10 Noise and Vibration

10.1 Introduction

Enfonic Ltd. have been commissioned by ORS Consulting Engineers to conduct a noise impact assessment in relation to the proposed Anaerobic Digestion Facility at Moneylane, Arklow, Co. Wicklow (the Proposed Development).

The noise and vibration impact during the construction and operational phases are considered in addition to taking account of mitigation measures to reduce or eliminate any residual impacts on the environment within the study area.

This assessment was prepared in accordance with the EIA Directive 2014/52/EC, current EPA guidelines and best practice.

10.2 Fundamentals of Noise

The audible range of sounds can be expressed in terms of Sound Pressure Levels (SPL) and ranges from 0dB (for the threshold of hearing) to 140dB (for the threshold of pain). It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity is most sensitive to the frequency range of language (300Hz-3,000Hz) and decreases substantially as frequency falls.

It is necessary to adjust the measured noise level by an instrument to reflect the sensitivity response of human hearing and the 'A-weighting' system has been defined in the international standard ISO 226:2003 Acoustics. A SPL measured using 'A-weighting' is expressed in terms of dBA.

An indication of the level of some common sounds on the dBA scale is as follows:

Table 10-1. Common sounds and dBA scale

Source	Decibel Level (dBA)
Threshold of Hearing	0
Rustling Leaves	10
Whisper	20
Quiet Rural Setting	30
Quiet Living Room	40
Suburban Neighbourhood	50
Normal Conversation	60
Busy Street Traffic	70
Vacuum Cleaner	80
Heavy Truck	90
Jackhammer	100
Front Row of Rock Concert	110
Threshold of Pain	130

A glossary of acoustic terminology used in this report is provided in **Appendix A.**

10.3 Methodology

The assessment of impact effects has been undertaken with reference to the guidance documents relating to noise and vibration for the construction and operational phase of the Proposed Development, which are set out within the relevant sections of this chapter.

The methodology adopted for this noise impact assessment is summarised as follows:

- Review of appropriate guidance to identify appropriate noise and vibration criteria for the construction, operational and decommissioning phases;
- Quantify the receiving environment through baseline noise surveys at representative Noise Sensitive Locations (NSLs) surrounding the Proposed Development;
- Undertake predictive calculations to assess the potential effects associated with the construction phase of the Proposed Development;
- Undertake predictive calculations to assess the potential effects associated with the operational phase of the Proposed Development;
- Evaluate the potential noise and vibration effects;
- Specify mitigation measures to reduce, where necessary, the identified potential outward effects relating to noise and vibration from the Proposed Development; and
- Describe the significance of the residual noise and vibration effects associated with the Proposed Development.

In addition, the following guidelines were considered and consulted for the purposes of this chapter:

  - EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022); and
  - EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (2003).

10.4 Guidance Documents and Assessment Criteria

10.4.1 Significance of Impact

The criteria for determining the significance of impacts and the effects used in this report are in line with the EPA's Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022).

The significance of effects of the Proposed Development shall be described in accordance with the Environmental Protection Agency (EPA) document *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), 2022* (EPA Guidelines).

The EPA Guidelines do not however quantify the impacts in decibel terms. In the absence of such information, reference is made to *Guidelines for Environmental Noise Impact Assessment (2014)* from the Institute of Environmental Management and Assessment (IEMA Guideline). The IEMA Guidelines references similar terminology to the EPA Guidelines and quantifies the effect categories in decibel terms for various receptor categories, with residential receptors having the greatest sensitivity to noise.

The effect descriptions and their respective noise level change for residential receptors are

presented in **Table 10-2.**

Table 10-2: Effects Description (EPA Guidelines and IMEA Guidelines) and noise level change criteria

EPAs Significance of Effects	IEMA Guidelines	Noise Level change dB
Imperceptible	None/Not significant	Less than 2.9
Not Significant		
Slight Effects	Slight	3.0 – 4.9
Moderate Effects	Moderate	
Significant Effects	Substantial	5.0 – 9.9
Very Significant	Very Substantial	Greater than 10.0 dB
Profound Effects		

10.4.2 Construction Phase (Noise)

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. Local authorities normally control construction activities by imposing limits on the hours of construction works and may consider noise limits at their discretion.

10.4.2.1 BS 5228-1:2009+A1:2014

In the absence of specific noise limits, appropriate construction limits adopted in this assessment make reference to *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Noise*. This provides information on the prediction and measurements of noise from construction sites and operations such as mines and quarries. It also includes a large database of source noise levels for commonly used equipment and activities on construction sites.

The standard provides guidance on the 'threshold of significant effect' in respect to noise impacts at dwellings. The proposed 'ABC method' derives appropriate construction noise limits from existing ambient noise levels and the relevant categories are provided in **Table 10-3.**

Table 10-3: BS 5228 Categorisation Table.

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00−07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)	65	70	75
NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. *NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.* *NOTE 3 Applied to residential receptors only.*			

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

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A)]	Category B [B)]	Category C [C)]
[D)]	Category D: 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.		

In general, the noise impact due to the construction phase will be from the specific items of plant used, the duration and phasing of the construction methods, the time of day that each plant will be used and their location.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB.

10.4.2.2 Construction Phase (Vibration)

The Transport Infrastructure Ireland (TII) (formally National Roads Authority) provides suitable criteria to prevent building damage from vibration in their *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014)* as given in **Table 10-4.**

Table 10-4: Summary of British Standard Vibration Criteria.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
<10Hz	**10-50Hz**	**>50-100Hz**
8mm/s	12.5mm/s	20mm/s

10.4.2.3 Operational Phase

Two separate assessments are appropriate for the Proposed Development as follows:

1. For the purposes of planning, noise emissions are assessed relative to the receiving environment.
2. Once operational, the emission license for the Proposed Development will fall within the remit of the Environmental Protection Agency (EPA) who will set noise emission criteria.

Assessment in relation to both is included herein.

10.4.2.4 EPA Noise Guidance

The Environmental Protection Agency (EPA) (2016), *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* provides noise guidance to operators' subject to IPPC, IE, or waste licences.

