS 4142:2014+A1:2019.

1.4.2. The proposed transformers will be procured under a contract with one of National Grid's suppliers and made to registered designs. These designs will undergo factory acceptance tests to ensure the sound power of the transformers comply or are below the maximum permitted sound power level outlined in National Grid's Technical Specification.

1.4.3. Once energised, the SGTs and SHRs will be in continuous operation 24/7.

1.5. Operational Noise Sources Scoped out of Assessment

SGT and SHR Cooling System

1.5.1. Under normal operating conditions, the cooling systems of the SGTs and SHRs will rarely operate. Cooling systems may operate during emergency conditions and during times of unusually high demand, typically where the asset is required to operate above 75% of designs full load. Such conditions usually occur only during exceptional events, (i.e. extreme weather combined with faults elsewhere on the system, requiring an SGT and SHR to carry a higher than normal load). These conditions would usually persist for a short duration and as such cooler operation can typically be regarded as an exceptional event. Therefore SGT and SHR cooling system noise is excluded from this assessment.

Auxiliary Substation Equipment

1.5.2. Circuit breakers, disconnectors and switches are also a potential source of noise. Their purpose is to disconnect the site from the high voltage transmission system in response to a fault or external event such as a lightning strike, and to isolate and earth parts of the site for maintenance.

1.5.3. The sound from a circuit breaker is impulsive and sounds like a car door slam, similar in level and duration, and the sound of disconnectors and switches sounds like a ‘click’ or ‘clack’, this equipment would operate very rarely.

1.5.4. The majority of breaker activations would take place during commissioning when there may be 10 or 20 activations during working hours only. Once commissioned, they may typically operate just a few times a year and in some years, they may never operate at all. Whilst the sound of this equipment when operating may be audible just beyond the site boundary, it is unlikely to be noticeable even in a quiet rural environment. Noise from circuit breakers, disconnectors and switches is therefore considered not significant and is scoped out of further assessment.

1.5.5. Items of equipment exposed to high voltage such as busbars, conductors, down droppers and transformer bushings are not inherently noisy, but they may make a ‘crackle’ sound similar to that which can occur from overhead power lines. This is a low-level noise and unlikely to be audible beyond the site boundary and is therefore scoped out of further assessment.

1.5.6. Other items of equipment form part of this development but do not produce noise, or produce very low-level noise that would generally not be audible beyond the site boundary and are therefore scoped out of further assessment. These items of auxiliary equipment include small current transformers, voltage transformers, low voltage site supplies, control kiosks, battery rooms, fences, gates and site lighting.

Emergency Backup Equipment

1.5.7. Two diesel generators will be installed to provide low voltage electricity supplies to the proposed substation on a temporary, emergency basis.

1.5.8. The diesel generators will only operate for 1 - 2 hours per month during daytime hours, for routine testing purposes. Operation for extended periods of time would be on a temporary basis under emergency conditions only.

1.5.9. As the diesel generators will not form part of the proposed substations typical operation, these has been excluded from further assessment.

Overhead Line (OHL) Turn In

1.5.1. The proposed substation will connect to the existing 4YV 400 kV OHL, requiring the construction of up to two new additional and one replacement 400 kV towers. The circuits carried by the overhead line would drop down into the substation and connect to the high voltage busbars.

1.5.2. Any noise that occurs from the existing overhead lines due to the occurrence of corona discharge are anticipated to not change significantly as a result of the project.

1.5.3. In light of the above, noise due to the operation of the OHL connections is therefore considered not significant and has been scoped out from this assessment.

Operational Traffic

1.5.4. Once a substation becomes operational, the substation will be unmanned. Personal will only be required on site for routine monitoring/inspection checks which are likely to be completed be a single person on a weekly basis. As such, there is expected to be no significant increase in normal traffic flows. Operational traffic noise is therefore considered to be unnoticeable against normal traffic and operational traffic noise is excluded from this assessment.

Operational Vibration

1.5.5. The installation of SGTs and SHRs typically employs measures to minimise vibrations from its operation, such as antivibration pads, therefore operational vibration is excluded from the scope of the assessment.

1.6. Noise Sensitive Receptors

1.6.1. Residential properties surrounding the proposed development are considered to be the most exposed NSRs that could be affected by the proposed development. These are listed in **Table 1** below:

Receptor Reference	Receptor Type
NSR1	Residential property at Llwyngwcw
NSR2	Residential property at Llwyncelyn
NSR3	Residential property at Upland Arms
NSR4	Residential property at Llyswen
NSR5	Residential property at Cross Inn Cottage
NSR6	Residential property at Lanfryn
NSR7	Residential property at Cwmafael
NSR8	Residential property at Crugan Fach
NSR9	Residential property at Penymaes Farm
NSR10	Residential property at Bwlch-y-gwynt

Table 1: Identified Noise Sensitive Receptors

1.6.2. **Figure 3** below, shows an aerial photograph of the proposed development red line boundary and NSRs.

Figure 3: Aerial view of Proposed Development red line boundary and identified NSRs – Source © Google Earth

2. Legislation, Policy, Guidance and Assessment Methodology

2.1. Planning Policy and Guidance on Noise

2.1.1. This acoustic report has been prepared to be submitted in support of a proposed planning application.

2.1.2. Reference to the planning guidance documentation is presented in this report:

- Planning Policy Wales 2024;
- Technical Advice Note 11: Noise 1997;
- Noise and Soundscape Plan for Wales 2023 – 2028: Our national strategy on soundscapes;
- Carmarthenshire Local Development Plan 2006 – 2021 (adopted 2014); and
- BS 4142:2014+A1:2019 – 'Methods for Rating and Assessing Industrial and Commercial Sound'

2.1.3. A summary of the relevant information with respect to noise contained within the planning documentation listed above is presented below.

2.2. Planning Policy Wales 2024

2.2.1. Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

2.2.2. The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation. The PPW was last updated in February 2024 and is currently in its 12th edition.

2.2.3. Section 6.7 "Air Quality and Soundscape" makes reference to the acoustic environmental and acoustic design. The following paragraphs are relevant to this assessment:

2.2.4. Paragraph 6.7.5 states:

"…the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes."

2.2.5. Paragraph 6.7.6 states:

"In proposing a new development, planning authorities and developers must, therefore:

- *address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- *not create areas of poor air quality or inappropriate soundscape; and*
- *seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes."*

2.2.6. Furthermore, Paragraph 6.7.14 states that:

"Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur."

2.3. Technical Advice Note (TAN11)

2.3.1. As previously mentioned, the PPW is supplemented by a series of Technical Advice Notes (TANs). TAN 11: Noise published October 1997 offers guidance on how the planning system should be used to mitigate the negative effects of noise, while ensuring that development is not unreasonably restricted and that businesses are not burdened with excessive costs and administrative requirements. TAN 11 outlines how Local Planning Authorities should establish local Planning Policies and Development Plans, including how to set out Planning Conditions relevant to noise.

2.3.2. Paragraphs 8 & 9 of TAN 11 address noise generating development and states the following:

> *"Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions…*
>
> *Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration…"*

2.3.3. Paragraph 11 outlines key mitigation measures that can be used to mitigate the impact of noise, these are taken to be:

> *"i. engineering: reduction of noise at point of generation (e.g. using quiet machines and/or quiet methods of working); containment of noise generated (e.g. insulating buildings which house machinery and/or providing purpose-built barriers around sites); protection of surrounding noise-sensitive buildings (e.g. improving sound insulation in these buildings and/or screening them by purpose-built barriers);*
>
> *ii. lay-out: adequate distance between noise source and noise-sensitive building or area; screening by natural barriers, other buildings, or non-critical rooms in a building;*
>
> *iii. administrative: limiting operating time of noise source; restricting activities allowed on the site; specifying an acceptable noise limit."*

2.3.4. Paragraph B17 of Annex D makes direct reference to noise from industrial development and states:

> *"The likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS 4142: 1990. Tonal or impulsive characteristics of the noise are likely to increase the scope for complaints and this is taken into account by the "rating level" defined in BS 4142. This "rating level" should be used when stipulating the level of noise that can be*

permitted. The likelihood of complaints is indicated by the difference between the noise from the new development (expressed in terms of the rating level) and the existing background noise. The Standard states that, 'A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance'. Since background noise levels vary throughout a 24 hour period it will usually be necessary to assess the acceptability of noise levels for separate periods (e.g. day and night) chosen to suit the hours of operation of the proposed development. Similar considerations apply to developments that will emit significant noise at the weekend as well as during the week. In addition, general guidance on acceptable noise levels within buildings can be found in BS 8233: 1987."

2.3.5. It should be note that British Standards BS 4142: 1990 and BS 8233: 1987, referenced in the current version of TAN11 have since been superseded.

2.4. Noise and Soundscape Plan for Wales 2023 – 2028: Our national strategy on soundscapes

2.4.1. The Noise and Soundscape Plan for Wales 2023 – 2028 sets out Wales national strategy on soundscapes i.e. the acoustic environment as perceived or experienced and/or understood by a person or people, in context.

2.4.2. Annex E – guidance to support decision-making directly references BS4142: 2019 as a guidance document that be used to aid the assessment of a soundscape.

