MWP

Noise Impact Assessment

Mill Farm Solar 110kV Substation

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1. Introduction

Mill Farm Solar Project Ltd. (the "applicant") is applying to An Bord Pleanála (ABP) for planning permission for the development of 1 No. 110kV onsite Eirgrid substation with associated electrical plant, 2 No. Over Head Line (OHL) End Mast structures, electrical equipment, security palisade fencing, an IPP building and a transformer (the "proposed development"), associated with an approved Solar PV Development (the "permitted development") at Ricetown Co. Meath (the "proposed development site").

MWP have been commissioned to carry out a Noise Impact Assessment of the proposed development.

This report describes the likely noise impact of the construction and operation of the proposed development.

1.1 Description of Proposed Development

It is proposed to construct a 110kV loop-in substation and associated works in the townland of Ricetown, County Meath to connect the permitted Mill Farm Solar Project to the National Grid. See **Figure 1** for the proposed site layout.

The proposed development site comprises agricultural land on a site of approximately 3.6 Ha within the townland of Ricetown, approximately 12 km north of Navan, Co. Meath.

The proposed development will comprise:

- A 110 kilovolt (kV) Air Insulated Switchgear (AIS) loop-in substation with associated compound, including control and operational buildings, electrical plant, equipment, cabling, lighting, CCTV, lightening masts, drainage infrastructure, security palisade fencing, and all associated and ancillary works necessary to facilitate the development.
- Erection of 2 no. OHL end masts (c. 20m high) and 2 no. lattice gantries (c. 16m high) and associated overhead cabling to enable a loop-in/loop-out grid connection to National grid via the existing Meath Hill-Gorman 110kV overhead powerlines located above the site.

The works will include site drainage and permanent signage associated with the new construction. The road layout for the proposed project makes use of the existing onsite access road and tracks, associated with the adjacent permitted solar farm development, where possible. The proposed development is compatible and does not in any way impede or alter the permitted Mill Farm Solar Farm.

The Solar PV development was approved by Meath County Council (MCC) under reference number 22/1044 on 14th February 2023. The approved development consists of:

'Permission for a period of 10 years to construct and complete a Solar PV development with a total site area of circa 97.05 hectares, to include solar panels mounted on steel support structures, associated cabling and ducting, 12 No. Transformers, 1 No. Temporary Construction Compound, 1 No. Storage Container, maintenance tracks, perimeter fencing and gates, 61 No. CCTV, 4 No. Weather Stations, 3 No. Bunds associated landscaping and ancillary works, with an operational life of 40 years.'

The Solar Development will have the energy capacity to power approximately 20,000 homes. The proposed 110kV substation, which is the subject of this report, will be connected to the National Grid by looping into 110kV overhead powerlines above the site.

1.1.1 Proposed 110kV Substation Compound

The overall substation compound will have an area of c.11,572m^2 divided into two adjoining sections: an EirGrid section (c. 9,262m^2 in area) and an IPP (Independent Power Producer) section (c.2,310 m^2 in area), each of which are enclosed within a 2.6m high palisade fence. An additional outer concrete post and rail fence (1.4m in height) will be installed around the perimeter of the EirGrid compound.

Each section will contain a control building and an outdoor electrical yard including electrical equipment such as electrical pylons, over and underground ducting & cables, busbars, disconnects, breakers, sealing ends, lightning and lighting masts. The IPP section will also contain 1 No. bunded transformer with a back up emergency diesel generator and associated diesel storage tank also located within the bund. Both buildings will be a block built single story building approximately 6.5m in height, with pitched roof and an external blockwork and plastered finish.

The overall substation compound will consist of a 50mm compound stone finish. The max height of the substation is 8.55m. 10 No. Lightning masts of 18m high will be erected within the compound.

1.1.2 Overhead loop-in Grid Connection

The electrical connection required from the proposed substation development will be facilitated by Overhead 110kV Loop-in Interface Masts. The erection of 2 No. Over Head Line (OHL) End Mast structures (c. 20m high) are required under the existing Meath Hill-Gorman 110kV OHL. There is also a requirement for the installation of 2 No. lattice gantries (c. 16m high).

The existing OHL will be terminated and 2 new towers will be erected to create 2 new OHL circuits. The new interface mast structure locations are to be selected based on ground surveys, ground profiles, allowable angles and ruling span checks. A foundation is excavated for each tower location and the placement of excavation material is temporarily stored in designated deposition areas. Any excess excavation material will be utilised as berms, deposited at the permanent deposition area and for landscaping purposes on the adjacent permitted solar farm. Reinforcing bars are placed into each excavation and the body of each tower assembled adjacent to the excavation. Concrete is poured directly into each excavation and allowed to cure until a preformed metal panel is set in place. The foundations are then backfilled individually. At this stage, the existing OHL is de-energized and construction of the 2 towers take place. An earth mat is laid and is a requirement for the electrical connection of the tower. A hardstand area is made available for the use of a crane to guide and position each section of the towers together. Once all sections of the towers are bolted securely the conductor can be centred and installed. All other associated equipment such as down dropper conductors and shackles are positioned before the electrical circuit can be tested in both directions to confirm OHL is re-energised.

1.1.3 Drainage

Foul sewage from the temporary facilities will be routed to covered precast concrete watertight 5m^3 tanks designed for receiving and storing sewage with no outlet. The tanks will be sized to suit the expected use and will be installed in a location remote from water courses. Contents and residues will be regularly emptied by a competent operator for safe disposal to an approved treatment works.

Surface water runoff from the roofs of the substation buildings, and hard-surfaced areas within the electrical yard, including areas where a risk of a contaminant leak or spill may be present (such as the transformer bund), will be collected in a series of filter drains, roof guttering and downpipes and routed to an underground gravity drainage network. All runoff collected in the stormwater sewer network will pass through an oil/petrol Interceptor prior to discharging to an attenuation unit on the north-eastern side of the compound. The attenuation unit will provide

attenuation of the increased volumes of surface water runoff generated from the hard surfaces of the development when compared to the current greenfield condition. The attenuated surface water runoff is then proposed to overflow at a controlled rate equal to the greenfield runoff rate to an existing vegetated land drain on the southern side of the compound.

1.1.4 Construction Compound

A suitably surfaced contractor's temporary construction compound and laydown area will be provided for the duration of the site works on the permitted adjacent Solar Farm. The construction compound will consist of temporary site offices, equipment storage and construction staff welfare facilities, as well as car parking areas for staff and visitors. A potable water supply will be provided by a water tanker.

1.1.5 Construction Overview

The project involves the following works:

- Pre-commencement activities including site investigation work and pre-construction surveys.
- Site preparation and installation of drainage systems.
- Bulk earthworks for formation of substation compound base.
- Substation compound base and equipment foundations.
- Cable trenching and cable laying.
- Construction of control building and installation of equipment within compound.
- Complete site works: security fencing, gates, signage, lighting.
- Demobilise offices and tidy up site.

1.1.6 Construction Duration

The construction of the proposed substation is estimated to be completed over a period of 14-18 months in combination with the other permitted elements of the Solar Farm granted under Meath County Council Planning Reference 221044.