Typically noise emissions limits are set at Noise Sensitive Locations (NSLs) or at the site boundary as follows:

- Daytime: 55dB L_{Aeq}
- Evening: 50dB L_{Aeq}
- Night-time: 45dB L_{Aeq}

Quiet Area Screening of the Development Location

The location of the Proposed Development should be screened in order to determine if it is to be located in or near an area that could be considered a 'Quiet Area' in open country according to the Agency publication Environmental Quality Objectives - Noise in Quiet Areas.

This involves determining if the following criteria are all satisfied:

- At least 3 km from urban areas with a population >1,000 people; No
- At least 10 km from any urban areas with a population >5,000 people; No
- At least 15 km from any urban areas with a population >10,000 people; No
- At least 3 km from any local industry; No
- At least 10 km from any major industry centre; No
- At least 5 km from any National Primary Route, and; No
- At least 7.5 km from any Motorway or Dual Carriageway. No

The site does not meet these criteria and is not considered to be a quiet area as per the Agency definition.

10.4.2.5 BS4142:2014

An appropriate noise impact assessment methodology is provided in *BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound*.

The procedure rates the 'Specific' noise (from the Biogas Facility in this case) at Noise Sensitive Locations (NSLs) and compares it with the 'Background' noise levels. The level difference is an indication of the impact that the operation under investigation may have.

In addition, Rating penalties applied to the Specific noise level may be appropriate to provide for the increased significance that additional characteristics such as Tonality or Impulsivity have on noise in the community.

The 'context' of the development and its environs e.g. time of day, nature of the neighbourhood, local attitudes to the development, etc ought also to be considered. There is also a degree of uncertainty applicable to the results e.g. for weather, instrumentation, measurement duration, calculation errors etc which ought to be considered.

10.4.2.6 ISO 9613-2:1996

*ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculatio*n describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.

10.4.2.7 Local Guidance

Wicklow County Council's *Noise Action Plan 2018-2023* is prepared as a requirement of Environmental Noise Regulations, 2006. It is primarily concerned with road traffic noise but includes some useful guidance for other noise sources.

Section 6.1 states:

> *"It is recommended that the population should not be exposed to night noise levels greater than 40 dB of Lnight outside (a long-term eight hour average between 23:00 and 07:00 hrs)."*
>
> *"To address the lack of legislative measures and unify the approach taken by Planning*

Authorities the EPA has issued guidelines for the assessment of noise exposure and prioritising areas for noise mitigation measures."

The proposed onset of assessment levels relating to road traffic noise are given below in **Table 10-5.**

Table 10-5. Onset levels from Wicklow Noise Action Plan

Location	L_{DEN}	L_{Night}
Onset Levels for Mitigation Measures	70	57
Onset levels for noise preservation	55	45

10.5 Receiving Environment

10.5.1 Noise Sensitive Locations

A Noise Sensitive Location (NSL) is defied in EPA NG4 as:

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

10.5.2 Study Area

The study area is defined as any NSL that may be affected by noise from the Proposed Development. A representative sample of the closest NSLs to the Proposed Development is used in this assessment. Noise levels diminish over distance therefore these locations represent a worse-case evaluation.

The locations assessed are shown in **Figure 10-1** below.

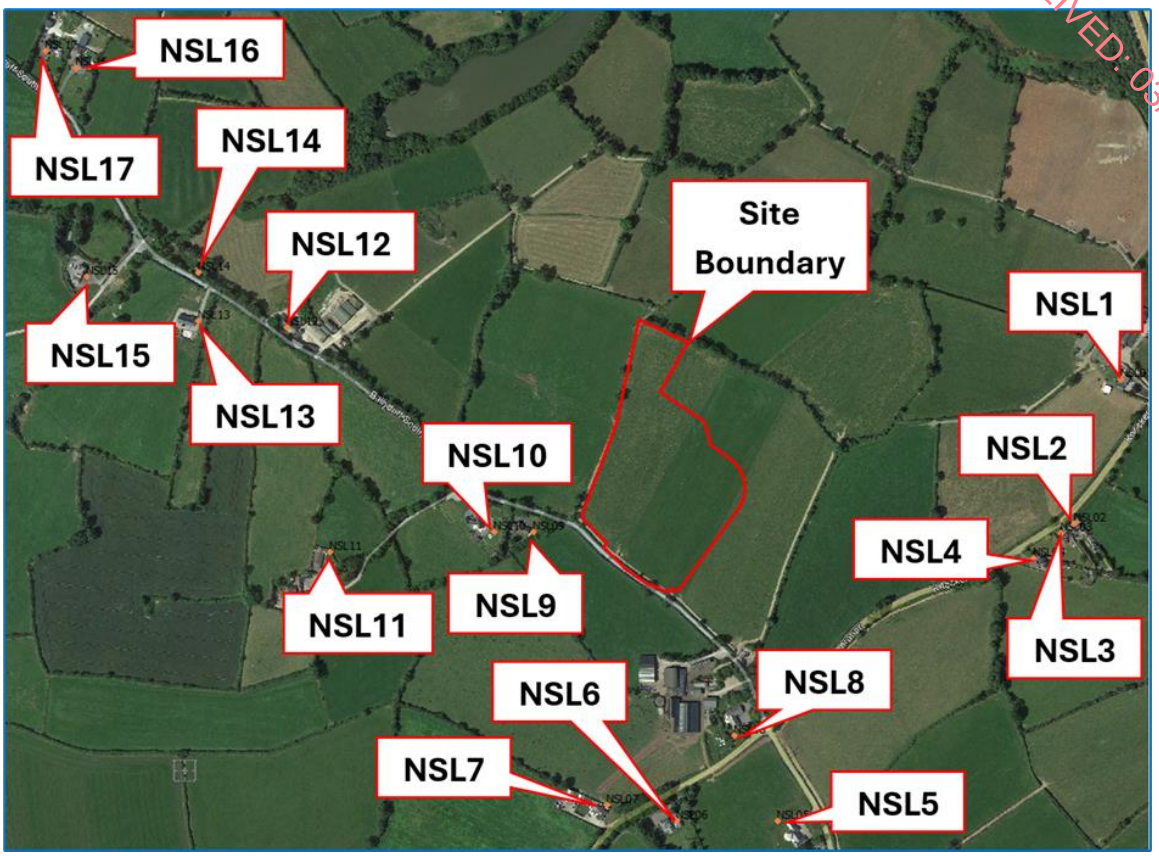

Figure 10-1: Study Area and Noise Sensitive Locations (NSL)

10.5.3 Background Noise Survey

A noise survey has been conducted at the site in order to quantify the baseline noise levels within the study area. The survey was conducted in general accordance with *ISO 1996: 2017: Acoustics - Description, Measurement and Assessment of Environmental Noise* and followed the methodology contained in EPA NG4. Specific details are set out below.