2.5. Local Planning Policy

Carmarthenshire County Council Local Development Plan (2006-2021)

2.5.1. Carmarthenshire County Councils Local Development Plan (LDP) sets out proposals and policies for the future use of all land within the County and is part of the development plan framework for Wales. The 2018-2033 LDP is yet to be adopted and therefore the existing 2006-2021 LDP is currently used to inform all planning decisions.

2.5.2. The following development policies are relevant to noise:

"Policy EP2 Pollution

Proposals for development should wherever possible seek to minimise the impacts of pollution. New developments will be required to demonstrate that they:

a. *Do not conflict with National Air Quality Strategy objectives, or adversely affect to a significant extent, designated Air Quality Management Areas (permitted developments may be conditioned to abide by best practice);*
b. *Do not cause a deterioration in water quality;*
c. *Ensure that light and noise pollution are where appropriate minimised;*
d. *Ensure that risks arising from contaminated land are addressed through an appropriate land investigation and assessment of risk and land remediation to ensure its suitability for the proposed use."*

2.6. BS 4142:2014+A1:2019 – 'Methods for Rating and Assessing Industrial and Commercial Sound'

2.6.1. BS 4142 describes methods for rating and assessing sound of an industrial and / or commercial nature.

2.6.2. This includes sound from industrial and manufacturing processes, including sound from fixed installations comprising mechanical and electrical plant and equipment.

2.6.3. The methods described in BS 4142 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.

2.6.4. BS 4142 assesses the likelihood of any adverse impact from proposed or existing industrial / commercial activities on existing or proposed NSRs.

2.6.5. To assess the potential impact, the measured background sound level at the closest NSR or at a representative location, is arithmetically subtracted from the rating level. This is the specific sound source level of the assessed source corrected for acoustical characteristics that may make the sound more subjectively noticeable to the NSRs.

2.6.6. The method in BS 4142 is based on the difference between the measured background sound level, without the influence of any industrial noise source assessed, and the rating level of the industrial source assessed, at the receiver location.

2.6.7. 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.

2.6.8. Typically, the greater the difference between the background sound level and the rating level, the greater the magnitude of the impact.

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

2.6.10. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

2.6.11. 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.

2.6.12. Regarding the context, BS 4142 states the following:

> *An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*

2.6.13. Main specific terms used in BS 4142 are presented below:

Ambient sound level, $L_a = L_{Aeq,T}$ – equivalent continuous A-weighted sound pressure level, L_{Aeq}, of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. The ambient sound level is a measure of the residual sound and the specific sound when present.

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.

Residual sound level, $L_r = L_{Aeq,T}$ – ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

Specific sound level, L_s = $L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Rating level, $L_{ar,Tr}$ – specific sound level plus any adjustment for the characteristic features of the sound.

2.6.14. The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

2.6.15. The background sound level should be measured at the assessment location(s), where possible. Where this is not possible, an alternative location, representative of the assessment locations, can be used.

2.6.16. The measurement time interval should be sufficient to obtain a representative value of the background sound level for the period of interest. This should comprise continuous measurements of normally not less than 15 min intervals, which can be contiguous or disaggregated.

2.6.17. The specific sound level needs to be determined at the assessment location(s) as a discrete entity, distinct and free of other influences contributing to the ambient sound. BS 4142 suggests that the specific sound needs to be evaluated over an appropriate reference time interval, 1 hour during daytime and 15 minutes during night-time.

2.6.18. The daytime period is defined as the hours ranging from 07:00 to 23:00. The night-time period comprises the hours from 23:00 to 07:00.

2.6.19. BS 4142 states that, where possible, the specific sound level by measurement of the ambient sound level and the residual sound level needs to be determined at the assessment location(s).

2.6.20. Where determining the specific sound level by direct measurement is not practicable, for example in the case of a source not yet in operation, the method of calculation has to be reported and justified in detail.

2.6.21. The rating level in BS 4142 depends on certain acoustic features that can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level.

2.6.22. Where such features are present at the assessment location, a character correction is added to the specific sound level to obtain the rating level.

2.6.23. BS 4142 states that it is typically feasible to undertake a subjective assessment of characteristics, based on the correction guidelines, as follows:

Tonality: +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', +6 dB for 'highly perceptible' tones;

Impulsivity: +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity;

Intermittency: if the on / off-time of the specific sound is readily distinctive at the NSRs, a +3 dB character correction is added; and,

Other sound characteristics: where the noise source features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.

2.6.24. If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically.

2.6.25. However, if any single feature is dominant to the exclusion of the others, then it might be appropriate to apply a reduced or even zero correction for the minor characteristics.

2.7. Consultation with Local Authority

2.7.1. In the absence of any quantitative noise guidance encapsulated within the LDP, and in response to Pre-Application advise issued to NGET (Application No. PRE/02162) on 13th June 2024, an email was sent from National Grid's Environmental Engineering (EE) Team to Carmarthenshire County Council on the 18th June 2024 addressed to the Public Protection department. The email set out the proposed assessment methodology, detailing that a Noise Impact Assessment would be completed in accordance with BS

4142:2014+A1:2019 – *'Methods for Rating and Assessing Industrial and Commercial Sound'.*

2.7.2. In response to the email referenced, an Environmental Health Officer (EHO), Mr Osian Thomas, agreed that a BS4142:2014+A1:2019 NIA would be satisfactory and relevant for this type of development.

2.8. Assessment Methodology

2.8.1. Based on the above and given that transformers are industrial noise sources in nature, it is therefore considered that the methodology based on BS 4142:2014+A1:2019, 'Methods for rating and assessing industrial and commercial sound' is the most appropriate and consequently has been adopted for the assessment of the potential noise breakout from the site at the identified NSRs, with the intention to design rating levels at or below background sound levels at NSRs.

3. Acoustic Survey

3.1. Measurement Locations and Equipment

3.1.1. Baseline sound levels at the site have been established by means of an automated noise survey completed between 23rd April to 1st May 2024 by Stantec Ltd, at three monitoring locations, considered representative of the NSRs, presented as LT1, LT2 and LT3 in **Figure 4** below.

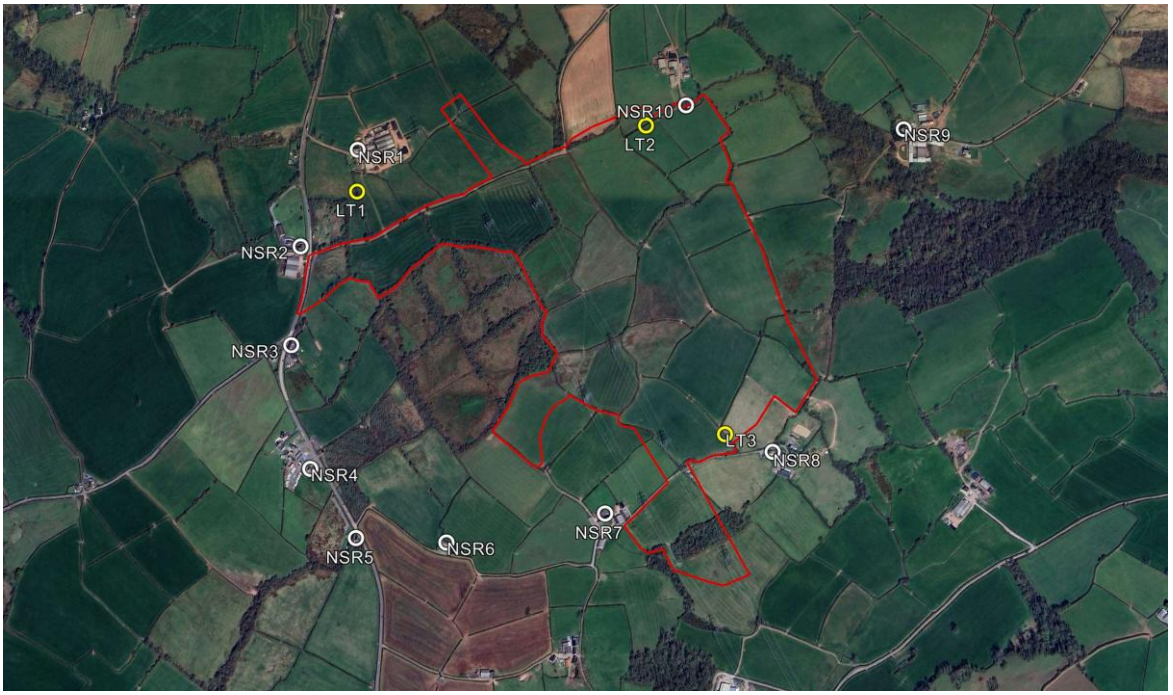


Figure 4: Aerial view showing locations of the proposed development red line boundary, noise monitoring locations LT1, LT2 and LT3 (yellow circles), and NSRs (white circles) – Source © Google Earth

3.1.2. Measurements are considered representative of the NSRs shown in **Table 1** below:

Measurement Location	Receptor
LT1	NSR1-6
LT2	NSR7 & NSR8
LT3	NSR9 & NSR10

Table 1: Measurement locations and representative receptors

3.1.3. Class 1 sound level meters (SLMs) were used and calibrated as per the requirements presented in Section 5.2 of BS 4142. A field calibration check was carried out before and after every measurement session and the drift noted was less than 0.1 dB in each case. The details of the SLMs used in this NIA are presented in **Table 2** below.