Construction working hours will be:

7:00am – 7:00pm (Monday – Friday inclusive)

8:00am – 2:00pm (Saturday)

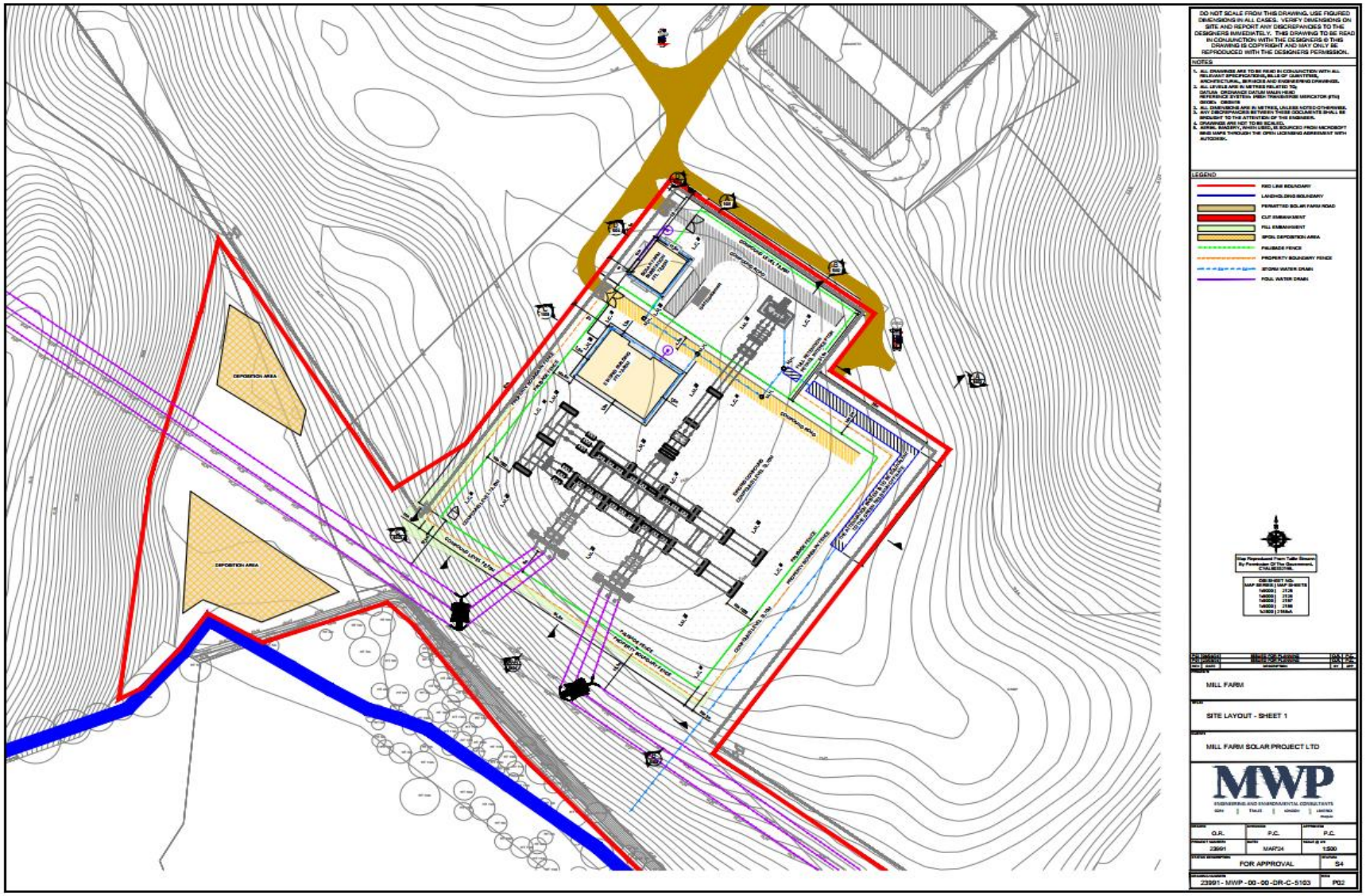

Figure 1 Proposed Site Layout

1.2 Substations and Noise Emissions

The main noise source from a substation is from the transformer(s). The noise is generally recognisable as a steady hum which arises from electric and magnetic forces within the transformer. Infrequent noise may also arise from voltage changes (tap changer) and cooling fans under high loads.

Other noise sources from electrical infrastructure include Aeolian noise (wind through power lines), Corona noise (hiss or crackling from high voltage power lines) and potentially noise from faulty equipment, although these are not considered significant (EirGrid, 2016).

Construction noise will occur during excavation and earth moving, laying of roads and hard standings, and transportation of materials. The construction phase will be phased and temporary.

Noise assessments were undertaken for the operational and construction phases of the proposed development. Consideration was also given to potential cumulative impacts with the permitted Solar PV development.

1.3 Fundamentals of Environmental Noise

Fundamentally, noise is vibrations of the air which are detectable by the ear. Sound waves radiate out spherically from a sound source in three dimensions. The human ear can detect a very wide range of pressure variations. In order to cope with this wide range, a logarithmic scale (decibel (dB) scale) is used to translate pressure values into manageable numbers from 0 dB to 140 dB. 0 dB is the threshold of hearing, and 120 dB is the threshold of pain.

Measuring in decibels means that a 3 dB increase is equivalent to a doubling of the sound energy and a 10 dB increase in a tenfold increase in energy. For broadband sounds which are very similar in all but magnitude, a change or difference in noise level of 1 dB is just perceptible under laboratory conditions, 3 dB is perceptible under most normal conditions and a 10 dB increase generally appears twice as loud. A healthy human ear is also sensitive to a large range of frequencies (approximately 20 Hz to 20,000 Hz) and varies in sensitivity depending on the frequency.

The human ear is not equally sensitive to sound at all frequencies and is less sensitive to sound at low frequencies and high frequencies. A -weighting (dB A) is the main way of adjusting measured sound pressure levels (noise) to take account of the uneven human response to frequencies. Figure 2 illustrates some everyday sounds on the dB(A) scale. A quiet bedroom is around 35 dB(A), a busy office around 60dB(A) and a rock concert around 100 dB(A).

Figure 2 The Level of Typical Common Sounds on the dB(A) Scale

2. Methodology

2.1 Guidelines and Best Practice

The assessment has been prepared with cognisance to the following best practice and guidance documents related to noise and vibration impact assessment:

- *British Standard (BS) 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound.*
- *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.*
- *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2 – Vibration.*
- *BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration.*
- *Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (EPA, 2016).*
- *Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment, (IEMA, 2023).*
- *ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise.*

2.2 Scope of Assessment

The scope of the assessment has been defined by industry standard best practice and guidance used in Ireland. In general, this includes:

- Baseline noise monitoring has been undertaken in the vicinity of the proposed development in order to characterise the existing noise environment on 12th October 2023 and 13th October 2023;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed for the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the nearest sensitive locations. A schedule of mitigation measures has been proposed to reduce where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

2.3 Noise Survey

A baseline environmental noise survey was conducted in the vicinity of the proposed development in order to quantify the existing noise environment at the nearest noise sensitive receptors (NSRs) that may be affected by the proposed development.

Existing levels of vibration in the vicinity of the proposed development are not expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property, therefore, based on professional judgment, a vibration survey was considered not required. Vibration was not perceptible at any of the noise survey locations.

2.3.1 Noise Sensitive Receptors and Noise Monitoring Locations

The noise sensitive receptors (NSRs), NSR1 to NSR 14, shown in **Figure 3,** are the closest residential properties in the surrounding areas to the proposed development and were identified through review of the proposed development site layout design.

The baseline noise monitoring locations, illustrated in **Figure 3** can be considered appropriate locations to represent the ambient noise environment of the NSRs which may be impacted by the proposed development. **Table 1** shows which NSRs are represented by the each NML. NML1 is representative of the houses closer to the public road and more influenced by traffic noise, NSR2 to NSR5. NML2 was considered a better representative location for NSR1 and NSR14 as these locations are further from public road and therefore less influenced by traffic noise. NML3 represents the cluster of houses, NSR6 to NSR13.

Photos of each noise monitoring location (NML) are shown in **Appendix A.**

The selection of noise monitoring locations (NMLs) was supplemented by reviewing aerial images of the study area and other online sources of information (Google Earth), and were then verified on the ground.