10.5.3.1 Noise Monitoring Locations

Several Noise Measurement Locations (NMLs) were selected to represent the ambient noise conditions at the positions shown in **Figure 10-2.**

Figure 10-2: Map of Noise Measurement Locations (NMLs) and site boundary

Attended noise measurements were taken at ASL1 and ASL2 to establish the daytime noise levels. Unattended noise monitoring at NML over several days was used to establish the night-time noise levels.

Noise measurements were taken using class 1 Bruel & Kjaer Type 2250 Sound Level Meters (SLMs). Each meter was calibrated prior to measurements and the sensitivity checked afterwards for any significant drift; none was found. Weather conditions were calm and dry throughout the survey.

Attended measurements took place on 13-11-2024 and 05-02-2025 and unattended noise monitoring took place between 07-11-2024 and 15-11-2024. Images of the installations are provided in **Appendix B.**

10.5.4 Survey Results

Day-time Levels

Measurements were taken at each of the two attended locations and the average of the results are used to set the prevailing Background (L_{A90}) Daytime noise levels. The results are presented in **Table 10-6.**

Table 10-6: Summary of Baseline Survey Results

Location	Start Time	Elapsed Time	L_{Aeq} (dB)	L_{A90} (dB)	Noise Source Description
ASL1	12:18	00:15:00	48.7	42.4	Constant distant road traffic noise from M11, Birdsong, Occasional local road traffic noise
ASL2	12:52	00:15:00	70.6	46.6	Local Road Traffic Noise from the nearby crossroads, Constant distant road traffic noise from M11, Birdsong
Overall Average:			**59.6**	**44.5**	

The average typical Daytime Background (L_{A90}) noise level was 45dB (rounded).

Night-time noise levels were derived from the unattended noise monitor and the typical Background (L_{A90}) noise level was 32dB (rounded).

A time-history plot of the average noise levels is given in **Appendix C**.

10.6 Impact Assessment

In general, noise impact is a result of the noise levels of the sources, the distance from the source to a receiver, the intervening topography and built environment, the time of day and the existing background noise levels.

The impact assessment considers the construction and operational phases separately.

10.6.1 Do-Nothing Scenario

If the development is not progressed the existing noise environment (as measured in the baseline assessment) in the vicinity of the Proposed Development will remain largely unchanged. Traffic flows on the road network in the area are expected to grow over time with associated increase in noise level.

10.6.2 Construction Phase

The appropriate methodology for the impact assessment of the construction phase is set out in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 Noise*. The standard sets out sound power levels and L_{Aeq} noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

Subject to agreement with the local authority, it is anticipated that the following times will constitute the standard working hours on the construction site:

- Monday to Friday 07:00 to 19:00
- Saturdays 08:00 to 16:00

Typical construction phases and timeframe are as follows:

- Site Preparation / Clearance: 6-8 weeks
- Civil / Structural Works: 6 months
- Mechanical and Electrical Installation: 3 months

- Commissioning and testing: 2 months

The Site Preparation/Clearance and Civil/Structural works represent the noisiest phases of construction and are assessed herein.

10.6.3 Construction Noise Limits

Following a review of the baseline noise survey results in **Table 10-3** the appropriate BS5228 construction noise category is A i.e. 65dB L_{Aeq}.

10.6.4 Construction Noise

An outline CEMP has been submitted in relation to the Proposed Development to include all mitigation measures outlined in this chapter. As a working initial hypothesis, the impact of assumed typical construction phases of work has been assessed.

Table 10-7 outlines typical plant items associated with each relevant phase, their noise levels and assumed operational times. Noise levels have been taken from BS 5228 and table references included.

Table 10-7: Summary of predicted noise levels from construction plant

Description	Item of Plant (BS5228 Table Ref.)	L_{Aeq} Noise Level @10m	Percentage on-time %[1]
Phase 1a – Site Preparation / Clearance	Tracked Excavator – 25t (C2.19)	77	50
	Tracked Excavator – 21t (D10.9)	75	50
	Dozer - 239kW (D3.27)	81	80
	Articulated Dump Truck (2no.) (C2.33)	81	50
	Tipper Lorry - 75kW (D3.112)	85	50
Phase 1b – Road Development for Construction Access	Tracked Excavator – 25t (C2.19)	77	80
	Excavator (C10.9)	75	50
	Articulated Dump Truck (C2.33)	81	50
	Excavator (C4.67)	74	80
	Dump Truck (C2.30)	79	50
	Roller (C5.27)	67	80
Phase 2a – Instate Finished Road Surface	Dump Truck (C2.30)	79	50
	Roller (C5.27)	67	80
	Asphalt Paver + Tipper Lorry (C5.31)	77	80
	Lorry (C11.9)	82	50
	Road Roller (C5.19)	80	80
Phase 2b – Civil / Structural works	Tracked Excavator (C2.19) (3no.)	82	50
	Tracked Excavator – 21t (D10.9)	75	50
	Dozer - 239kW (D3.27)	81	80
	Articulated Dump Truck (2no.) (C2.33)	81	50
	Tipper Lorry - 75kW (D3.112)	85	30

Description	Item of Plant (BS5228 Table Ref.)	L_{Aeq} Noise Level @10m	Percentage on-time %[1]
	Concrete mixer truck etc (C4.32)	78	80
	Telescopic Handler (C4.54)	79	80
	Angle grinder (C4.93)	80	50
1Best-practice assumptions.			

