Appendix 9.5 Construction Noise & Vibration Assessment

Hownsgill Energy Facility

Hownsgill Park, Consett, Durham

For:

Project Genesis Limited

CRM.0138.001.NO.R.002

'Experience and expertise working in union'

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Appendix 9.5 Construction Noise & Vibration Assessment

Project:	Hownsgill Energy Facility, Hownsgill Park, Consett, Durham
For:	Project Genesis Limited
Status:	FINAL
Date:	November 2020
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1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited (Enzygo) has been commissioned by Project Genesis Limited (PGL) to undertake a construction noise and vibration impact assessment, as part of an Environmental Statement, to support a planning application for a new energy facility at Hownsgill Park, Consett, Durham.

1.1.2 The construction noise and vibration assessment has been undertaken to assess the potential impacts, in accordance with the relevant standards and guidance, at the nearest noise-sensitive properties to the site and to provide outline mitigation advice where considered necessary.

1.1.3 Details of the assessment methodology employed, together with the results of the predictions, assessment and conclusions are presented within this report.

1.2 Site Description

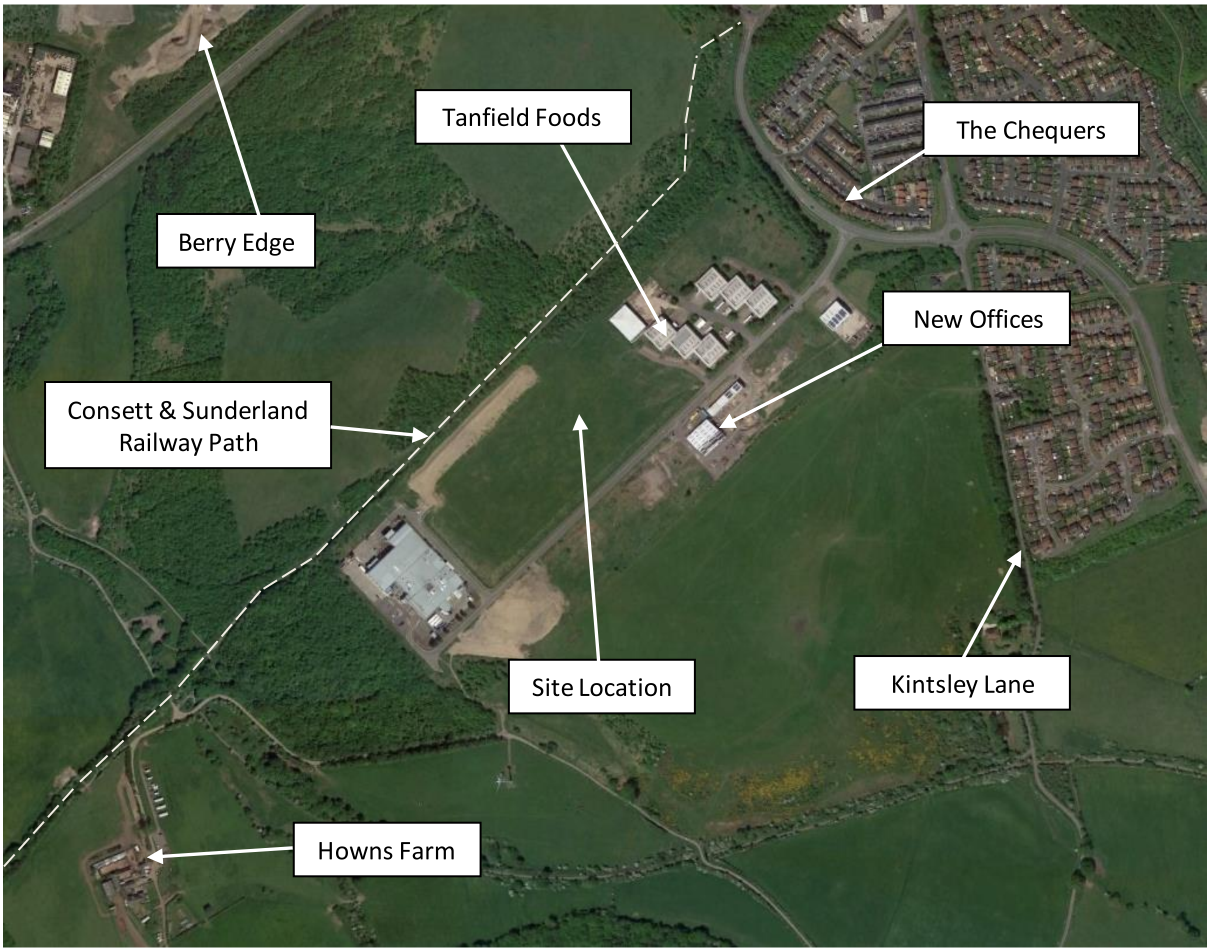
1.2.1 The proposed facility would be located within Hownsgill Park, Consett, Durham, on land to the north of the main road. The site is centred at grid reference NZ 10374 49735 approximately.