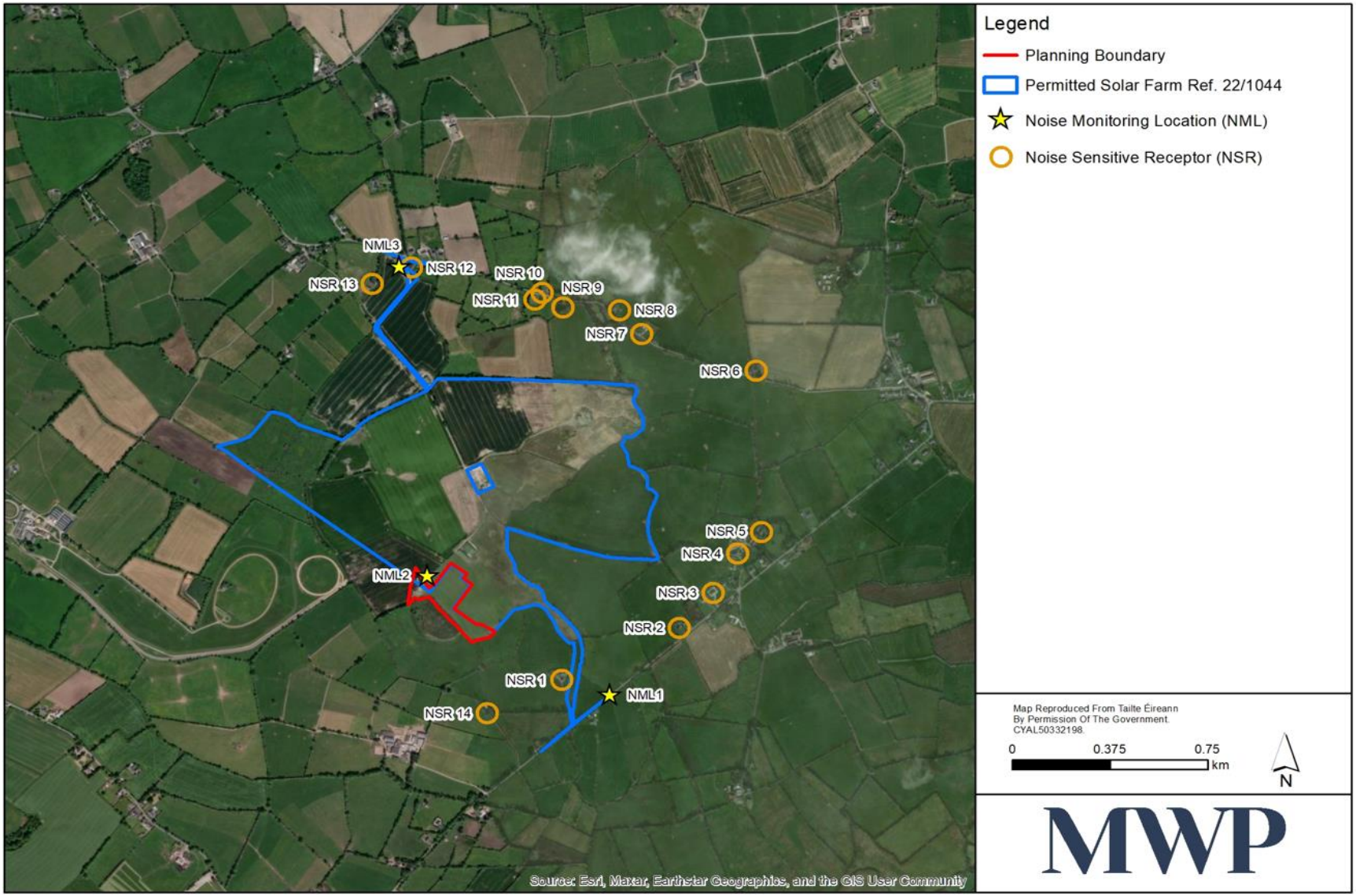

Figure 3 Noise Sensitive Receptors and Noise Monitoring Locations

Table 1 Noise Monitoring Locations and Noise Sensitive Receptors

NML	Representative NSR
NML1	NSR2, NSR3, NSR4, NSR5,
NML2	NSR14, NSR1
NML3	NSR6, NSR7, NSR8, NSR9, NSR10, NSR11, NSR12, NSR13

2.3.2 Survey Periods

MWP personnel (Kieran Barry) conducted the noise monitoring survey at noise monitoring locations NML1 to NML3, refer to **Figure 3**, on 12th October 2023 and 13th October 2023.

Kieran is an experienced environmental consultant with 8 years experience working on environmental projects, including three years experience in the measurement, prediction, assessment, and control of environmental noise He has completed the Institute of Acoustics (IOA) Certificate of Competence in Environmental Noise Measurement course and is currently undertaking the Institute of Acoustics' Diploma in Acoustics and Noise Control.

2.3.3 Instrumentation and Setup

The baseline noise survey was carried out in accordance with best practice and guidelines relevant to the measurement of environmental noise, in particular guidance set out in the Environmental Protection Agency's (EPA) Noise Guidance 4 document[1].

The sound level meter was located away from reflective surfaces, in open ground. The microphone was at a height of 1.5 m above the ground. The measurements were performed using the following equipment:

Table 2 Noise Equipment Details

Manufacturer	Equipment Model	Serial Number	Microphone	Calibration Date
Larson Davis	831	0003826	PCB377B02	10th May 2022

The microphone was protected using a proprietary Larson Davis windshield. Before and after the survey the measurement apparatus was check calibrated in the field using a Larson Davis CAL200 Sound Level Calibrator Serial Number 11262 that produces a sound level of 93.96 dB re. 2 x 10^{-5} PA, at a frequency of 1k Hz.

The calibration certificates are attached as **Appendix B**.

2.3.4 Procedure

Noise measurements were conducted at the three locations identified. Measurements were conducted on a cyclical basis with sample periods of 15 minutes for each location for daytime, evening and night-time periods.

[1] https://www.epa.ie/publications/monitoring--assessment/noise/NG4-Guidance-Note-(January-2016-Update).pdf

The survey results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted the primary sources contributing to noise build-up during the survey.

2.3.5 Weather

The weather conditions were generally sunny and mild with light winds less than 5 meters per second, ideal for environmental noise monitoring. Conditions during night time readings on 12th and 13th October 2023 were cool and mostly dry with light winds. Meteorological conditions therefore did not influence the baseline noise measurements.

2.3.6 Measurement Parameters

The data collected during the attended measurements, during the survey periods is summarized in Table 5 to Table 7. Periods are defined as follows:

- Daytime 07:00hrs to 19:00hrs
- Evening 19:00hrs to 23:00hrs
- Night 23:00hrs to 07:00hrs

The noise survey results are presented in terms of the following five parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. This parameter is representative of the specific noise from plant when plant is the dominant noise source, i.e. there is no extraneous noise from sources such as traffic.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

L_{Aeq} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The “A” suffix denotes the fact that the sound levels have been “A-weighted” in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2x10-5 Pa. A summary of the acoustic terminology used in this report is included in Appendix C.

2.4 Assessment Criteria

2.4.1 Construction – Noise Impacts

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the *British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded, indicates a significant noise impact is associated with the construction activities.

Table 3 sets out the values which, when exceeded, potentially signify a significant effect at the facades of residential receptors as recommended by BS 5228 – 1. These levels relate to construction noise only.

Table 3 Construction Phase Noise Assessment Criteria

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq}T$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evening and Weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 -13:00hrs)	65	70	75

Note A: *Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.*
Note B: *Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.*
Note C: *Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.*
Note D: *19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.*

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB. In this instance, with the rural nature of the proposed development site, all properties in the vicinity of the proposed development have existing ambient noise levels in the environment of less than 65dB L_{Aeq}. Therefore, if the predicted construction noise exceeds Category A threshold values, then this is assessed as a significant effect.

Traffic Noise

There are no specific guidelines or limits for existing local traffic sources along the local or surrounding road network. As traffic from the proposed development will make use of these existing roads, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. Access to the substation will be via existing roads and roads constructed as part of the permitted solar farm development.

2.4.2 Construction – Vibration Impacts

According to TII's 2014 *'Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes'*, there are two separate considerations for vibration during the construction phase namely 1) that which affects human comfort and 2) that which affects cosmetic or structural damage to buildings.

The guidelines suggest that human tolerance for daytime blasting and piling, two of the primary sources of construction vibration, limits vibration levels to a peak particle velocity (ppv) of 12mm/s and 2.5mm/s respectively.

To avoid the risk of even cosmetic damage to buildings, the guidelines suggest that vibration levels should be limited to 8mm/s at frequencies of less than 10Hz, to 12.5mm/s for frequencies of 10 to 50Hz, and to 20mm/s at frequencies of 50Hz and above.

2.4.3 Operational Phase – Noise Impacts

There are no specific noise criteria relating to the operation of substation and associated infrastructure. The setting of appropriate noise criteria is based on a review of the EPA's document '*Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) – 2016*'. Section 4.4.2 of the guidance notes sets out a screening process to set the appropriate noise criteria according to the location of the development and the measured baseline results. The guidance notes provide a flow chart on the Identification of Appropriate Noise Criteria, see Figure 4.