As a worst-case assessment, construction noise levels at the closest NSL (NSL09) which is approximately 150m south-west of the site boundary is considered, NSLs further away receiving a commensurate reduction in noise level. A suitably constructed hoarding around the construction perimeter has been assumed.

The predicted noise levels for each construction phase and comparison with the criteria are given in **Table 10-8.**

Table 10-8: Summary of Predicted Construction Noise at the closest NSL.

Phase	Predicted Noise Level $L_{Aeq, 1hr}$ @150m	Construction Noise Criteria	Criteria Exceeded?
Phase 1a - Site Preparation / Clearance	62dB	65dB	No
Phase 1b – Road Development for Construction Access	59dB	65dB	No
Phase 2a – Instate Finished Road Surface	60dB	65dB	No
Phase 2b – Civil / Structural works	64dB	65dB	No

Construction-related noise levels do not exceed the established criteria for any phase. Nevertheless, mitigation measures set out in **Section 10.7** will further reduce any adverse impact.

10.6.5 Construction Traffic

For the main construction phase, the site will be accessed via the Knockenrahan and Ballyduff South Roads. The most significant sources of construction traffic are Heavy Good Vehicles (HGVs) accessing the site, and to assess the associated impact it is necessary to estimate the number of vehicles. It has been estimated that during the course of an average day during construction, that up to 10no. HGVs will access the site to deliver materials i.e. 20no. movements per day.

Additional light goods and contractor related vehicles would be expected in the morning and evening peak periods. The impact from these vehicle movements is expected to be negligible.

The closest identified property has been identified as NSL5, approximately 10m from the site

access road. Using formula F.2.5 from BS 5228-1:2009+A1:2014 the noise level associated with the HGV movements has been calculated as $L_{Aeq,1hr}$ = 48dB at this location. Combined with the other construction works set out in **Table 10-8,** the construction noise criteria are not expected to be exceeded.

10.6.6 Construction Vibration

Empirical data provided in BS5228-2 demonstrates that ground borne vibration waves are attenuated rapidly as they propagate from a source through the substrate. The magnitude of source vibration levels, ground attenuation and distance to the nearest NSL are such that no signification vibration impact will occur.

10.6.7 Extension of the Gas Network Pipeline

It is proposed to extend the existing medium pressure gas network out to the Proposed Development to allow on-site direct injection into the gas network. The Gas pipeline will follow the roadway east to connect to the existing medium pressure distribution network at Ballynattin, Co. Wicklow as indicated in turquoise in **Figure 10-3**.

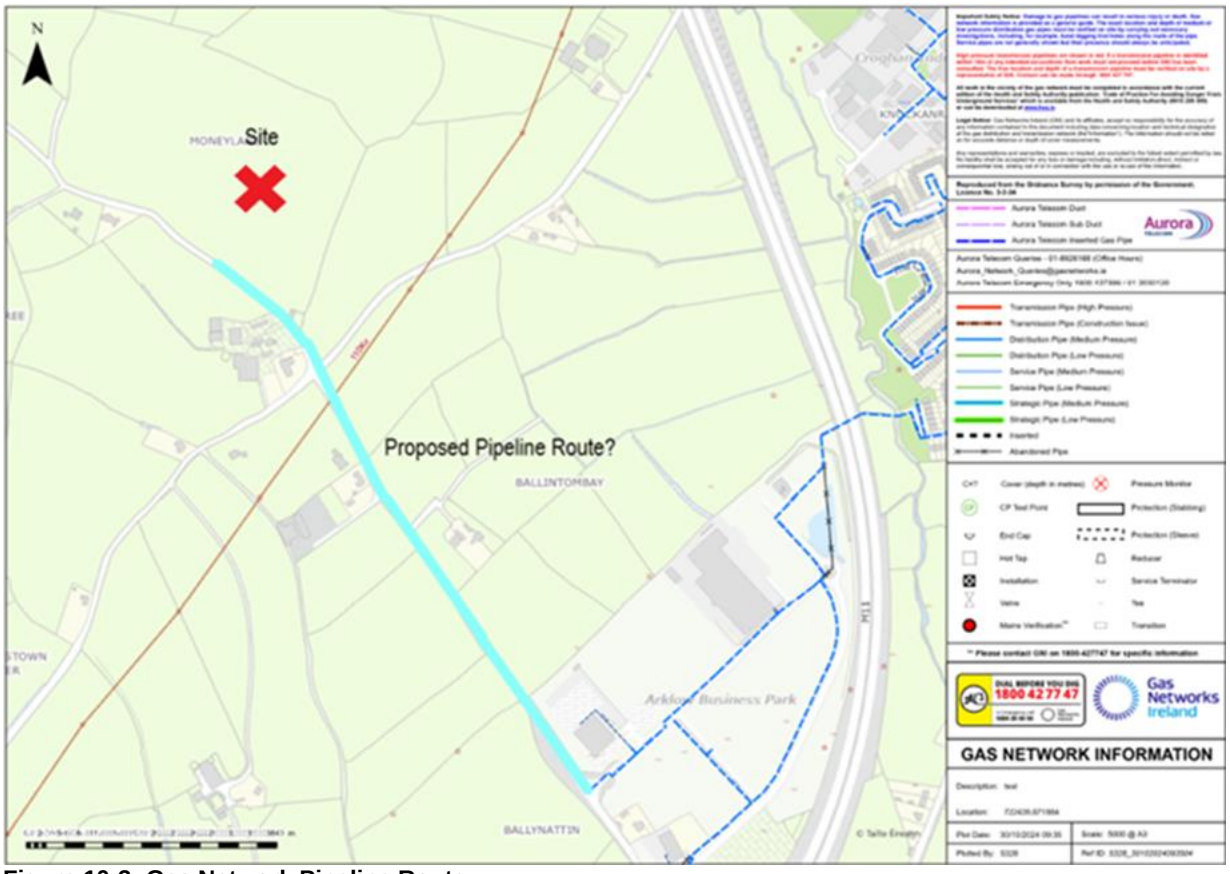

Figure 10-3: Gas Network Pipeline Route

It is planned that the gas pipe will be laid in a mix of grass verge and road, and the pipe will be laid by open cut method.