Monitoring Location	Description	Manufacture	Type	Serial Number	Laboratory Calibration Date
LTM-1	Sound Level Meter	RION	NL-52	54903	12/01/2023
	Microphone		UC-59	6480	
	Pre-amplifier		NH-25	42931	
LTM-2	Sound Level Meter	RION	NL-52	1010734	19/06/2023
	Microphone		UC-59	23232	
	Pre-amplifier		NH-25	11381	
LTM-3	Sound Level Meter	RION	NL-52	1043457	12/01/2023
	Microphone		UC-59	7232	
	Pre-amplifier		NH-25	43486	
All	Calibrator	B&K	4231	2619373	02/01/2024

Table 2: Sound level meter details

3.2. Weather Conditions

3.2.1. The weather conditions during the installation and collection of LT1, LT2 and LT3 were noted as dry with light winds, deemed suitable for the measurement of environmental noise.

3.2.2. Weather conditions were also recorded during the unattended monitoring. Following the guidance presented within BS 4142, measurement periods affected by adverse weather conditions (15-minute periods with wind speeds higher than 5 m/s and periods where rainfall occurred) have been excluded from all tabulated numbers and calculations presented later in the report.

3.3. Acoustic Survey Observations

3.3.1. At each location during the time of installing and retrieving the monitoring equipment, it was noted that on-site sound levels were dominated by distant vehicular movements on the surrounding road network specifically the A484 as well as birdsong, distant animal cries,

and rustling trees at all locations. The soundscape across all monitoring locations is therefore considered similar and one typical of a rural area.

3.4. Survey Procedure

3.4.1. The sound level meters were configured to measure the A-weighted equivalent sound pressure level, L_{Aeq}, the A-weighted level exceeded for 90% of the time, considered to be representative of the background or ambient level of a noise environment (L_{A90}), and the L_{Amax} noise indices at high resolution 0.100ms. This data has been post-processed to obtain 15-minute period noise levels.

3.5. Automated Noise Monitoring Results

3.5.1. Detailed time history graphs showing the A-weighted L_{Aeq}, L_{A90}, and L_{Amax} sound levels measured during each consecutive 15-minute period of the survey are presented in **Figure 5-7** for LT1, LT2 and LT3 respectively.