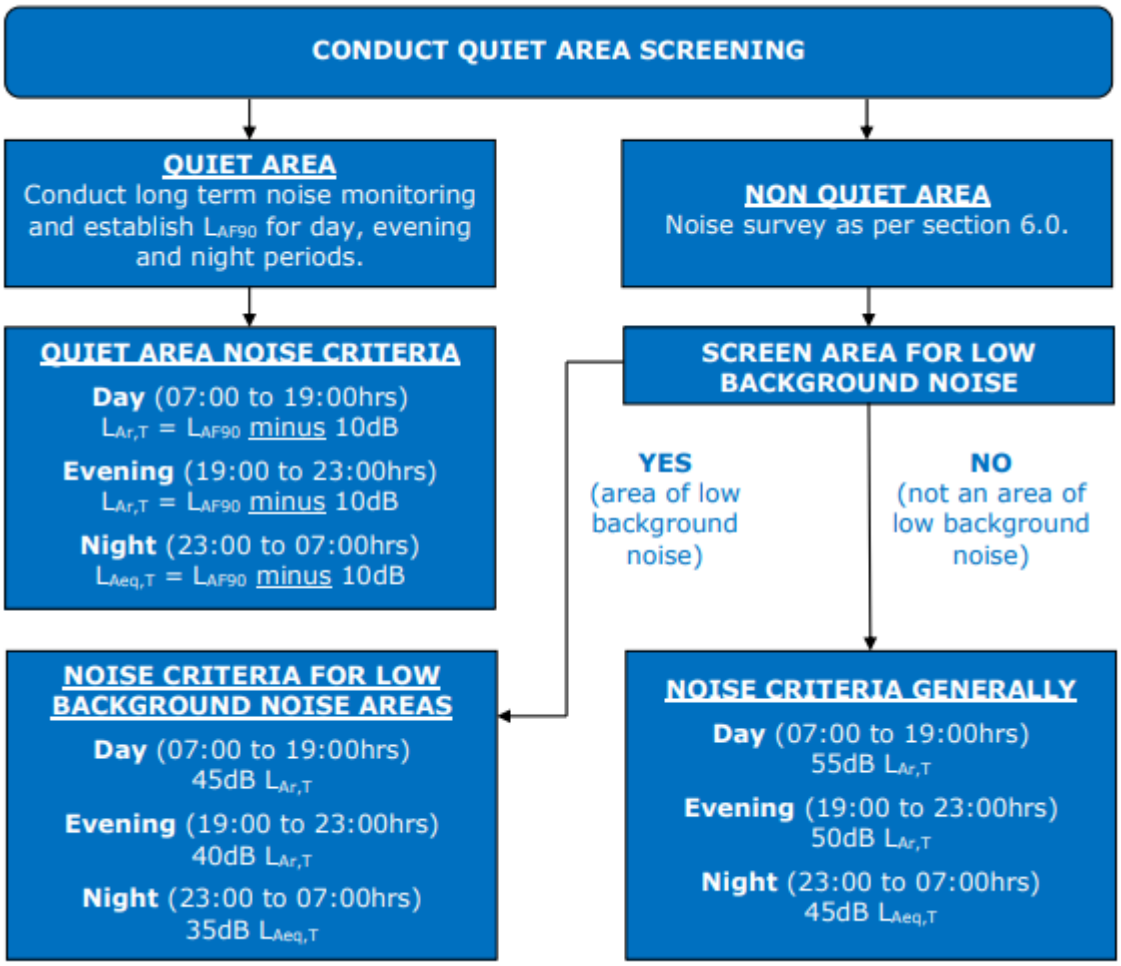

Figure 4 Flow Chart for the Identification of Appropriate Noise Criteria (Source: Guidance Note for Noise Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)

The noise levels measured during the baseline noise survey (refer to **Section 3.1**), determined that the 'Areas of Low Background Noise Category' criteria may be considered appropriate at the nearest NSR, refer to **Table 4**. Therefore, if the predicted operation noise exceeds the 'Areas of Low Background Noise Category' criteria (i.ie 45dB $L_{Aeq,T}$ Daytime, 40dB $L_{Aeq,T}$ Evening, 35dB $L_{Aeq,T}$ Night-time), then this is assessed as a potentially significant effect.

Table 4 Recommended Noise Limit Criteria (Source: Guidance Note for Licence Applications, surveys and Assessments in Relation to Scheduled Activities (NG4))

Assessment category and threshold value period (T)	Quiet Area	Areas of Low Background Noise	All other Areas
Night-time Noise Criterion, dB Lar,T (23:00 – 07:00hrs)	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey	35dB	45dB
Evening Noise Criterion, dB Lar,T (19:00 – 23:00hrs)	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey	40dB	50dB
Daytime Noise Criterion, dB Lar,T (07:00 – 19:00hrs)	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey	45dB	55dB

2.4.4 Operational Phase – Vibration Impacts

There are no significant sources of vibration during the operational phase of the proposed development and therefore no further assessment of vibration effects at this stage was carried out.

2.5 Statement of Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of assessment.

3. Baseline Environment

This section describes the existing environment in terms of the NMLs, existing noise sources at these locations and the prevailing noise levels.

3.1 Results of Noise Surveys

The data collected during the attended monitoring at NML1 to NML3 is summarised in **Table 5** to **Table 7**.

Table 5 Results for Noise Monitoring Location NML1

Period	Date	Start Time	Measured Noise Levels (dB re. 2x10-5 Pa)					Observations
			L_{Aeq}	L_{AFmax}	L_{Amin}	L_{A10}	L_{A90}	
Daytime	2023-10-12	13:02	44	62	35	46	40	Main sound was regular traffic passing. Intermittent sound of birds singing and trees rustling also contributed.
	2023-10-12	14:25	62	86	31	53	35	
	2023-10-12	15:58	64	88	27	55	30	
	Average		**57**	**79**	**31**	**51**	**35**	
Evening	2023-10-12	20:54	**54**	**79**	**24**	**38**	**25**	Main sound was intermittent traffic passing. Intermittent sound of birds singing and trees rustling also contributed.
Night	2023-10-12	23:00	38	65	19	30	20	Environment generally quiet except for occasional car passing.
	2023-10-12	23:15	38	66	19	29	20	
	Average		**38**	**65.5**	**19**	**29.5**	**20**	

Table 6 Results for Noise Monitoring Locations NML2

Period	Date	Start Time	Measured Noise Levels (dB re. 2x10-5 Pa)					Observations
			L_{Aeq}	L_{AFmax}	L_{Amin}	L_{A10}	L_{A90}	
Daytime	2023-10-12	13:29	37	64	25	38	31	Main source of noise was birdsong as well as occasional passing aircraft in sky. There was also a light sound of a tractor intermittently operating in far off field.
	2023-10-12	15:17	39	55	27	41	36	
	2023-10-12	16:28	36	59	27	38	30	
	Average		**37**	**59**	**26**	**39**	**32**	
Evening	2023-10-12	21:19	**34**	**62**	**22**	**34**	**24**	Main source of noise was birdsong. There was also the light sound of a tractor intermittently operating in far off field.
Night	2023-10-12	23:38	23	49	17	22	18	Noise environment was quiet.
	2023-10-12	23:54	24	47	17	24	18	
	Average		**24**	**48**	**17**	**23**	**18**	

Table 7 Results for Noise Monitoring Locations NML3

Period	Date	Start Time	Measured Noise Levels (dB re. 2x10-5 Pa)					Observations
			L_{Aeq}	L_{Afmax}	L_{Amin}	L_{A10}	L_{A90}	
Daytime	2023-10-12	13:49	**37**	**64**	**25**	**38**	**31**	Main sound was intermittent traffic passing. Intermittent sound of birds singing and trees rustling also contributed.
	2023-10-12	15:35	39	55	27	41	36	
	2023-10-12	17:21	36	59	27	38	30	
	Average		**37**	**59**	**26**	**39**	**32**	
Evening	2023-10-12	21:44	**44**	**71**	**19**	**36**	**22**	Main sound was intermittent traffic passing. Intermittent sound of birds singing and trees rustling also contributed.
Night	2023-10-13	00:22	26	58	18	27	21	Environment was quiet with no notable sounds.
	2023-10-13	00:39	27	56	18	26	19	
	Average		**27**	**57**	**18**	**27**	**20**	

3.2 Evaluation of Results

3.2.1 Daytime Noise Survey

The daytime measurements were carried out between the hours of 07.00 and 19.00 and ranged in value from 36 dB L_{Aeq} at NML2 and NML3 to 64 L_{Aeq} at NML1. The background noise characterized by the L_{A90} measurements ranged from 30dB L_{A90} at NML2 and NML3 to 40dB L_{A90} at NML1.