The closest NSL to the works is NSL5 approximately 10m from the works. The typical plant required and associated noise levels are presented in **Table 10-9** and the predicted noise levels in **Table 10-10** below.

Table 10-9: Summary of Noise Levels for Gas Network Extension Works.

Item of Plant (BS5228 Table Ref.)	L_{Aeq} Noise Level @10m	Percentage on-time %[2]
Road Sweeper – 70kW (C4.90)[1]	76	50
Mini Excavator w/ Hydraulic Breaker (C5.2) [1]	83	50
Vibrator Roller – 3t (C5.27)	77	50
Hand-held Circular Saw (petrol (C5.36) [1]	87	50
Dump Truck (C2.30)	79	50
Vibratory Plate (petrol) (C2.41)	80	50
[1]In the case of works along the grass verge, these sources will not be required. *[2]Best-practice assumption.*		

Table 10-10: Summary of Predicted Noise levels for Gas Network Extension Networks.

Phase	Predicted Noise Level $L_{Aeq, 1hr}$ @10m (dB)	Construction Noise Criteria (dB)	Criteria Exceeded?
Gas Network Extension Works	87	65	Yes

There is potential for brief periods where noise levels will be elevated at the dwelling closest to the works. The noise levels presented are predicted maximum expected levels and are expected to occur for only short periods of time as the works will likely only be in the closest position for one or two days.

In addition to the noise mitigation measures discussed in **Section 10.7**, residents affected will be notified by GNI via a letter drop before the works are due to start with disruption kept to a minimum and access to properties will be maintained.

10.6.8 Description of Effects – Summary

With respect to the EPA's criteria for description of effects, the potential worst-case effects at the nearest NSLs associated with the above aspects of the construction phase are described **Table 10-11**.

Table 10-11:Summary of Description of Effects (Construction Phase).

Aspect	Quality	Significance	Duration
Construction Phase	Negative	Slight	Temporary
Construction Traffic	Negative	Not Significant	Temporary
Gas Pipe Extension Works	Negative	Significant	Temporary

10.6.9 Operational Phase

Anaerobic digestion is a continuous process and therefore the digestion and gas upgrade and injection processes will operate continuously.

Feedstock deliveries and the removal of digestate will only occur from 08:00 to 18:30 hrs Monday to Friday and from 09:00 to 13:00 hrs on Saturday.

The most stringent noise impact assessment is for the Night-time period due to the lower measured Background (L_{A90}) noise levels compared with the Daytime period.

10.6.10 Noise Sources

Each of the potential operational noise sources were identified and reference sound power data assigned. The data has been sourced from manufacturers datasheets, noise source databases, and BS 5228-1:2009+A1:2014 standard.

Several noise sources will be installed inside enclosures and estimates of the acoustic performance of these structures to attenuate the noise within, based on manufacturers datasheets and published data, have been included.

Noise sources that are contained within buildings are estimated to have negligible significance due to the attenuation of the building fabric. The Flare Stack and associated Biogas Blower operate only in an emergency or for testing purposes. It is therefore appropriate not to include these sources in the noise impact assessment.

The associated noise sources with the Proposed Development are described in **Table 10-12** below.

Table 10-12: Summary of Significant Noise Sources.

Grouping	Item	#	Location Details	Run Time
Digester (Primary)	Agitator motor	8	Digester (Primary) Tank	Continuous
Digester (Secondary)	Agitator motor	4	Digester (Secondary) Tank	Continuous
Digestate Storage	Agitator motor	4	Digestate Storage Tank	Continuous
Pasteurisation Units	Agitator motor	2	External	2/24 hrs
	Pasteuriser Outlet Pump	1	Sound Proofed Container	30min/hr - 4/24 hrs
	Pasteuriser Inlet Pump	1	Sound Proofed Container	30min/hr - 4/24 hrs
Biogas Upgrading System	Biogas Blower	1	Sound Proofed Container	Continuous
	Biogas Blower	2	External	Continuous
	Cooling Fan	1	External	Continuous
	Gas Chiller	1	Sound Proofed Container	Continuous
Digestate Treatment System	Digestate Transfer Pump	2	Within Building	8/24 hrs
	Internal Pump	1	Within Building	8/24 hrs
	Reverse Osmosis System	1	Within Building	8/24 hrs
	Nanofiltration	1	Within Building	8/24 hrs
Screw Press Separator	Digestate Transfer Pump	2	Sound Proofed Container within Building	8/24 hrs
	Screw Press Separator	1	Sound Proofed Container within Building	8/24 hrs
CO2 Liquefaction System	Biogas Compressor	1	Sound Proofed Container	Continuous
	Plate Heat Exchanger	1	Sound Proofed Container	Continuous

Grouping	Item	#	Location Details	Run Time
	Reboiler	1	Sound Proofed Container	Continuous
	Condenser	1	Sound Proofed Container	Continuous
	Biogas Blower	1	Sound Proofed Container	Continuous
	Cooling Fan	4	Roof mounted	Continuous
Biogas Flares	Biogas Blower	2	Sound Proofed Cover	Emergency
	Flare Stack	2	External - Enclosed by stainless steel stack	Emergency
CHP	Biogas Blower	1	External motor	Continuous
	Exhaust Stack	1	External	Continuous
Odour Abatement	Extract Fans	1	External	Continuous

10.6.11 Noise Prediction

A computer-based noise propagation model has been prepared to predict the noise levels. This section discusses the methodology behind the noise modelling process and presents the results.

10.6.12 Noise Prediction Software

The proprietary software used, Brüel & Kjær Type 7810-C Predictor, calculates noise levels in accordance with ISO 9613:1996 Acoustics – Attenuation of sound during propagation outdoors. The resultant noise levels are calculated considering a range of factors affecting the propagation of the sound, including:

- The magnitude of the noise source in terms of A-weighted sound power levels (LWA);
- The distance between the source and the receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces;
- The acoustic property of the ground between the source and receiver;
- Attenuation due to atmospheric absorption

10.6.13 Input Data

Octave band sound power levels (L_{WA}) as provided by the manufacturers or from empirical measurements as used in the noise model are presented in **Table 10-13.**

Table 10-13: Summary of Noise Source Sound Power Data.