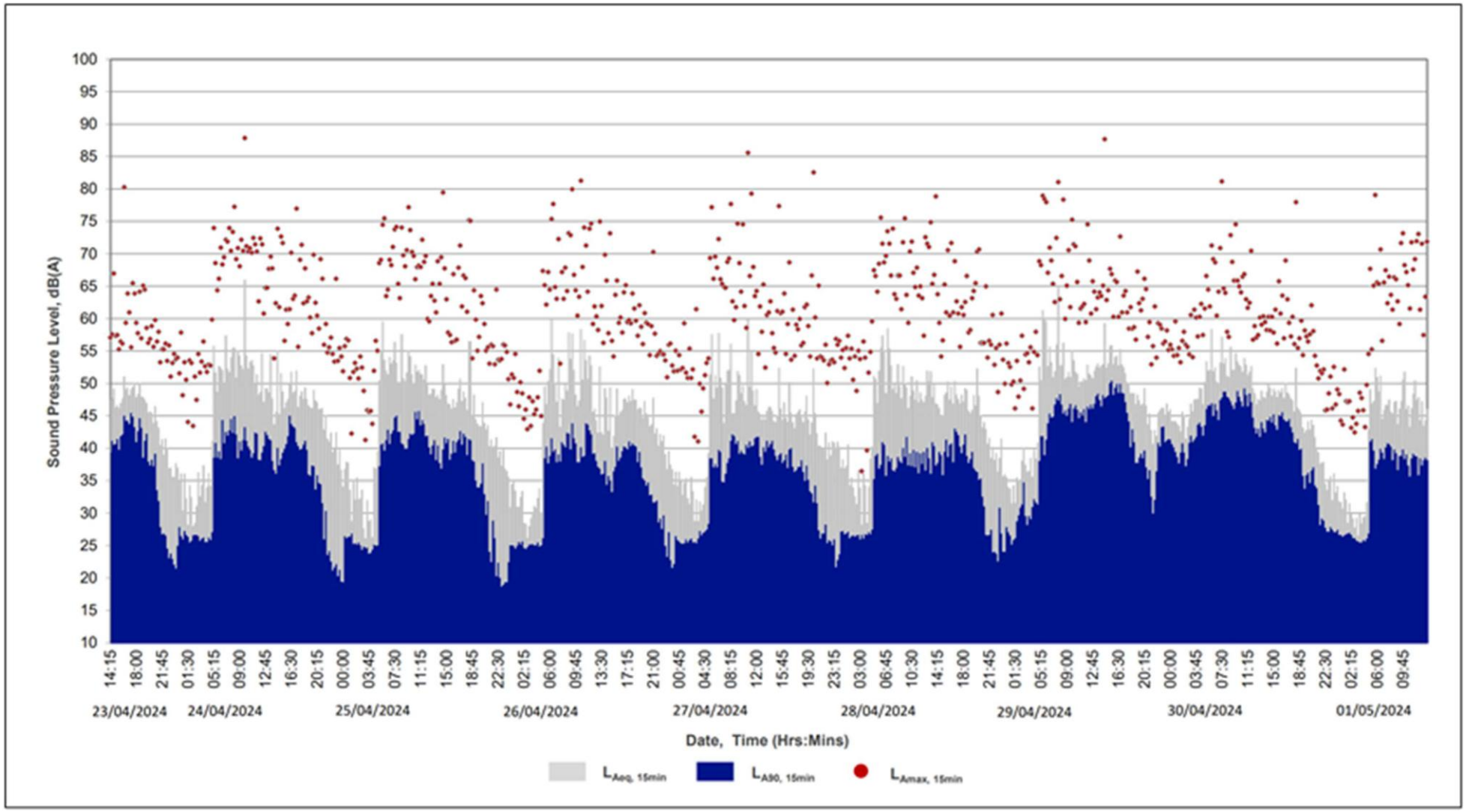


Figure 5: Time history graph of LT1

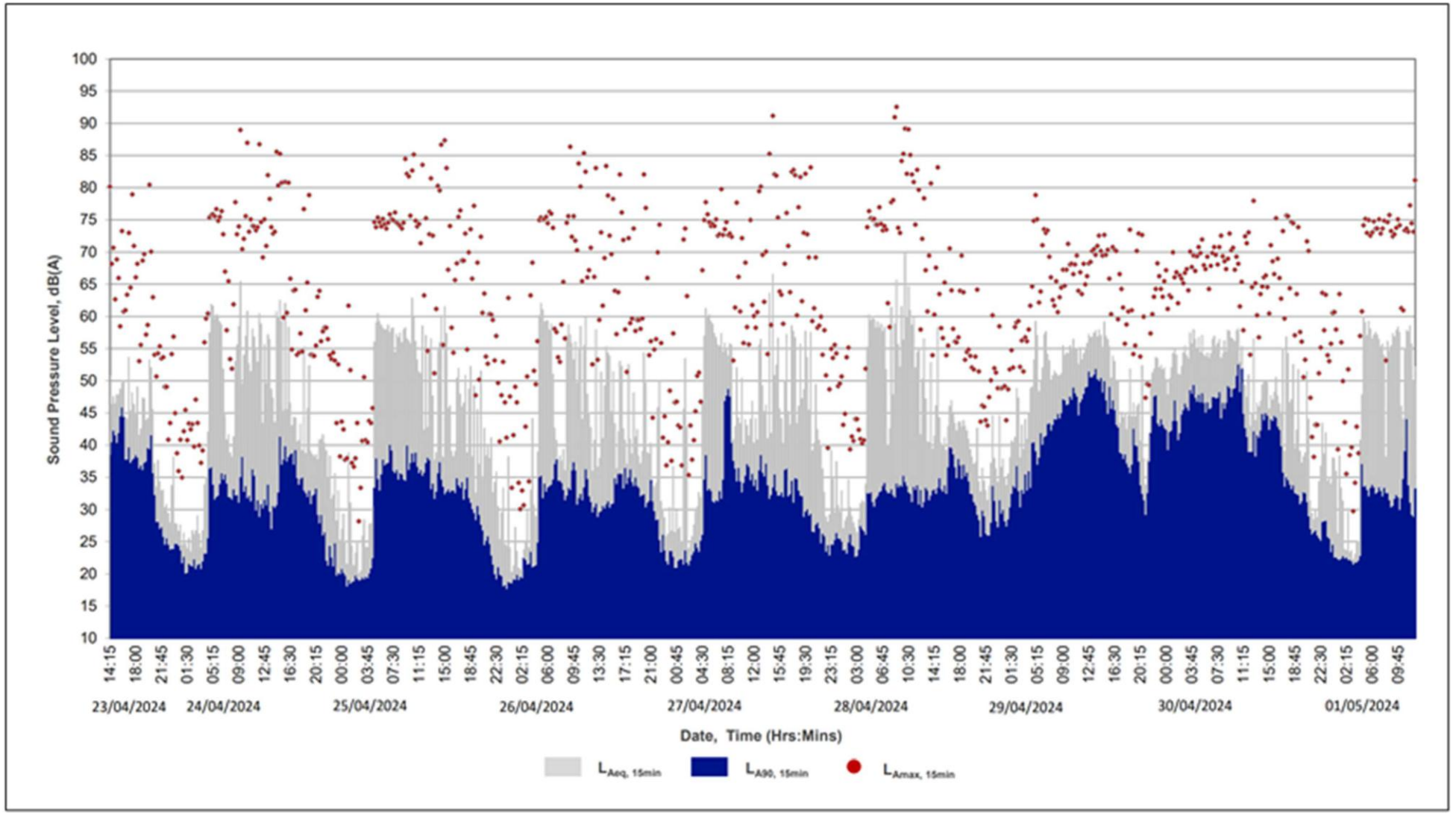


Figure 6: Time history graph of LT2

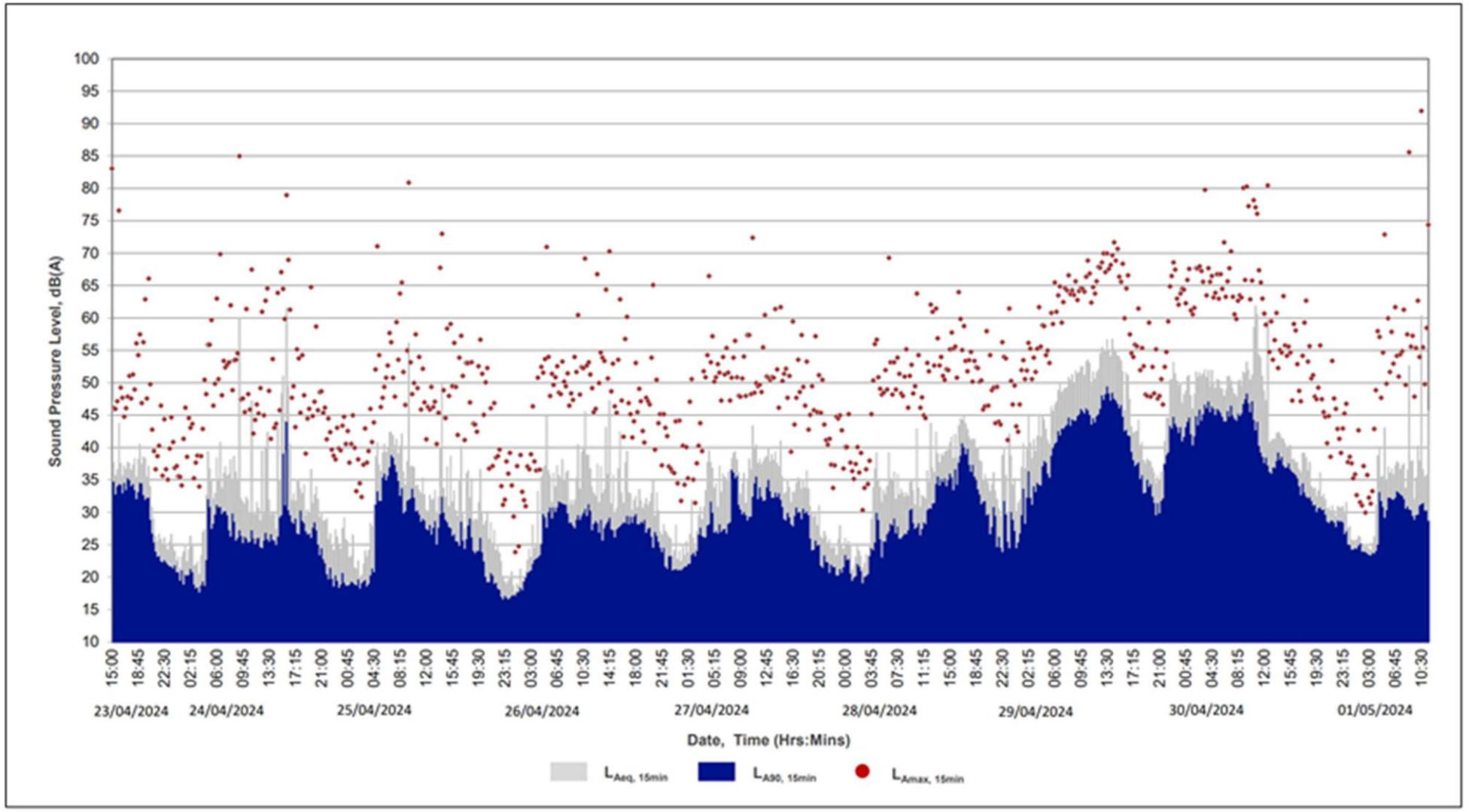


Figure 7: Time history graph of LT3

3.5.2. The measurement data presented in **Figures 5-7** above has been analysed by Stantec Ltd who have highlighted specific time periods where extraneous noise associated with farming activities was recorded. **Table 4-6** below present the typical daytime ($L_{Aeq,16hour}$) and night-time ($L_{Aeq,8hour}$) noise levels measured at each monitoring location and excludes such periods of extraneous noise.

Date	Daytime sound level ($L_{Aeq,16hour}$, dB)	Night-time sound level ($L_{Aeq,8hour}$, dB)
23/04/2024	*47	46
24/04/2024	53	48
25/04/2024	51	48
26/04/2024	50	48
27/04/2024	49	48
28/04/2024	49	41
29/04/2024	53	49
30/04/2024	50	44
01/05/2024	*47	--

* Data does not represent full period

Table 4: LT1 Ambient Noise Level

Date	Daytime sound level ($L_{Aeq,16hour}$, dB)	Night-time sound level ($L_{Aeq,8hour}$, dB)
23/04/2024	*47	54
24/04/2024	55	53
25/04/2024	54	54
26/04/2024	51	54
27/04/2024	54	54
28/04/2024	57	51
29/04/2024	54	54
30/04/2024	52	53
01/05/2024	*56	--

* Data does not represent full period

Table 5:LT2 Ambient Noise Levels

Date	Daytime sound level ($L_{Aeq,16hour}$, dB)	Night-time sound level ($L_{Aeq,8hour}$, dB)
23/04/2024	*38	32
24/04/2024	47	35
25/04/2024	41	34
26/04/2024	37	33
27/04/2024	36	32
28/04/2024	39	43
29/04/2024	51	50
30/04/2024	50	34
01/05/2024	*49	--

* Data does not represent full period

Table 6: LT3 Ambient Noise Levels

3.5.3. The ambient sound levels at each location have been logarithmically averaged to determine the typical daytime and night-time ambient sound levels, presented in **Table 7** below.

Measurement Location	Typical Daytime sound level ($L_{Aeq,16hour}$, dB)	Typical Night-time sound level ($L_{Aeq,8hour}$, dB)
LT1	50	48
LT2	54	53
LT3	46	43

Table 7: Typical Ambient Sound Levels

3.6. Background Sound Levels

3.6.1. Statistical analysis of the background sound levels has also been carried out to determine a representative background sound level for the monitoring locations.

3.6.2. **Figure 8-13** present histograms of the daytime and night-time background sound levels for LT1, LT2 & LT3.