It was generally observed that the main source of anthropogenic noise was caused by occasional cars passing surrounding roads in the environment, especially at NML1 where cars passing was most prevalent. Other monitoring locations such as NML2 were not as influenced by occasional noise from cars passing.

Non-anthropogenic noise sources such as or birdsong were prevalent at various times during monitoring and had only a minor impact on the noise environment at the NMLs.

3.2.2 Evening Time Noise Survey

The evening time noise measurements were carried out between the hours of 19.00 and 23.00 and ranged in value from 34 dB L_{Aeq} at NML2 to 54L_{Aeq} at NML1. The background noise characterised by the L_{A90} measurements ranged from 22dB L_{A90} at NML3 to 25dB L_{A90} at NML1.

Again as was the case with the daytime measurements, rural passing traffic was the main anthropogenic source of noise and again was particularly prevalent at NML1 and to a lesser degree at NML2. Non-anthropogenic noise sources at the monitoring locations birds tweeting and these had only a minor impact on the noise environment at the NMLs.

3.2.3 Night Time Noise Survey

The night time noise measurements were carried out between the hours of 23.00 and 07.00 and ranged in value from 23dB L_{Aeq} at NML2 to 38dB L_{Aeq} at NML1. The background noise characterized by the L_{A90} measurements ranged from 18dB L_{A90} at NML2 to 21dB L_{A90} at NML3.

Rural traffic noise during the night time period was minimal except occasional cars passing at NML1. In general, the environment was quiet at all other monitoring locations during the night time survey.

4. Potential Impacts

4.1 Construction Phase

4.1.1 Construction Phase Works Noise

The main source of construction will emit from the substation construction works. This section presents the predicted noise levels associated with the construction of the substation. It is expected that the overall installation and construction phase for the proposed substation development will have a 18-24 month duration. Table 8 presents the predicted noise levels from a number of plant items required during the construction phase of the substation at the nearest residential NSRs, NSR1 and NSR14. NSR1 is located approximately 507m southeast from the substation while NSR14 is 446m to south of the substation.

The plant and machinery outlined in Table 8 are typical of plant commonly used in substation construction activities and can provide an accurate assessment of construction noise emissions.

The associated noise levels have been sourced from *BS 5228 Noise and Vibration from open and construction sites*, totalled, and extrapolated to the nearest noise sensitive receptor. The resultant noise level is then compared against the relevant noise threshold. The result is a theoretical worst case, as it assumes all machinery will be operating simultaneously which will not be the case and accounts for attenuation due to distance only. In reality there will be further noise attenuation due to atmospheric absorption, ground absorption, and landform screening. Therefore, the noise levels presented herein are an overestimate.

Using the following equation, noise emissions from the construction site are extrapolated to the nearest noise sensitive receptor.

$$SPL_2 = SPL_1 - 20\log(r2/r1)$$

Where:

- Sound Pressure Level 1 (SPL1) = Known noise level at 10m from construction site
- Sound Pressure Level 2 (SPL2) = Unknown noise level at nearest receptor
- r2 = Distance between noise sensitive receptor and construction site
- r1 = 10 m

The resultant theoretical worst-case noise emission level at the nearest residential receptors, is 53 dB L_{Aeq} for NSR14 and 52 dB L_{Aeq} for NSR1. This is below the construction noise thresholds of 65 dB L_{Aeq} for daytime hours. Working hours at the site during the construction phase will be limited to 08:00 to 19:00 Monday to Friday and 08:00 to 16:00 Saturday with no work on Sundays, therefore no construction noise is anticipated for evening and night-time hours.

Table 8 Plant and Machinery predicted noise emissions at residential receptors NSR1 and NSR14

Plant and Machinery	Sound Pressure Level @10m dB(A)	Predicted Sound Pressure Level @ NSR1 Leq dB(A)	Predicted Sound Pressure Level @ NSR14 Leq dB(A)
Telescopic Handler	71	52	53
Mobile Crane	70		
30-50T Excavator	79		
15-30T Excavator	78		
12T Roller	80		
Dump truck	78		
Tractor & Trailer	79		
15-20T Rubber Tired	68		
3-10T mini digger	69		
Diesel Generator	61		
Total	**86**		

4.1.2 Construction Phase Traffic Noise

Access to the Site is from an existing access point off the L1604. It is anticipated the haul route will likely be from the N52, which is located to the northwest of the site. Vehicles will exit the N52 onto the L1604 in a southwest direction from approximately 1km, before turning right into the site access point.

For further detail on the construction traffic and haul route for the proposed development please see the Construction Traffic Management Plan (CTMP) prepared by Neo Environmental Ltd. for the permitted development as the proposed development will be constructed simultaneously with the permitted solar farm.

During the construction works there will be deliveries of building materials to the substation site. It is proposed that excavated material will remain on-site. The volume of traffic generated by the transportation requirements will be minimal. Construction traffic will include:

- HGVs importing construction materials including concrete and piping.
- HGVs delivering plant and fuel.
- Traffic associated with on-site construction personal.

The relatively low volume of additional traffic on the public road will be temporary and intermittent over the construction phase and will not be discernible from existing daytime traffic volumes.

Considering that in order to increase traffic noise levels by 1 dB traffic volumes would need to increase by the order of 25%[2], it is considered that additional traffic introduced onto the local road network due to the construction phase associated with various phases of the development will not result in a significant noise impact.

[2] Calculation of Road Traffic Noise (CRTN) issued by the Department of Transport in 1988

4.2 Operational Phase

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the operational phase of the proposed facility.

The Environmental Protection Agency (EPA) Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (Environmental Protection Agency, 2016) provides noise guidance to operator's subject to IPPC or waste licences. While the proposed development does not fall under the remit of the EPA, the EPA's NG4 guidelines are considered the most appropriate noise assessment criteria as they follow best practice principles. Hence, the proposed development is appraised against the EPA's NG4 guidelines as set out in Table 3. As the baseline monitoring determined that the area be designated under the 'Areas of Low Background Noise Category' criteria, the limits 45dB Daytime, 40dB Evening, 35dB Night-time, will be used to assess whether there is a potentially significant effect.

4.2.1 Operational Phase Substation Noise

There are several ways in which noise can be generated from electricity infrastructure. Continuously radiated noise is the most noticeable to neighbours and this is associated primarily with transformers. This is acknowledged in the 2016 EirGrid research report (*EirGrid Evidence Based Environmental Studies Study 8: Noise. Literature review and evidence based filed study on the noise effects of high voltage transmission development*) on noise from electrical infrastructure which states:

there is strong evidence that the only relevant noise sources are the power transformers and associated cooling systems.

Transformers typically generate a low frequency humming noise, the extent of which depends on the transformer type and the level of noise attenuation at the substation. Generally, modern transformers are manufactured with a specified and guaranteed emission level. Improvements in the manufacture of transformers have reduced the associated level of noise emissions and hence modern transformers are typically quieter than equivalent capacity older transformers.

An Air Insulated Switchgear (AIS) substation, such as the one proposed, is where the electrical equipment infrastructure is primarily installed outdoors, with the use of natural air as an insultation between circuits.

The proposed development is a 110kV kV Air Insulated Switchgear (AIS) substation. The components of which consist of a compound containing outdoor Air Insulated Switchgear (AIS) equipment comprising busbars, line bays, grid transformers and associated bays, house transformers and control building.

The sound power levels for a typical 110 kV substation is in the order of 93dB (A). For the purpose of this assessment, 93dB (A) is used as the sound power level output for the 110 kV substation in the noise model, refer to Figure 5.

4.2.1.1 Operational Noise Prediction Methodology

The noise predictions were undertaken using noise prediction software, specifically Bruel & Kjaer's software (iNoise 2023 V1.1). The software calculations are based on ISO 9613, Attenuation of sound during propagation outdoors, Part 2, General Method of Calculation. The ISO 9613-2 model can take account of the following factors that influence sound propagation outdoors:

- Geometric divergence
- Air Absorption
- Reflecting obstacles
- Screening
- Vegetation; and
- Ground reflections

The following inputs were used to inform the noise prediction software.