Grouping	Item	Octave Band (Hz) Sound Power Levels L_w (dB)								Weighting
		63	125	250	500	1k	2k	4k	8k	
Digester (Primary)	Agitator motor	44	58	65	73	77	77	73	58	A
Digester (Secondary)	Agitator motor	44	58	65	73	77	77	73	58	A
Digestate Storage	Agitator motor	44	58	65	73	77	77	73	58	A

Grouping	Item	Octave Band (Hz) Sound Power Levels L_w (dB)								Weighting
		63	125	250	500	1k	2k	4k	8k	
Pasteurisation Unit	Agitator motor	85	78	77	76	82	80	73	66	Z
Biogas Upgrading System	Biogas Blower	65	73	83	86	80	78	77	55	A
CHP	Biogas Blower	65	73	83	86	80	78	77	55	A
CHP	Exhaust Stack	76	70	79	84	92	86	83	77	A
CO2 Liq. System	Biogas Blower	65	73	83	86	80	78	77	55	A
Odour Abatement	Fans	85	78	77	76	82	80	73	66	A

In addition, HGV movements associated with Feedstock Intake and Biobased Fertiliser Export were modelled along the site access road. The associated traffic flows are given in **Table 10-14.**

Table 10-14: Operational Traffic Flows

Feedstock Intake	Delivery Periods	Total In/Out Movements
Feedstock Deliveries	Daytime (Mon-Sat)	28.0
Staff Vehicles (non-HGV)		10.0
Sub Total		**38.0**
Digestate liquid (after dewatering)	Daytime (Mon-Sat)	4.0
Digestate Fibre		2.0
Sub total		**6.0**
Total Movements		**44.0**

10.6.14 Results

The predicted Specific L_{Aeq} noise levels at the NSLs, the measured Background (L_{A90}) levels as well as the BS4142 impacts and EPA Significance of Effect categories are presented for the Daytime (07:00 – 23:00)and Night-time (23:00 – 07:00) periods in **Table 10-15** and **Table 10-16** respectively.

Table 10-15: Summary of Noise Impact – Daytime Period

Location	Measured Background L_{A90} (dB)	Predicted Specific L_{Aeq} Noise Level (dB)	BS4142 Impact	EPA Significance of Effects
NSL01	45	33	-12	Imperceptible/Not Significant
NSL02		35	-11	Imperceptible/Not Significant
NSL03		35	-10	Imperceptible/Not Significant
NSL04		36	-9	Imperceptible/Not Significant
NSL05		47	2	Imperceptible/Not Significant
NSL06		38	-7	Imperceptible/Not Significant
NSL07		36	-9	Imperceptible/Not Significant
NSL08		48	3	Slight
NSL09		39	-6	Imperceptible/Not Significant
NSL10		35	-10	Imperceptible/Not Significant
NSL11		30	-15	Imperceptible/Not Significant
NSL12		23	-23	Imperceptible/Not Significant
NSL13		27	-18	Imperceptible/Not Significant
NSL14		26	-19	Imperceptible/Not Significant
NSL15		24	-21	Imperceptible/Not Significant
NSL16		23	-22	Imperceptible/Not Significant
NSL17		23	-22	Imperceptible/Not Significant

Table 10-16: Summary of Noise Impact – Night-time Period.

Location	Measured Background L_{A90} (dB)	Predicted Specific L_{Aeq} Noise Level (dB)	BS4142 Impact	EPA Significance of Effects
NSL01	32	32	0	Imperceptible/Not Significant
NSL02		33	1	Imperceptible/Not Significant
NSL03		33	1	Imperceptible/Not Significant
NSL04		34	2	Imperceptible/Not Significant
NSL05		34	2	Imperceptible/Not Significant
NSL06		32	0	Imperceptible/Not Significant
NSL07		32	0	Imperceptible/Not Significant
NSL08		28	-4	Imperceptible/Not Significant
NSL09		32	0	Imperceptible/Not Significant
NSL10		30	-3	Imperceptible/Not Significant
NSL11		27	-5	Imperceptible/Not Significant
NSL12		17	-15	Imperceptible/Not Significant
NSL13		26	-6	Imperceptible/Not Significant
NSL14		25	-7	Imperceptible/Not Significant
NSL15		23	-9	Imperceptible/Not Significant
NSL16		23	-9	Imperceptible/Not Significant

Location	Measured Background L_{A90} (dB)	Predicted Specific L_{Aeq} Noise Level (dB)	BS4142 Impact	EPA Significance of Effects
NSL17		22	-10	Imperceptible/Not Significant

Colour noise contour plots of the noise propagation are provided in **Appendix D.**

The assessment criteria can be summarised as follows:

- **Daytime**

  There is likely to be no adverse impact during the Daytime period as the predicted levels are below the existing Background (L_{A90}) noise levels at all NSLs with the exception of NSL08, where a slight impact is indicated under the worst case scenario. Here, the predicted noise levels are primarily influenced by delivery vehicles. The location is also closest to the roads and therefore the nature of the ambient noise environment will not alter as a result of the Proposed Development.

- **Night-time**

  There is likely to be no adverse impact during the Night-time period as the predicted levels are below the existing Background (L_{A90}) noise levels at the majority of NSLs and marginally above at some. The maximum exceedance is 2dB which is considered negligible and imperceptible.

- **EPA IE License**

  Operation noise emission levels will satisfy the likely EPA license conditions as set out in **Section 10.4.2.4.**

10.6.15 Acoustic Characteristics

There are no tonal, impulsive or other characteristics associated with the noise sources considered and therefore no applicable rating penalties apply.

10.6.16 Description of Effects

With respect to the EPA's criteria for description of effects, the potential worst-case effects at the nearest NSLs associated with the Proposed Development are described in **Table 10-17** in the absence of mitigation.