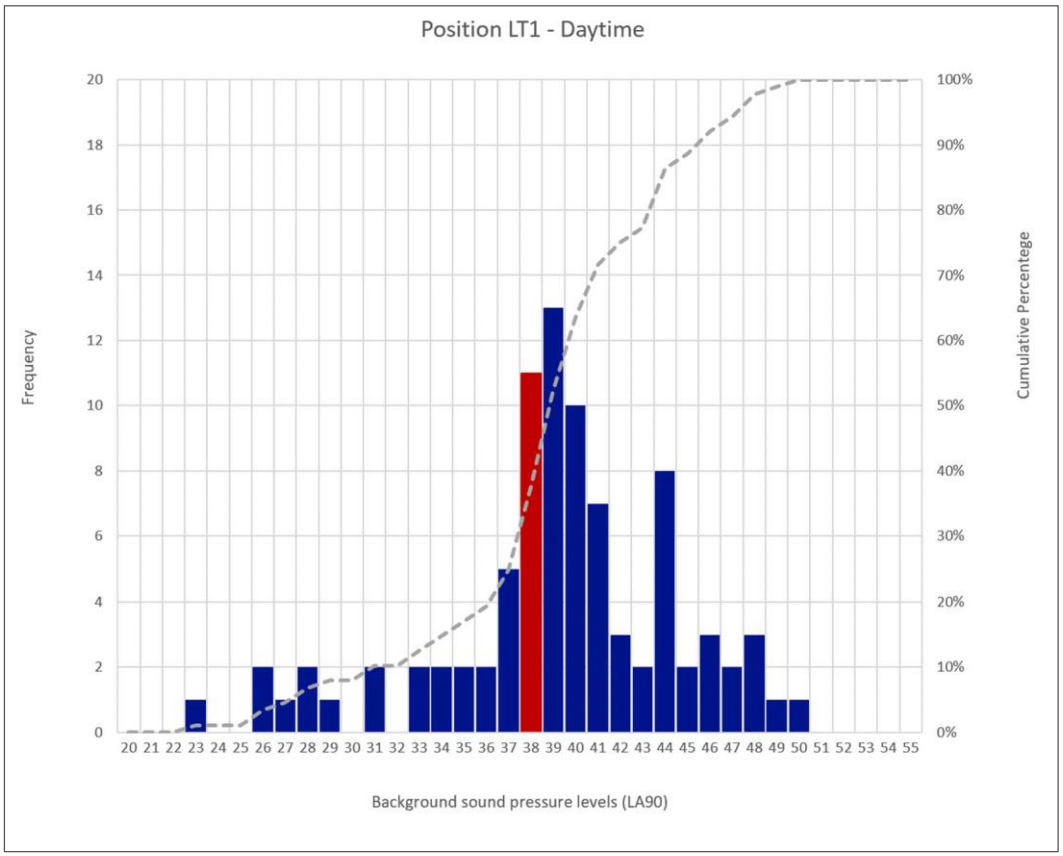


Figure 8: LT1 Daytime background sound level histogram

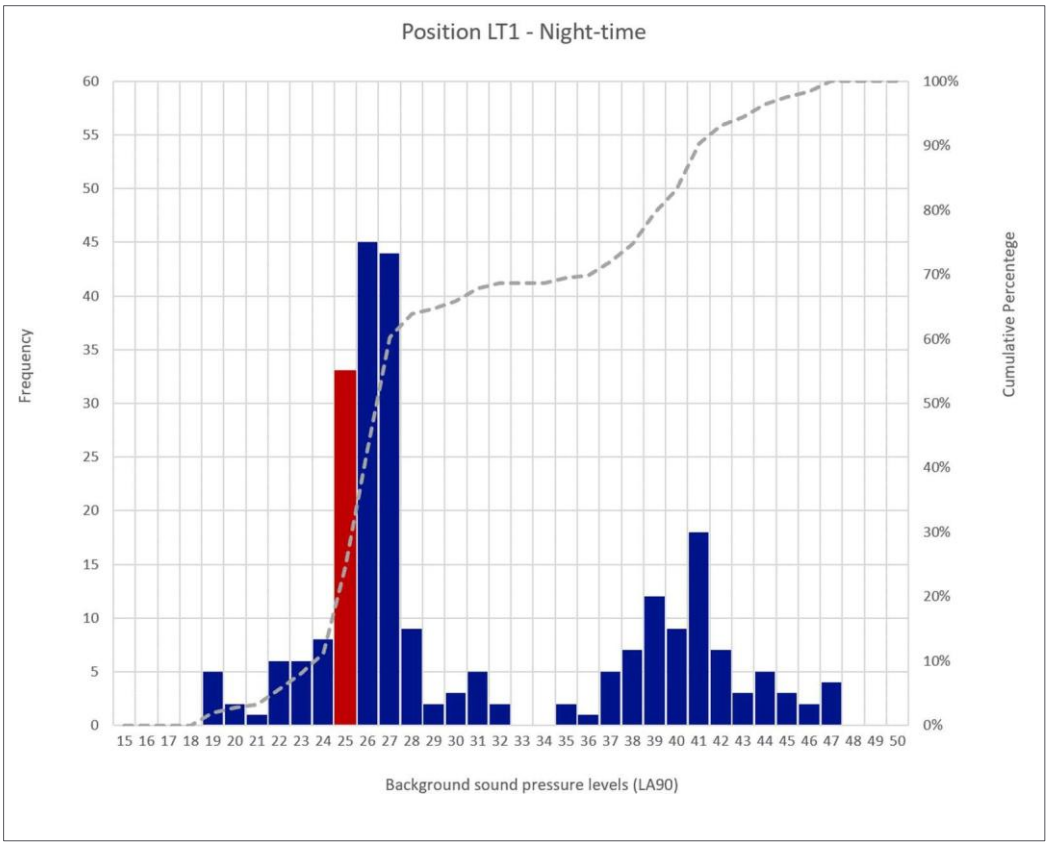


Figure 9: LT1 Night-time background sound level histogram

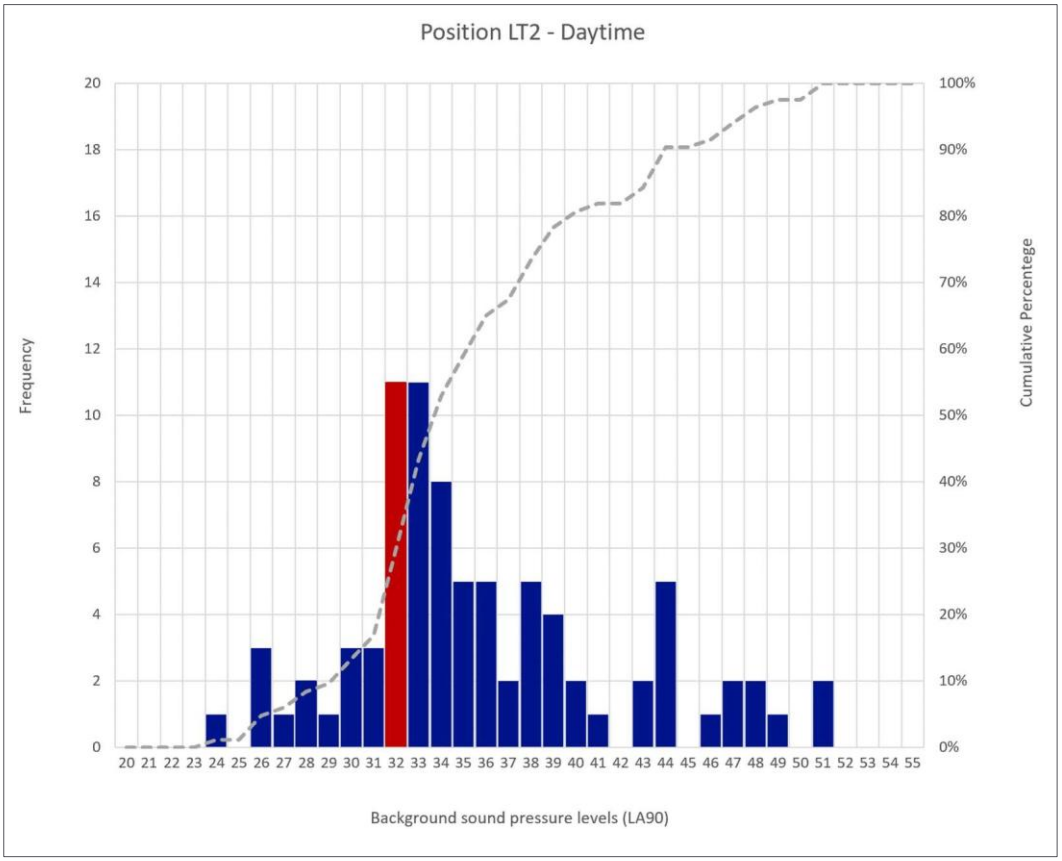


Figure 10: LT2 Daytime background sound level histogram

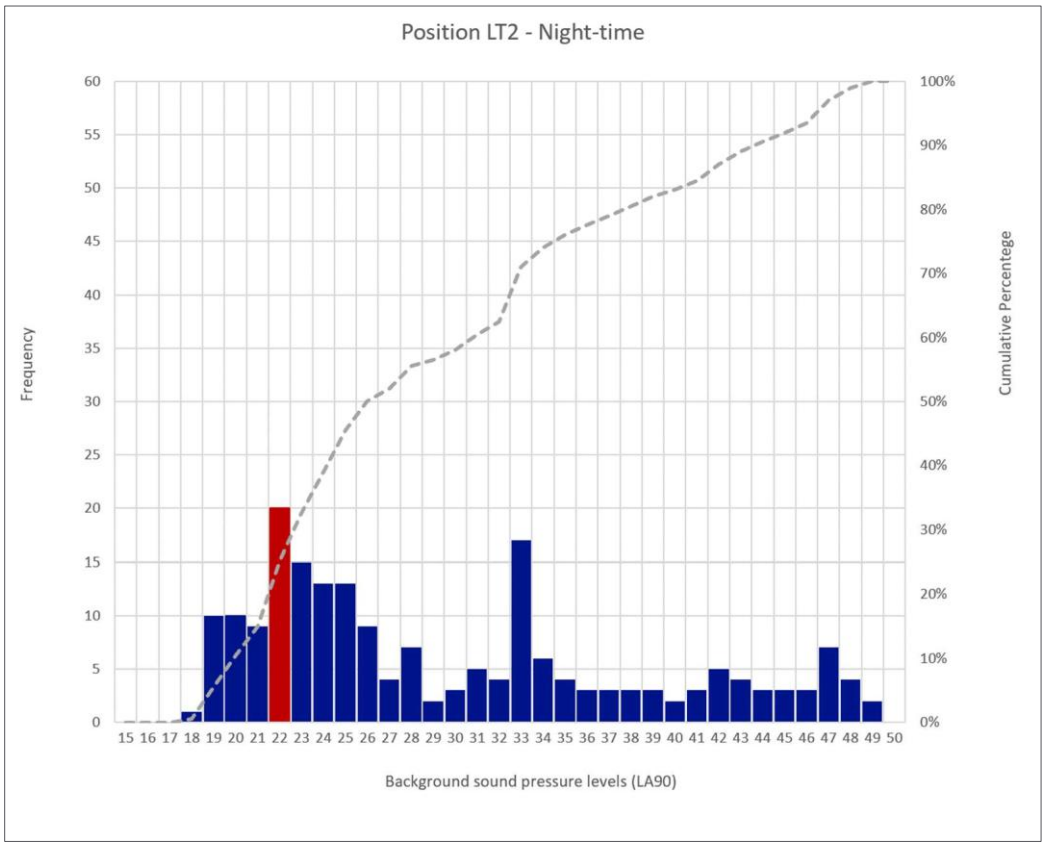


Figure 11: LT2 night-time background sound level histogram

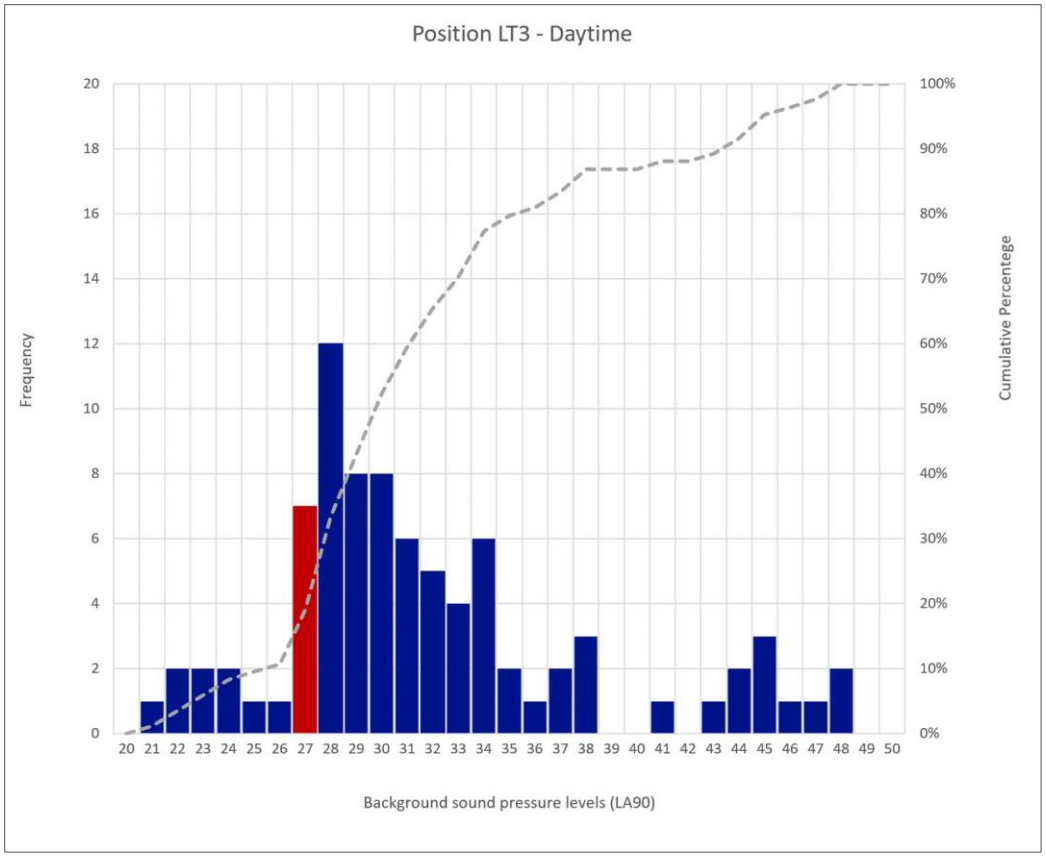


Figure 12: LT3 Daytime background sound level histogram

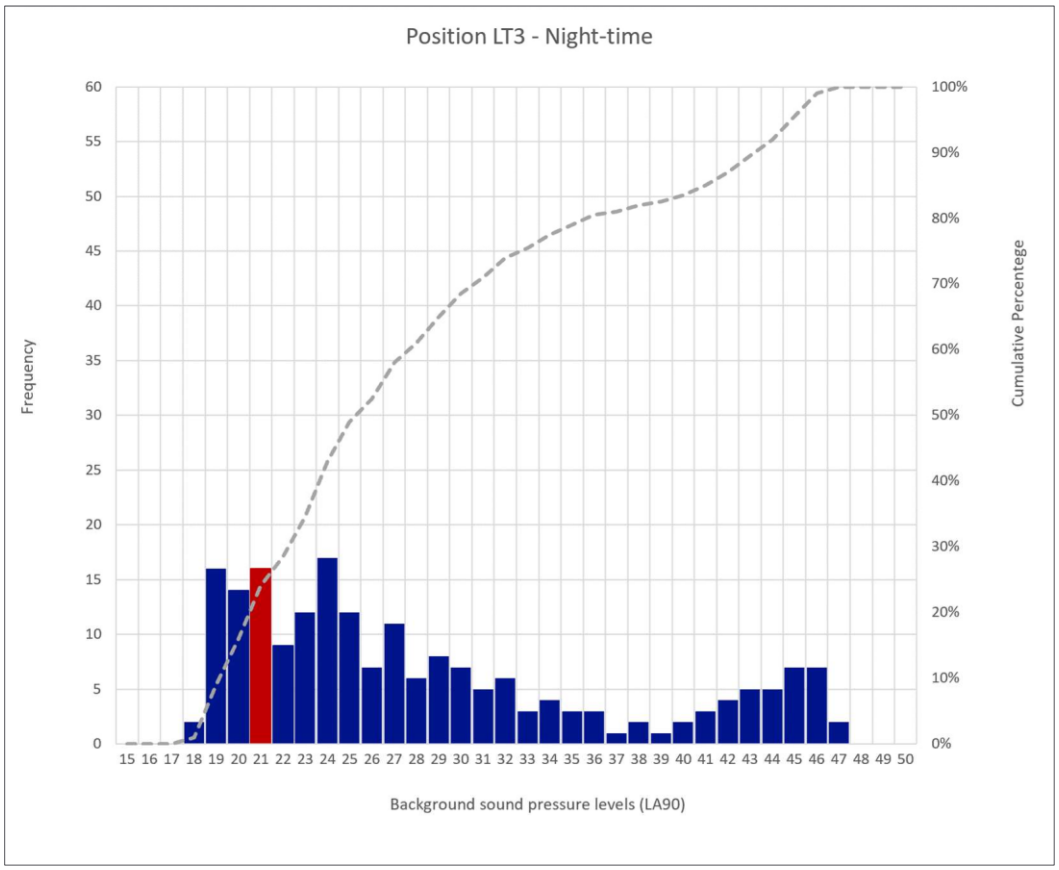


Figure 13: LT3 night-time background sound level histogram

3.6.3. During night-time periods, the background sound levels ($L_{A90,15min}$) are lower than the daytime background sound levels, and as the SGTs and SHRs operate 24/7, this makes the night-time period a more onerous assessment. Therefore, only the night-time assessment is presented in this NIA.

3.6.4. Based on analysis of the background levels presented in **Figures 7-13** above, the typical background noise levels are summarised in **Table 8** below:

Monitoring Position	**Night-time Background Sound Level, $L_{A90,15min}$ dB(A)**
LT1	25
LT2	22
LT3	21

Table 8: Summary of Background sound levels at LTM-1, LTM-2 & LTM-3.

3.6.5. In line with BS 4142, a typical background sound level should be selected and should not automatically be assumed to be the minimum value. The typical background sound levels presented above have been carefully selected based on the statistical cumulative percentage analysis, which indicates that background sound levels will typically exceed the chosen representative sound levels approximately 70-75% of the time.

3.6.6. In light of the above it is considered that the selected background sound levels are conservative and will aid in providing a robust assessment.

4. Noise Impact Assessment

4.1. SGT and SHR Sound Power Levels

4.1.1. Sound power levels from the SGTs and SHRs of the proposed site have been derived from National Grids Technical Specification 2.03, Power Transformers and Reactors, TS 2.03, Issue 7, June 2021 (TS2.03).

4.1.2. This document specifies the maximum sound power level for transformers and reactors under specific operating conditions, in accordance with IEC 60076-10, Power transformers - Part 10: Determination of sound levels.

4.1.3. It is considered that the sound power levels outlined in TS2.03 present a worst-case scenario for the SGTs and SHRs as they are set at a higher excitation voltage and higher loading than would occur during typical conditions. It is anticipated that noise from the proposed SGTs and SHRs would typically be lower than outlined in the Technical Specification, however these have been used within this assessment to provide a robust and 'worst case' assessment.