Table 9 Noise Model Input Data

Item	Description
Noise Source Locations	Planning Drawings
House Locations	Aerial Imagery
Acoustic Emission	Estimate
Source Height	2m
Landform	10m Contours
Ground Factor	0.8 Note 1
Receptor Height	1.5m at bungalows 4m two storey residential receptor
Wind Direction	Downwind
Relative Humidity	70%
Temperature	10°C

Note 1: Ground Factor is a value between 0 and 1, where 0 represents hard/ reflective surfaces and 1, represents soft absorbent surfaces.

4.2.1.2 Operational Noise Prediction Results

The noise model, shown in **Figure 5**, shows the predicted noise levels from the 110 kV substation in operation, at the noise sensitive receptors (NSRs). **Table 10** shows the predicted noise levels at the NSRs from the 110 kV substation in relation to the operational noise targets.

Table 10 Operational Noise Levels and Operational Noise Targets

NSL	Location	Predicted Noise Levels dB (A) Day/Evening/Night	Daytime Operational Noise Target, L_{Aeq} dB (A)	Evening Operational Noise Target, L_{Aeq} dB (A)	Night-time Operational Noise Target, L_{Aeq} dB (A)
NSR1	Refer **Figure 5**	28	45	40	35
NSR2	Refer **Figure 5**	25	45	40	35
NSR3	Refer **Figure 5**	24	45	40	35
NSR4	Refer **Figure 5**	23	45	40	35
NSR5	Refer **Figure 5**	22	45	40	35
NSR6	Refer **Figure 5**	21	45	40	35
NSR7	Refer **Figure 5**	23	45	40	35
NSR8	Refer **Figure 5**	22	45	40	35
NSR9	Refer **Figure 5**	23	45	40	35
NSR10	Refer **Figure 5**	22	45	40	35
NSR11	Refer **Figure 5**	23	45	40	35
NSR12	Refer **Figure 5**	21	45	40	35
NSR13	Refer **Figure 5**	21	45	40	35
NSR14	Refer **Figure 5**	28	45	40	35

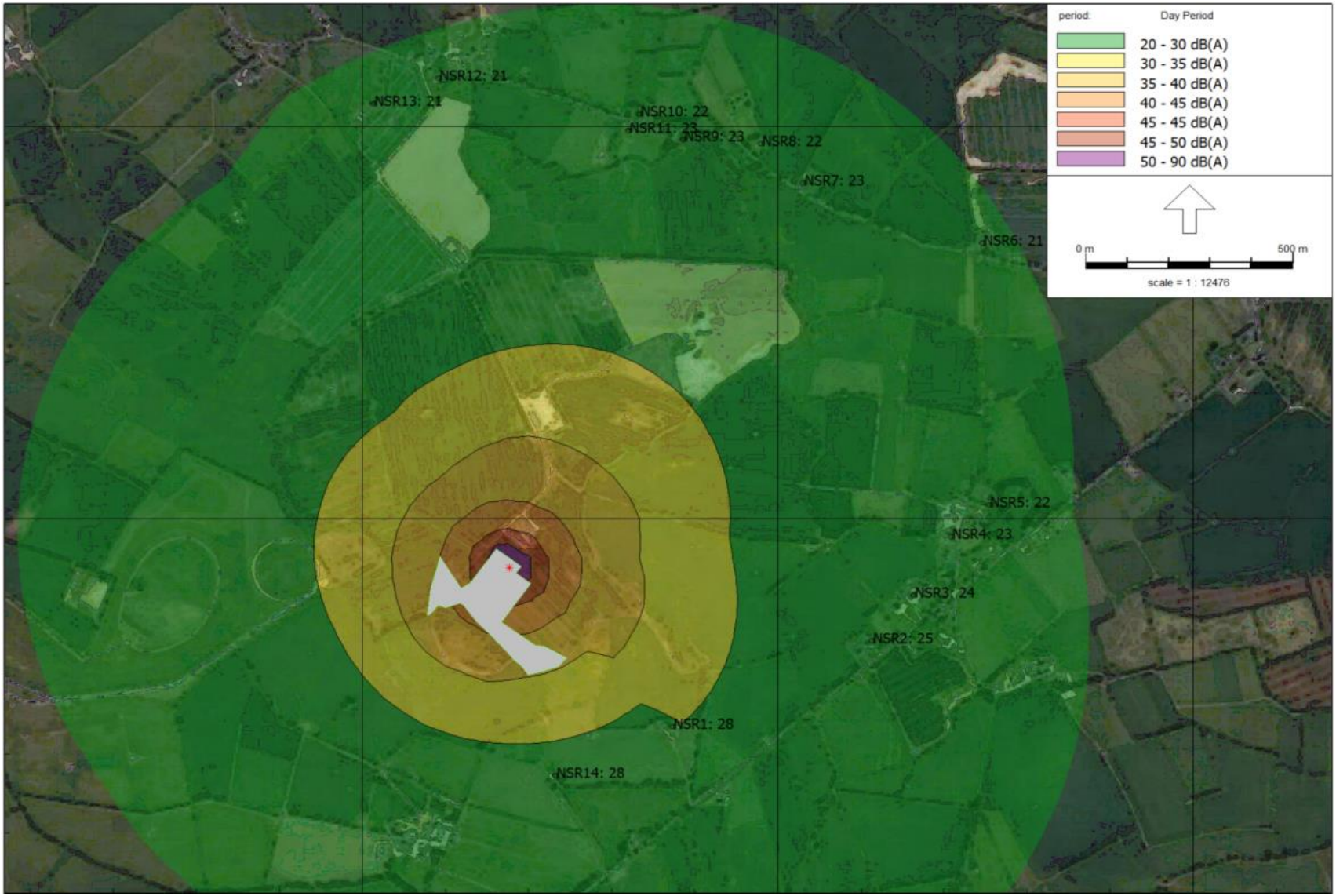

Figure 5 Noise Contour Propagation Map

Figure 5 and Table 10 show that the predicted noise emissions at the nearest sensitive receptors, NSR1 and NSR14 when the proposed 110 kV substation is operating, are below operational noise targets. The predicted noise emission at the NSR1/NSR14 is 28 dB L_{Aeq} which does not exceed the operational noise targets.

Noise emissions at the other receptors further away from the substation dissipate further due to distance and will therefore be less than the highest predicted noise level of (28 dB (A)) at NSR1/NSR14.

Overall, the noise model demonstrates that noise emissions from the proposed development are not predicted to exceed the noise limit targets set to prevent significant operation noise impacts at the nearest noise sensitive receptors.

It is likely, that in reality, noise levels will be lower than predicted due to the conservative assumptions used in the prediction methodology.

4.2.2 Operational Phase Traffic Noise

There will be a low number of workers required during the operational phase. There will also be occasional traffic coming to site for maintenance and deliveries.

Additional traffic during the operational phase will not increase by the order of 25%, which is required for a 1 dB increase. Significant noise impacts as a result of increased traffic during the operational phase are therefore not anticipated.

4.2.3 Cumulative Impacts and Effects

4.2.3.1 Construction Phase Cumulative Impacts

The proposed development will be constructed in parallel with the adjoining permitted development, Mill Farm solar project.

A variety of items of plant will be in use for the purposes of site preparation, construction of the solar array and other site works, including some piling required for the mounting of panels as part of the solar farm construction. There will be vehicular movements to and from the proposed development that will make use of existing roads. Due to the nature of these activities, there is potential for generation of noise.

Table 11 is a typical list of plant and machinery involved in solar farm construction activities. Noise levels from the equipment identified above have been sourced from *BS5228 Noise Database for Noise and Vibration Control on Construction and Open Site 1& 2: 2014+A1*.

Table 11 Plant and Machinery and associated noise levels to be used in Solar Farm Construction

Activity	BS 5228, 2014 Predicted Sound Pressure Level (@10m (r_1) L_{eq} dB(A)	Predicted Sound Pressure Level @ NSR1 (r_2), L_{eq} dB(A).	Predicted Sound Pressure Level @ NSR14 (r_2), L_{eq} dB(A).
HGV Movement (C.2.30)	79	59	59
Tracked Excavator (C.4.64)	77		
Piling Operations (C.12.14)	88		
General Construction (Various)	78		
Dewatering Pumps (D.7.70)	80		
JCB (D.8.13)	82		
Roller (C.2.38)	73		
Total	**90**		

The closest receptors to the substation are NSR1 (c.507m) and NSR14 (c.446m). NSR1 is approximately 345m south of the nearest solar farm array and NSR14 is 357m. The resultant theoretical worst-case noise emission level from construction works at the solar farm is 59dB(A) for NSR1 and NSR14.