1.2.2 To the north of the proposed development site is the Consett & Sunderland Railway Path (also known as Hownsgill Viaduct National Cycle Route) with woodland beyond to the A692; beyond that is new residential development at Berry Edge. To the east are other commercial/industrial premises within Hownsgill Park with residential development beyond. To the south is further commercial/industrial development under construction with open land beyond as far as the Lanchester Valley Railway Path and woodland beyond. To the west is further commercial/industrial development with woodland beyond to the Lanchester Valley Railway Path and Consett & Sunderland Railway Path beyond which is Hownsgill Viaduct.

1.2.3 The nearest identified sensitive receptors are shown in Figure 1.1, namely:

- Properties on Berry Edge to the north of the A692;
- Properties on The Chequers to the northeast of the site;
- Properties on Knitsley Lane to the east on the site;
- Howns Farm, to the southwest of the site;
- Tanfield Foods offices to the east within Hownsgill Park;
- The Consett & Sunderland Railway Path; and
- Offices in the commercial/industrial unit under construction on the opposite side of the road.

Figure 1-1: Site Location Plan



1.3 Noise Assessment Methodology

1.3.1 The noise assessment for the proposed development has been undertaken in accordance with the guideline noise criteria outlined in British Standard 5228:209+A1:2014 *Code of practice for noise and vibration control on construction and open sites*.

2 Standards and Guidance

2.1 British Standard 5228:2009+A1:2014

Part 1: Noise

2.1.1 British Standard 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites, Part 1: Noise* (BS5228-1) sets out methods for predicting noise levels arising from a wide variety of construction and related activities.

2.1.2 Noise level generated by construction activities and experienced at local receptors will depend on several variables, the most significant of which are:

- The sound power outputs of the plant, equipment and/or process.
- The periods of operation of the plant, equipment and/or process.
- The distance between the source of noise and the receptor.
- The presence of screening by buildings, barriers or landforms.
- The potential reflection of sound.
- Soft ground attenuation.

2.1.3 It is understood that construction operations at the proposed development would only occur during normal daytime working hours, i.e. between 07:00 and 19:00 hours Monday to Friday and between 07:00 and 13:00 hours on Saturdays.

2.1.4 BS5225-1 gives several examples of acceptable limits for construction noise. For the purposes of this assessment, the 'Potential significance based upon noise change – The ABC method' has been used for residential receptors and the 'Potential significance based on fixed noise limits' method has been used for all other receptors. Both methods are described below.

Potential Significance Based upon Noise Change – The ABC Method

2.1.5 The ABC method gives examples of thresholds of potential significant effects at dwellings when the noise level from construction operations, rounded to the nearest decibel, exceeds the tabulated value. The values are shown in Table 2-1 below.

2.1.6 The table is designed to be used as follows:

"for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5dB. This is then compared to the site noise level. If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant impact."

Table 2-1: BS5228 – Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) $L_{Aeq,T}$		
	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 potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.			
NOTE 2 If the ambient noise level exceeds Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise.			
NOTE 3 Applies to residential receptors only.			
A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.			
B) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.			
C) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.			
D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays			

Potential Significance based on Fixed Noise Limits

2.1.7 Noise from construction sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. Noise levels, between 07:00 and 19:00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise.
- 75dB(A) in urban areas near main roads in heavy industrial areas.

2.1.8 These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments and when working outside the normal hours, e.g. between 19:00 and 22:00 hours, the allowable noise levels from building sites will be less and should be agreed with the Local Planning Authority. Noisy work likely to cause annoyance locally should not be permitted between 22:00 and 07:00 hours.

Part 2: Vibration

2.1.9 British Standard 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites, Part 2: Vibration* (BS5228-2) gives recommendations for basic methods of vibration control relating to construction site where work activities/operations generate significant levels of vibration.

2.1.10 BS5228-2 indicates that most people are known to be very sensitive to vibration with the threshold of perception being typically in the 0.14mms-1 to 0.30mms-1 peak particle velocity range. Vibration levels above these values can cause disturbance.

2.1.11 Table 2-2 details the guidance on the effects of construction vibration outlined in BS5228-2.

Table 2-2: BS5228 Guidance on the effects of vibration levels

Vibration Level mms^{-1}	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30	Vibration might just be perceptible in residential environments.
1.00	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warnings and explanation has been given to residents.
10.00	Vibration is likely to be intolerable for any more than a very brief exposure at this level.