Table 10-17: Summary of Description of Effects.

Aspect	Quality	Significance	Duration
Daytime Period	Negative	Imperceptible to Slight[1]	Long-term
Night-time Period	Negative	Imperceptible	Long-term
[1]At 1no. location			

10.7 Mitigation & Monitoring

The following mitigation measures may be considered to minimise the noise impact to nearby noise sensitive locations.

10.7.1 Operational Phase

The impact assessment herein adopts a worst-case with all noise sources associated with the site operating simultaneously and continuously. In reality the noise levels and the impact will be less.

Noise emissions associated with deliveries will be subject to operational restrictions including timings to minimise any adverse impacts.

There is no further mitigation measures required to minimise the impact of the operational phase with the exception of regular maintenance of the plant and suitable assessment of any replacement plant that may be required in the future.

10.7.2 Construction Phase

The Construction Environmental Management Plan (CEMP) will deal specifically with management processes and strategic mitigation measures to remove or reduce significant noise and vibration impacts, and cumulative noise and vibration impacts from the construction works. The Plan will also define noise and vibration monitoring and reporting. The CEMP will also include method statements for each phase of the works, the associated specific measures to minimise noise and vibration in so far as is reasonably practicable for the specific works covered by each plan and a detailed appraisal of the resultant construction noise and vibration generated.

The contract documents shall specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction on open sites - Noise.* The following list of measures will be implemented, where necessary, to ensure compliance with the relevant construction noise criteria:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working for the duration of the contract.
- Compressors will be attenuated models, fitted with properly lines and sealed acoustic convers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.

- During the construction programme, supervision of the works will be include ensuring compliance with the limits detailed in Section 6.2.1 using methods outlined in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Noise.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs weekdays and between 08:00hrs and 16:00hrs on Saturdays. However, any necessary or emergency out of hours working will be agreed in advance with the local Planning Authority.

10.7.3 Decommissioning Phase

It is anticipated that the decommissioning phase will adopt a similar approach to the construction phase of this assessment including the same noise criteria. To minimise the potential impact on noise sensitive locations, mitigation measures in line with those proposed for the construction phase are proposed.

10.7.4 Monitoring

Noise and vibration emissions may be monitored by the planning and/or licensing authority as required to ensure compliance with conditions and in the event of complaint.

10.8 Residual Impacts

The assessment identified that there is potential for elevated noise levels during the construction phase and mitigation measures are prescribed as applicable. However, given the nature of the work there may be occasions where there are residual effects. It is therefore considered that the residual impact will be slight and for a brief period.
During the operational phase, the Night-time predicted noise levels may be above the existing baseline noise levels at the limited number of Noise Sensitive Locations close to the facility. Mitigation measures are prescribed as applicable. A new noise source will be introduced into the environment however the noise levels for the vast majority of NSLs are insignificant.

Appendix A

Glossary of Terms:

Terminology	Description
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
Ambient Noise	Encompassing sound, at a given place. Usually, a composite of sounds from many sources near and far.
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.
A-weighting	Frequency weighting scale to account for non-linear response of the human ear. Used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. Denoted by suffix A in parameters such as L_{Aeq}, L_{AF10}, etc.
Background Noise	A-weighted noise level of exceeded for 90% of the measurement time. Denoted LAF90. Often classed according to daytime, evening, or nighttime periods.
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
$L_{Aeq, T}$	Equivalent continuous A-weighted sound pressure level. The value of the sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time
L_{AF}	The RMS (root mean square) of the instantaneous sound pressure over a given period of time (T). T is usually Fast (0.125sec) or Slow (1sec)
L_{A10}	The noise level just exceeded for 10% of the measurement period, A-weighted and calculated by Statistical Analysis.
L_{A90}	The noise level exceeded for 90% of the measurement period, A-weighted and calculated by Statistical Analysis.
$L_{Ar,T}$	The Rated noise levels. The A-weighted, Leq, Sound Pressure Level of an industrial noise during a specified time period, adjusted for Tonal, Impulsiveness and other characteristics.
External Noise	The noise level, in decibels, measured outside a building
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

Appendix B

Noise Monitoring Locations

ASL 1	
	
	

ASL2	
	

NLM	
	
	