4.1.4. In light of the above, the sound power level for each proposed SGT and SHR are presented in **Table 9** below:

Asset	Voltage Ratio (kV)	MVA / MVAr	TS2.03 Maximum Sound Power Level (dBA)
SGT1 SGT6 SGT7 SGT8	400/132	240	92
SGT2 STG3 SGT4 SGT5		460	95
SHR1 SHR2	400	200	91

Table 9: TS2.03 Maximum Sound Powers for Proposed SGTs and SHRs

4.1.5. Once an SGT or SHR has been manufactured it undergoes Factory Acceptance Testing (FAT) to demonstrate conformance with National Grid's Technical Specifications. Once energised, the SGTs and SHRs will be in continuous operation 24/7.

4.2. Noise Model Parameters

4.2.1. The specific sound level at the NSRs have been calculated using a 3D sound model using acoustic modelling software Datakustik CadnaA. This software's calculation method is based on ISO 9613-2:2024 and considers the distance between source and receiver including reflection or screening effects from buildings. Details of the noise model parameters are presented in **Table 10**.

Parameter	Detail
Software Version	Datakustic CadnaA, Version 2025 (64Bit) build 209.5501
Calculation Methodology	ISO 9613-2 (2024) Reflection Order of 3 used
Mapping	OpenStreetMap and proposed layout drawing reference: PDD-101256-LAY-082)
Topography	Height point taken form LIDAR composite digital terrain model, available at: https://datamap.gov.wales/maps/new#/
Ground Absorption	Partially absorptive (G = 0.7)
Building Heights	Assumed 5 m for single storey buildings, 8 m for two storey buildings
Noise Contours	The model has been set to a 1 m x 1 m spacing. Grid height of 4 m used for first floor, night-time assessments
Noise Levels	The model produces "free-field" data

Table 10: Noise model parameter details

4.2.2. The 3D sound model includes the following noise sources, as shown in **Table1**.

Name	Description	Type of Source	A-Weighted Sound Power Level L_w of Main Tank dB(A)
SGT1,6,7,8 Tank	Omnidirectional source located at the proposed SGT location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	92
SGT 2,3,4,5 Tank	Omnidirectional source located at the proposed SGT location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	95
SHR1 & 2	Omnidirectional source located at the proposed SHR location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	91

Table 11: Description of sound sources used in unmitigated noise model

4.2.3. In the United Kingdom, the electrical mains frequency is 50 Hz, resulting in a fundamental frequency of 100 Hz, with higher order harmonics occurring at 200 Hz, 300 Hz, 400 Hz, and so on.

4.2.4. The 3D computational noise model assumes that each point source emits 100% of its acoustic energy at 100 Hz, which aligns with the primary audible frequency produced by transformers and reactors operating at the UK's electrical mains frequency.

4.2.5. Modelling all acoustic energy at 100 Hz is a conservative assessment, as a proportion of energy will, in reality, be emitted at higher harmonics (e.g., 200 Hz, 300 Hz), which are attenuated to a greater extent with distance from the source. Calculations using higher order harmonics, such as 200 Hz, yielded lower values, indicating that the 100 Hz values provide a suitable conservative estimate.

4.3. Unmitigated SGT and SHR Assessment

4.3.1. A specific sound contour plot showing the propagation of sound from the proposed transformers at the proposed site and NSRs is presented in **Figure 74**, below.

Figure 74: Proposed unmitigated specific sound, L_s, propagation

4.3.2. Predicted specific sound levels at each NSR location are presented in **Table 12**, below.

NSR Reference	Predicted specific sound level, dB(A)
NSR1	**31**
NSR2	**30**
NSR3	**30**
NSR4	**29**
NSR5	**29**
NSR6	**31**
NSR7	**36**
NSR8	**32**
NSR9	**32**
NSR10	**37**

Table 32: Predicted unmitigated specific sound levels at NSRs

4.3.3. The rating level is calculated from the specific sound level and the addition of character corrections, applied using the subjective method outlined in BS 4142, presented in **Table 13** below.

Acoustically Distinguishing Characteristic	Correction	Description / Justification
Tonality	**+6** (highly perceptible) at all NSRs	Transformer/reactor noise is perceived as a highly tonal 'hum', comprising precise acoustic harmonics of the UK electricity supply frequency. It is therefore deemed necessary to apply a character correction for tonality. Based on the specific noise levels outlined in Table 12, it is likely that noise generated by the SGTs and SHRs will be audible at all NSRs. Since the specific noise does not align with the character of the area, a +6dB correction is applied.
Impulsivity	**0**	The nature of the operation of transformers does not present any impulsivity characteristics as these operate constantly with similar load with no peaks in their operation that could create impulsive sounds. Therefore, no impulsivity corrections have been applied.
Intermittency	**0**	The nature of the operation of transformers does not present any intermittency characteristics as these operate constantly on a 24/7 basis. No intermittency correction has been applied.

Table 43: BS 4142 character corrections

4.3.4. Based on the character corrections and background level presented above and the predicted sound levels at the different NSRs, **Table 54** presents the rating level initial assessment for the proposed development.

Receiver	Specific Sound Level dB(A)	Background Sound Level dB(A)	Character Corrections			Rating Level dB(A)	Excess Rating Level Over Background dB(A)
			Tonality	Intermittency	Impulsivity		
NSR1	**31**	25	6	0	0	37	**+12**
NSR2	**30**	25	6	0	0	36	**+11**
NSR3	**30**	25	6	0	0	36	**+11**
NSR4	**29**	25	6	0	0	35	**+10**
NSR5	**29**	25	6	0	0	35	**+10**
NSR6	**31**	25	6	0	0	37	**+12**
NSR7	**36**	22	6	0	0	42	**+20**
NSR8	**32**	22	6	0	0	38	**+16**
NSR9	**32**	21	6	0	0	38	**+17**
NSR10	**37**	21	6	0	0	43	**+22**

Table 54: BS 4142 initial assessment – SGT and SHR Operation

4.3.5. Based on the results presented above, there is potential to create a significant adverse impact at all ten NSRs. It is therefore considered that acoustic mitigation on the SGTs and SHRs is needed and its consequential potential impact on the NSRs needs to be further assessed.

4.4. Mitigated SGTs and SHRs

4.4.1. Transformer noise can be mitigated through the use of acoustic enclosures. Their installation provides a 20 dB(A) insertion loss at 100 Hz, a standard that National Grid suppliers are contractually required to meet, with the possibility of achieving even greater performance at 200 Hz and higher harmonics.

4.4.2. In light of the above, an additional noise model has been created where the sound power levels of the SGTs and SHRs have been adjusted to reflect the 20dB(A) insertion loss provided by the enclosures. The respective sound power levels used within the mitigated noise model are presented in **Table 15** below.

Name	Description	Type of Source	A-Weighted Sound Power Level L_w dB(A)
SGT1,6,7,8 Tank	Omnidirectional source located at the proposed SGT location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	72
SGT 2,3,4,5 Tank	Omnidirectional source located at the proposed SGT location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	75
SHR1 & 2	Omnidirectional source located at the proposed SHR location. Main tank emitting at 200 Hz at 4 m above ground level.	Point source	71

Table 65: Description of sound sources used in mitigated noise model

4.4.3. A specific sound contour plot showing the propagation of sound from the proposed transformers inside the acoustic enclosures at the proposed site and identified NSRs is presented in **Figure 15**, below.

Figure 85: Proposed mitigated specific sound, L_s, propagation

4.4.4. Predicted specific sound levels for the model with enclosed SGTs and SHRs is presented in **Table 16**, below.

Description	Predicted specific sound level, dB(A)
NSR1	**11**
NSR2	**10**
NSR3	**10**
NSR4	**9**
NSR5	**9**
NSR6	**11**
NSR7	**16**
NSR8	**12**
NSR9	**12**
NSR10	**17**

Table 76: Predicted sound levels at the identified NSRs – Enclosed SGT Tanks and SHRs

4.4.5. For the determination of the rating level, acoustic corrections using the subjective method and based on the predicted sound level from BS 4142 have been applied and are presented in **Table 17** below.

Acoustically Distinguishing Characteristic	Correction	Justification
Tonality	**+2**	The calculated specific sound levels at NSRs are low, and therefore tonality is less likely to be perceptible. However, to ensure for a robust assessment, a +2dB character correction is applied.
Impulsivity	**0**	The nature of the operation of transformers does not present any impulsivity characteristics as these operate constantly with similar load with no peaks in their operation that could create impulsive sounds. Therefore, no impulsivity corrections have been applied.
Intermittency	**0**	The nature of the operation of transformers does not present any intermittency characteristics as these operate constantly on a 24/7 basis. No intermittency correction has been applied.

Table 87: BS 4142 character corrections for NIA.

4.4.6. Based on the character corrections and background level presented above and the predicted sound levels at the different NSRs, **Table 18** presents the BS 4142 assessment for mitigated SGTs and SHRs.