Table 12 shows the cumulative noise level of the solar farm and substation construction noise levels. At NR1 and NSR14, the noise levels are below the construction threshold.

This is a conservative prediction and in reality, all plant from **Table 11** would not be in operation at the same time.

Table 12 Construction Phase Cumulative Noise

NSR	Mill Farm Solar Farm Predicted Noise dB (A)	Mill Farm Substation Predicted Noise dB (A)	Cumulative Noise Level dB(A)	Daytime Operational Noise Target, dB (A)
NSR1	59	52	60	65
NSR14	59	53	60	65

Due to the separation distance between the proposed works area and NSRs, no significant vibrations effects are expected from the solar farm works. Vibrations from the construction plant and activities involved will not be perceptible or cause structural or cosmetic damage, therefore no cumulative vibration impacts are anticipated.

4.2.3.2 Operational Phase Cumulative Impacts

As part of the planning process for the Mill Farm solar project, Neo Environmental carried out a noise assessment (Neo Environmental 2022) and predicted noise emissions at locations NSR1 to NSR14. **Table 13** shows the cumulative noise of the proposed development in operation with the permitted Mill Farm solar project.

Noise emissions at NSRs from both the permitted development and proposed development, are predicted to be below operational noise thresholds and therefore there will be no significant cumulative impacts as a result of the proposed development and permitted development in operation together.

Table 13 Operational Noise Cumulative Noise Impacts

NSR	Mill Farm Solar Farm Predicted Noise dB (A)	Mill Farm Substation Predicted Noise dB (A)	Cumulative Noise Level dB(A)	Daytime Operational Noise Target, dB (A)	Evening Operational Noise Target, dB (A)	Evening Operational Noise Target, dB (A)
NSR1	12	28	28	45	40	35
NSR2	9	25	25	45	40	35
NSR3	10	23	24	45	40	35
NSR4	10	22	23	45	40	35
NSR5	9	22	22	45	40	35
NSR6	9	20	19	45	40	35
NSR7	13	22	22	45	40	35
NSR8	13	22	22	45	40	35
NSR9	14	22	23	45	40	35
NSR10	13	22	22	45	40	35
NSR11	14	23	23	45	40	35
NSR12	11	21	21	45	40	35
NSR13	12	21	21	45	40	35
NSR14	11	28	27	45	40	35

5. Mitigation and Monitoring Measures

5.1 Construction Phase Mitigation

5.1.1 Construction Phase Noise

The noise levels generated during the construction phase of the proposed development is not predicted to reach noise limits at NSRs.

Best practice mitigation techniques as specified in *BS 5228:2009+A1 2014 – Noise and Vibration Control on Construction and Open Sites* will be implemented during the construction phase. Contractors will be familiar with the measures in this document, in order to implement the best practice measures.

To mitigate against the impacts of noise on the local community during construction, the following measures are proposed:

- A pre-construction commitment to managing nuisance noise will be agreed through notification and consultation with affected parties, if deemed necessary.
- Working hours at the site during the construction phase will be limited to 7:00am – 7:00pm (Monday – Friday inclusive) and 8:00am – 2:00pm (Saturday) with no work on Sundays.
- Construction contractors will be required to comply with the requirements of the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations, 1988 as amended in 1990 and 1996 (S.I. No. 320 of 1988, S.I. No. 297 of 1990 and S.I. No. 359 of 1996), and the Safety, Health and Welfare at Work (Control of Noise at Work) Regulations, 2006 (S.I. No. 371 of 2006).

The main control measures will be control of noise at source using the following methods in line with Clause 8 'Control of noise' of BS 5228-1:2009+A1:2014:

- Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery (Clause 8.2.1 General).
- Use of appropriate plant and equipment where possible with low noise level generation where possible (Clause 8.2.2 Specification and substitution).
- All construction plant to be used on site should have effective well-maintained silencers (Clause 8.2.3 Modification of existing plant and equipment).
- Noise generating equipment will be located as far as possible away from local noise sensitive areas identified (Clause 8.2.5 Use and siting of equipment); and,
- Regular and effective maintenance of site machinery including a full maintenance schedule to ensure that all pieces of equipment are in good working order. With efficient use of well-maintained mobile equipment, considerably lower noise levels than those predicted can be attained (clause 8.2.6 Maintenance).

In addition, the following best practice measures are proposed:

- Training of site staff in the proper use and maintenance of tools and equipment.
- Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment.
- Machines that could be in intermittent use will be shut down between work periods or will be throttled down to a minimum.
- Plant start-up will be sequential rather than all together.
- Internal access tracks to be well maintained.
- Plant known to emit noise strongly in one direction will, when possible, be orientated so that the noise is directed away from noise-sensitive locations and
- Drop heights for materials such as gravels will be minimised whenever practicable

5.1.2 Construction Phase Vibration

Vibration levels will not exceed those described *in BS5228 –1&2:2009 + A1 2014, Code of Practice for the Control of Noise and Vibration on Construction and Open Sites* and this chapter, therefore no further mitigation measures are required in relation to vibration.

5.2 Operational Phase Mitigation

5.2.1 Operational Phase Noise Mitigation

The results demonstrate that the proposed development 110 kV substation will not exceed the operation noise limit target at the nearest sensitive receptors. Therefore, no mitigation measures are required.

5.2.2 Operational Phase Vibration Mitigation

There will be no vibration during the operational phase therefore no mitigation measures are required.

5.3 Construction Phase Monitoring

5.3.1 Construction Phase

Noise and vibration monitoring should be considered, for example in the instance that a complaint is received. Monitoring can then be undertaken to validate any complaint.

5.3.2 Operational Phase

Ongoing monitoring is not considered necessary given the insignificant noise impact during operational phase.

6. Conclusion

6.1 Construction Phase

No significant construction noise impacts are predicted as all construction noise activities are predicted to be below the construction noise limits in relation to a potential significant construction noise impact at residential properties.

Cumulatively, the permitted Mill Farm Solar development construction works in combination with the proposed development are predicted to be below construction noise limits at all NSRs.

Generally, significant vibrations which may cause structural damage only occur from piling or blasting operations. Although there is no piling or blasting associated with the proposed development, there is some piling associated with mounting of panels at the adjacent permitted solar farm project. Given the distance to the nearest residential receptors, vibrations of the magnitude to cause cosmetic damage are not expected to occur.

6.2 Operational Phase

The predicted noise emissions from the proposed development operational phase are predicted to be below operational noise thresholds and also below baseline noise levels at NSRs.

From a cumulative viewpoint, operational noise emissions at NSRs from both the permitted solar farm development and the proposed substation development are predicted to be below operational noise thresholds and therefore there will be no significant cumulative impacts as a result of the proposed development and permitted development in operation together.

There will be no significant vibrations associated with the operational phase of the proposed development or permitted Mill Farm solar farm development.

7. References

EirGrid Evidence Based Environmental Studies Study 8: Noise

BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound.

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2 – Vibration.

BS 6472 Guide to evaluation of human exposure to vibration in buildings (2008): Part 1 - Vibration sources other than blasting.

BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.

BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings

Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (EPA, 2016).

ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise.