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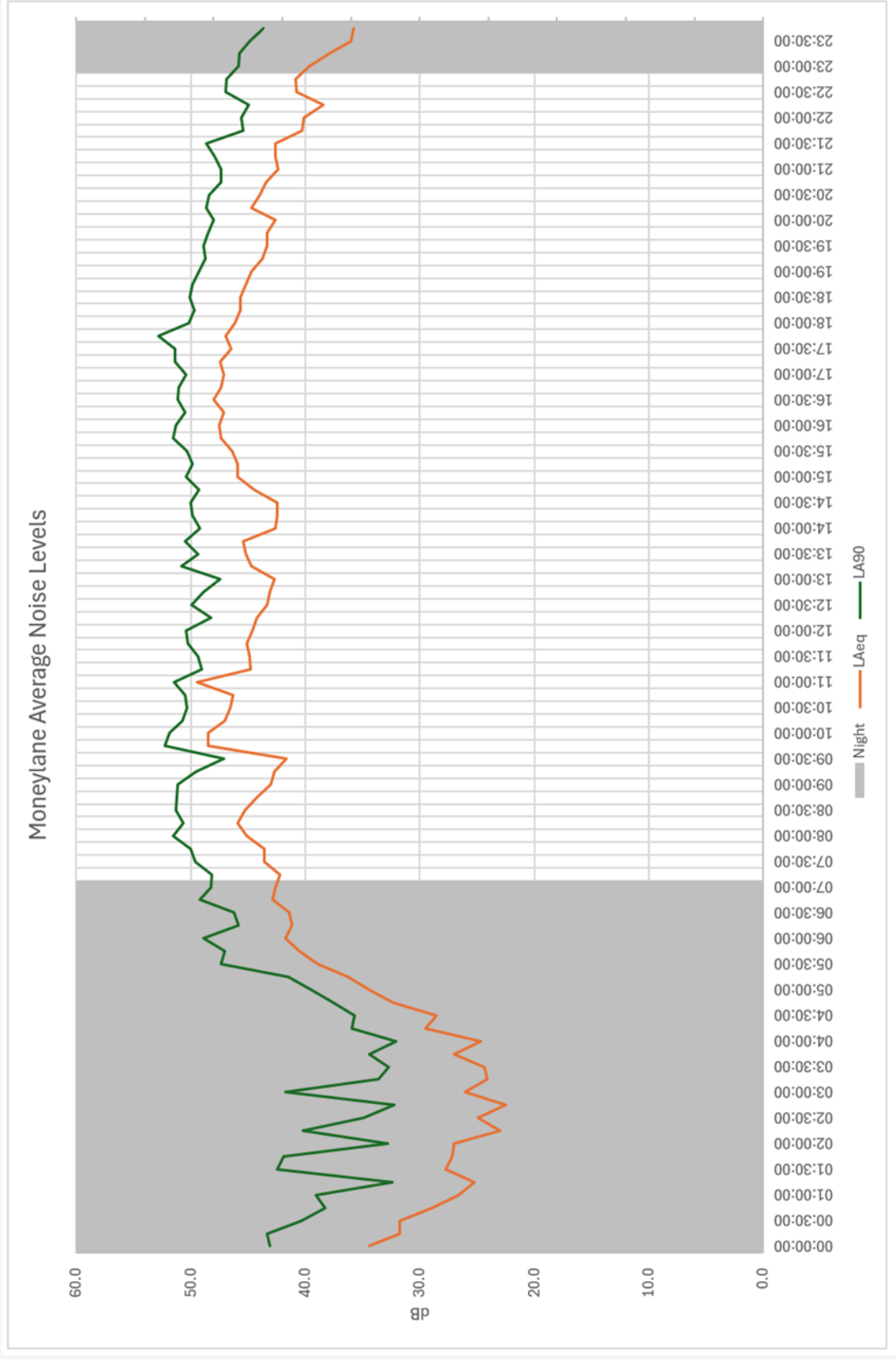
Appendix C

Time-history plot of monitored noise levels.



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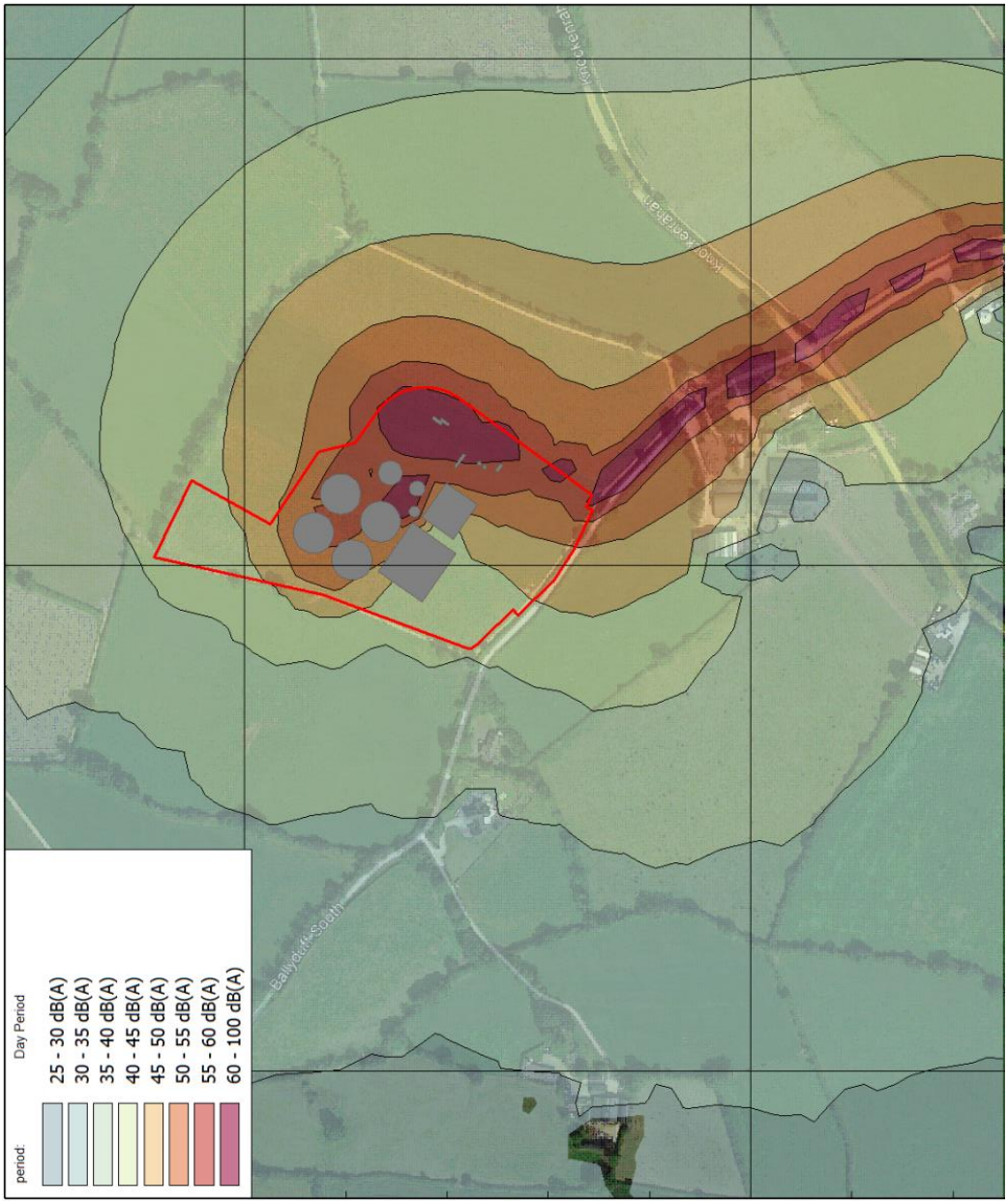
Appendix D

Noise Contour Plot – Day Period



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Noise Contour Plot – Night Period