Receiver	Specific Sound Level dB(A)	Background Sound Level dB(A)	Character Corrections			Rating Level dB(A)	Excess Rating Level Over Background dB(A)
			Tonality	Intermittency	Impulsivity		
NSR1	**11**	25	2	0	0	**13**	**-12**
NSR2	**10**	25	2	0	0	**12**	**-13**
NSR3	**10**	25	2	0	0	**12**	**-13**
NSR4	**9**	25	2	0	0	**11**	**-14**
NSR5	**9**	25	2	0	0	**11**	**-14**
NSR6	**11**	25	2	0	0	**13**	**-12**
NSR7	**16**	22	2	0	0	**18**	**-4**
NSR8	**12**	22	2	0	0	**14**	**-8**
NSR9	**12**	21	2	0	0	**14**	**-7**
NSR10	**17**	21	2	0	0	**19**	**-2**

Table 98: BS 4142 initial assessment – Mitigated SGTs and SHRs Operation

4.4.7. Based on the results presented above, impacts are anticipated to be low to all NSRs. Therefore, acoustic mitigation on the SGTs and SHRs is considered suitable to mitigate potential noise impacts from the proposed substation.

4.5. Context

4.5.1. Assessments indicate that acoustic mitigation is recommended in the form of acoustic enclosures for the SGTs and SHRs to reduce possible adverse impacts to NSRs.

4.5.2. The predicted specific levels at NSRs range from -14 to -2 dB below representative background noise levels. As specific levels are lower than the background sound level, it is unlikely that tonal noise would be audible. A character correction of +2 (just perceptible) has however been applied to ensure for a robust, worst case, assessment.

4.5.3. The following contextual maters are also considered noteworthy:

- The specific sound level used in this assessment for the SGTs is based on 102.5% voltage and 50% load and the maximum sound power level of SHRs. Typically, the transformers and shunt reactors will operate at a lower voltage and load and, subsequently, with a lower sound power level.
- Moderately conservative background sound levels have been used in the assessment. This is considered robust, as background sound levels throughout the survey regularly exceed the chosen representative background sound level.
- The absolute predicted noise levels are low and would not, in their own right, be expected to have a material adverse impact to NSRs.
- significant noise sources will be mitigated by best practicable means through the use of noise enclosures.
- Operational noise from the proposed development will be controlled below background noise levels at all NSRs. It is therefore considered unlikely that operational noise from the proposed development will change the existing soundscape of the area.

4.6. Uncertainty

4.6.1. The background sound levels derived from the acoustic survey for the assessment are considered to be suitably representative for surrounding NSRs. The weather conditions were continuously monitored during the unattended measurement using a weather station

and those periods with wind speeds higher than 5 m/s, and/or rainfall as discussed in BS 4142 were discarded from the dataset for the assessment.

4.6.2. Specific noise levels have been calculated using a 3D sound model and rated noise levels have considered character corrections.

4.6.3. Based on the aforementioned, it is considered that the uncertainty of the measurements, the determination of the background levels, and calculations for this NIA have minimal influence on the outcome of the assessment.

5. Conclusions

5.1.1. The National Grid Electricity Transmission Environmental Engineering Team have undertaken a Noise Impact Assessment for operational noise to accompany a full planning application for the proposed development of the new Llandyfaelog 400kV substation, centred E:341868 N:213542, circa 6 km south of Carmarthen. The main noise sources of the proposed development are eight SGTs and two SHRs. Additional substation elements, such as circuit breakers, disconnectors or switches have been scoped-out of this assessment due to their relatively low noise level.

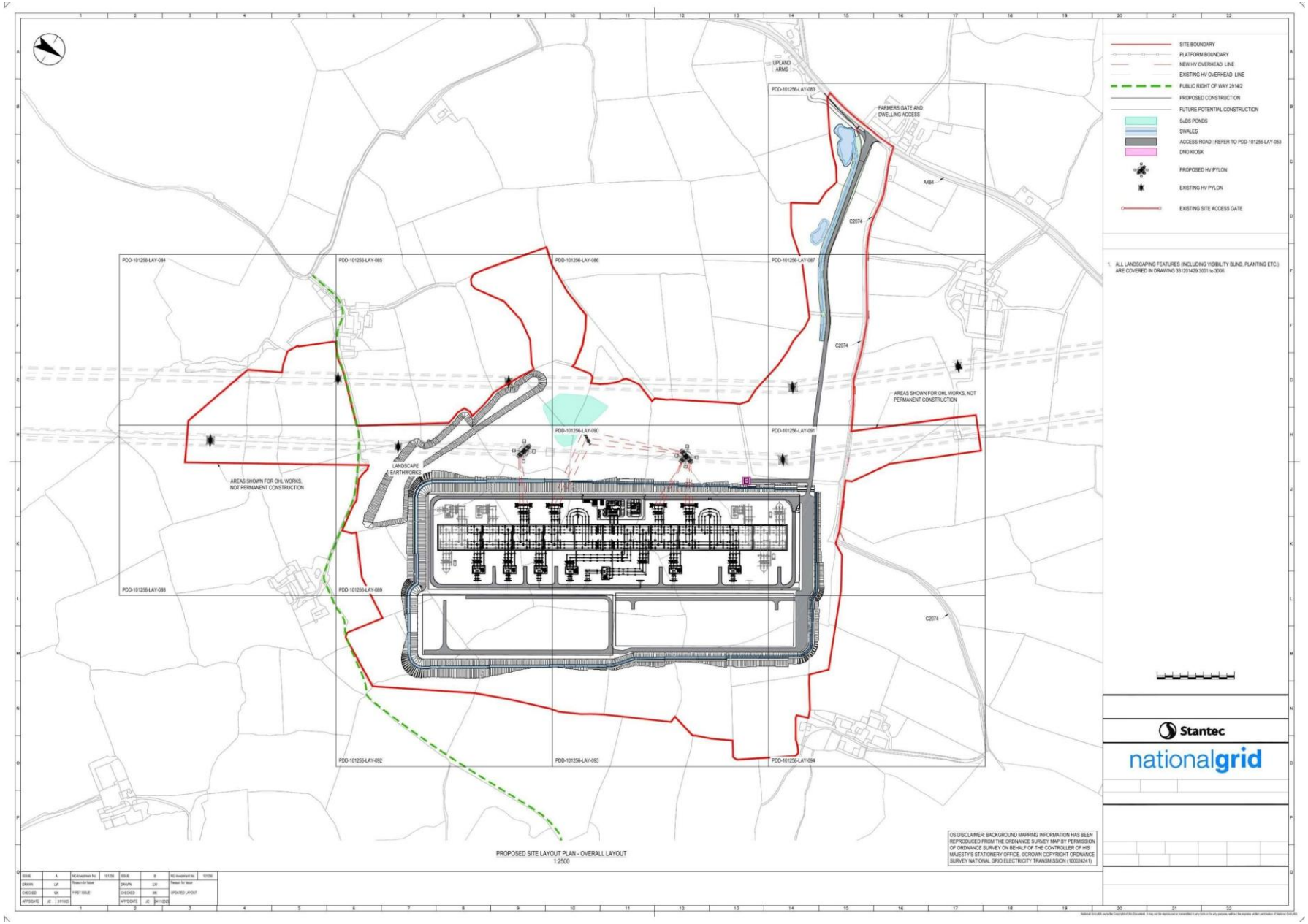
5.1.2. An unattended noise survey was undertaken at three locations considered representative of the closest NSRs, between 23rd April to 1st May 2024.

5.1.3. Two 3D noise models, with and without acoustic mitigation, have been created to predict the potential noise levels from the operation of the proposed development to NSRs. The assessment is considered in general accordance with BS 4142, to evaluate the potential impact.

5.1.4. Without mitigation, significant adverse impacts are predicted at NSRs. With mitigation, consisting of enclosing the SGTs and SHRs, low impacts are predicted for all NSRs, as all rating levels are below the representative background level. **It is therefore recommended that the SGTs and SHRs are enclosed within acoustic enclosures.**

5.1.5. Given the context in which the negative rating level over background sound level calculated from the BS 4142 assessment at all NSRs is predicted, **it is considered that an adverse impact from the site is not likely for any of the identified NSRs and that the proposed development will comply with all relevant planning objectives.**

Appendix A – Drawings


SITE BOUNDARY
PLATFORM BOUNDARY
NEW HV OVERHEAD LINE
EXISTING HV OVERHEAD LINE
PUBLIC RIGHT OF WAY 29/4/2
PROPOSED CONSTRUCTION
FUTURE POTENTIAL CONSTRUCTION
SuDS PONDS
SWALES
ACCESS ROAD : REFER TO PDD-101256-LAY-053
DNO KIOSK
PROPOSED HV PYLON
EXISTING HV PYLON
EXISTING SITE ACCESS GATE
1. ALL LANDSCAPING FEATURES (INCLUDING VISIBILITY BUND, PLANTING ETC.) ARE COVERED IN DRAWING 331201429 3001 to 3006.
UPLAND ARMS
FARMERS GATE AND DWELLING ACCESS
A484
C2074
AREAS SHOWN FOR OHL WORKS, NOT PERMANENT CONSTRUCTION
LANDSCAPE EARTHWORKS
AREAS SHOWN FOR OHL WORKS, NOT PERMANENT CONSTRUCTION
PDD-101256-LAY-083
PDD-101256-LAY-084
PDD-101256-LAY-085
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nationalgrid
PROPOSED SITE LAYOUT PLAN - OVERALL LAYOUT
1:2500
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