Calculation of Road Traffic Noise (CRTN) issued by the Department of Transport in 1988

Mill Farm Solar Project Noise Impact Assessment (Neo Environmental 2022)

Appendix A

Noise Monitoring Location Photos

NML1

NML2

NML3

Appendix B

Equipment Calibration Certificates

NSAI
National Metrology Laboratory

Certificate of Calibration

Issued to

Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

Certificate Number	221922
Item Calibrated	Larson Davis Sound Level Meter with PCB PCB377B02 Microphone
Serial Number	0003826 (SLM) and 150020 (Microphone)
ID Number	None
Order Number	27026
Date Received	10 May 2022
NML Procedure Number	AP-NM-09
Method	The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).
Calibration Standards	Norsonic 1504A Calibration System incorporating: SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022] Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022] B&K 4134 Measuring Microphone, No. 0744 [Cal Due Date: 03 Jun 2023] B&K 4228 Pistonphone, No. 0740 [Cal Due Date: 04 Jun 2023] B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 07 Oct 2022]

Calibrated by	David Fleming	**Approved by**	PP Paul Hetherington
Date of Calibration	31 May 2022	**Date of Issue**	31 May 2022

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

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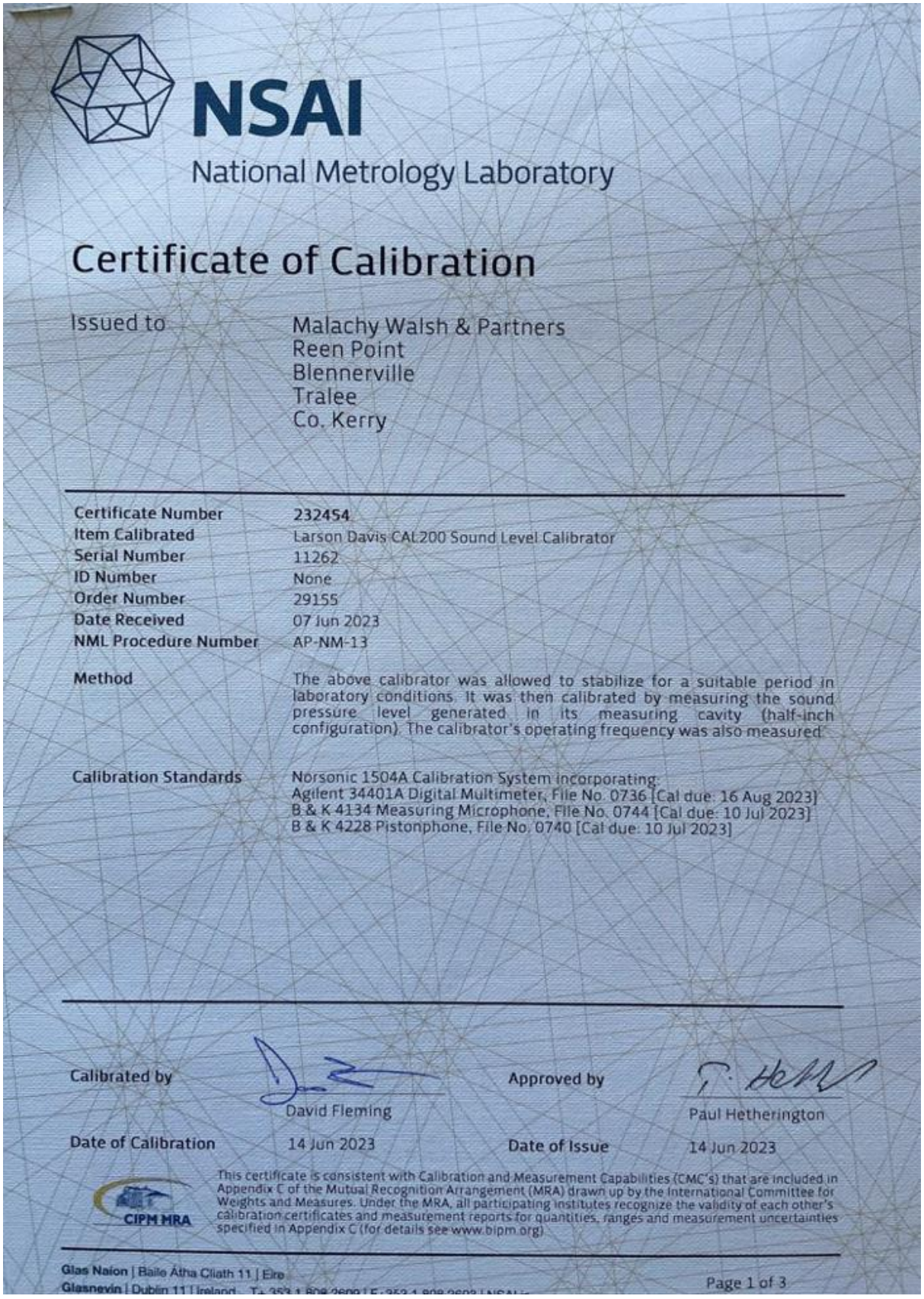

NSAI
National Metrology Laboratory

Certificate of Calibration

Issued to
Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

Certificate Number	**232454**
Item Calibrated	Larson Davis CAL200 Sound Level Calibrator
Serial Number	11262
ID Number	None
Order Number	29155
Date Received	07 Jun 2023
NML Procedure Number	AP-NM-13
Method	The above calibrator was allowed to stabilize for a suitable period in laboratory conditions. It was then calibrated by measuring the sound pressure level generated in its measuring cavity (half-inch configuration). The calibrator's operating frequency was also measured.
Calibration Standards	Norsonic 1504A Calibration System incorporating: Agilent 34401A Digital Multimeter, File No. 0736 [Cal due: 16 Aug 2023] B & K 4134 Measuring Microphone, File No. 0744 [Cal due: 10 Jul 2023] B & K 4228 Pistonphone, File No. 0740 [Cal due: 10 Jul 2023]

Calibrated by David Fleming — **Approved by** Paul Hetherington

Date of Calibration 14 Jun 2023 — **Date of Issue** 14 Jun 2023

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org).

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Appendix C

Glossary of Noise Related Terminology

Terminology	Description
A-weighting	a filter that down-weights low frequency and high frequency sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
acoustic character	one or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
acoustic screening	the presence of a solid barrier (natural landform or manmade) between a source of sound and a receiver that interrupts the direct line of sight between the two, thus reducing the sound level at the receiver compared to that in the absence of the barrier
ambient noise	All-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
annoyance	a feeling of displeasure in this case evoked by noise
attenuation	the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
audio frequency	any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz to 20,000 Hz
background noise	the noise level rarely fallen below in any given location over any given time period, often classed according to day-time, evening or night-time periods (for the majority of the population of the UK the lower limiting noise level is usually controlled by noise emanating from distant road, rail or air traffic)
dB	abbreviation for ‘decibel’
dB(A)	abbreviation for the decibel level of a sound that has been A-weighted
decibel	the unit normally employed to measure the magnitude of sound
directivity	the property of a sound source that causes more sound to be radiated in one direction than another
equivalent continuous sound pressure level	the steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, T, denoted by $L_{Aeq,T}$
external noise level	the noise level, in decibels, measured outside a building
filter	a device for separating components of an acoustic signal on the basis of their frequencies

Terminology	Description
frequency	the number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
frequency analysis	the analysis of a sound into its frequency components
ground effects	the modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver
hertz	the unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
impulsive sound	a sound having all its energy concentrated in a very short time period
instantaneous sound pressure	at a given point in space and at a given instant in time, the difference between the instantaneous pressure and the mean atmospheric pressure
internal noise level	the noise level, in decibels, measured inside a building
L_{Aeq}	the abbreviation of the A-weighted equivalent continuous sound pressure level
L_{A10}	the abbreviation of the 10 percentile noise indicator, often used for the measurement of road traffic noise
L_{A90}	the abbreviation of the 90 percentile noise indicator, often used for the measurement of background noise
level	the general term used to describe a sound once it has been converted into decibels
loudness	the attribute of human auditory response in which sound may be ordered on a subjective scale that typically extends from barely audible to painfully loud
noise	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure. Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
noise emission	the noise emitted by a source of sound
noise immission	the noise to which a receiver is exposed
noise nuisance	an unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it
octave band frequency analysis	a frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit)
percentile exceeded sound level	the noise level exceeded for n% of the time over a given time period, T, denoted by $L_{An,T}$

Terminology	Description
receiver	a person or property exposed to the noise being considered
residual noise	the ambient noise that remains in the absence of the specific noise whose effects are being assessed
sound	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also 'noise')
sound level meter	an instrument for measuring sound pressure level
sound pressure amplitude	the root mean square of the amplitude of the acoustic pressure fluctuations in a sound wave around the atmospheric mean pressure, usually measured in Pascals (Pa)
sound pressure level	a measure of the sound pressure at a point, in decibels
sound power level	the total sound power radiated by a source, in decibels
spectrum	a description of the amplitude of a sound as a function of frequency
Standardised wind speed	Values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
threshold of hearing	the lowest amplitude sound capable of evoking the sensation of hearing in the average healthy human ear (0.00002 Pa)
tone	the concentration of acoustic energy into a very narrow frequency range