2.2 ISO9613 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

2.2.1 The noise levels generated by the operation of the proposed development have been predicted using the calculation methodology set out in ISO9613-2. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

2.2.2 The methodology assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3 Baseline Noise Survey & Receptor Noise Climate

3.1.1 Baseline noise measurements were undertaken on Thursday 6th August 2020 to gather background and ambient noise levels at locations at or representative of the nearest residential receptor locations to the proposed development site.

3.1.2 Measurement were taken over two non-consecutive 1-hour periods. The monitoring locations used for the survey are shown in Figure 3-1. The noise monitoring equipment used during the surveys is shown in Table 3-1 and was set to record the $L_{Aeq,T}$, L_{A90}, L_{A10} and L_{Afmax} parameters.

Figure 3-1: Noise Monitoring Location Plan

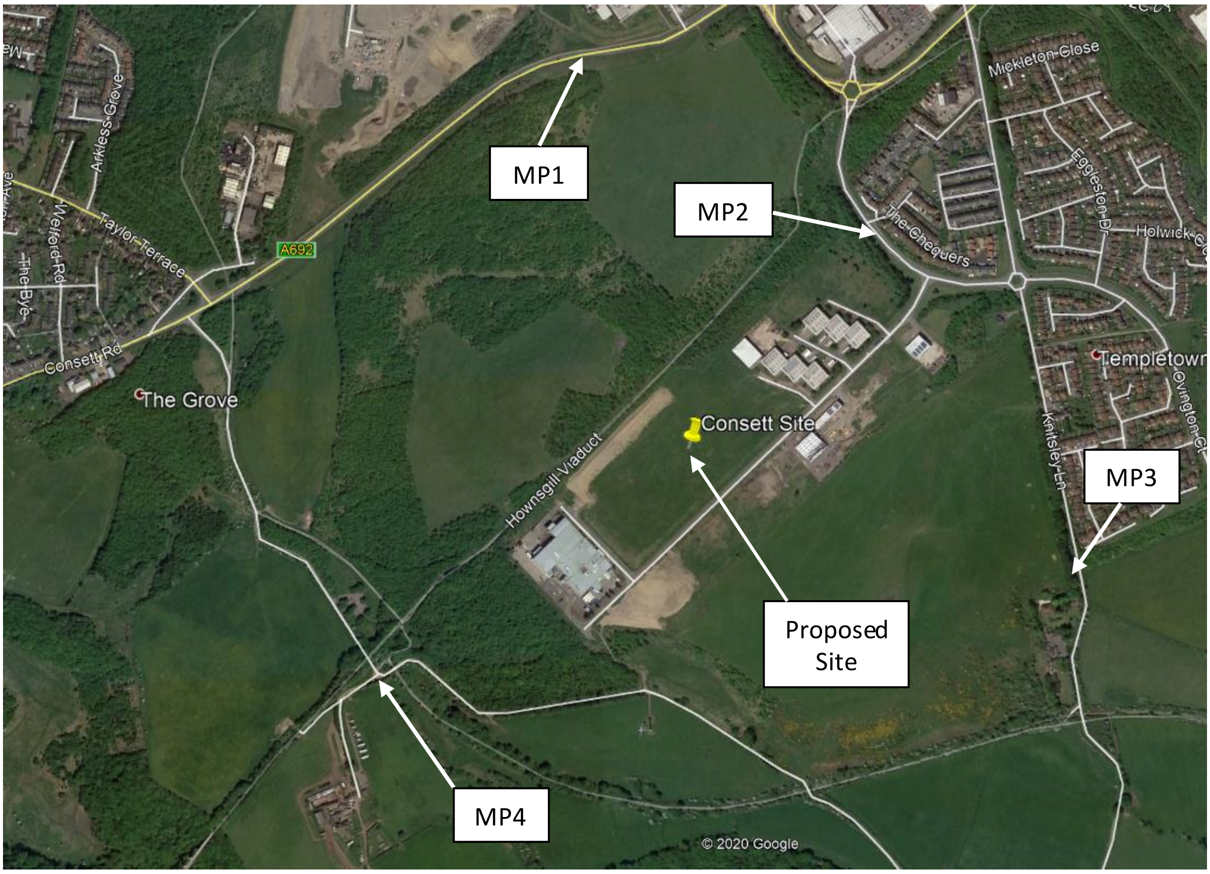


Table 3-1: Noise Monitoring Equipment

Location	Equipment Description	Serial Number	Calibration Date
MP1 & MP3	01dB Solo Class 1 sound level meter	065396	05/02/2020
MP2	01dB Solo Class 1 sound level meter	065446	17/04/2020
All	Cirrus CR:515 Acoustic calibrator	59522	05/02/2020

3.1.3 The following set-up parameters were used on the sound level meter during all the noise measurements undertaken:

Time Weighting: Fast

Frequency Weighting: "A"

3.1.4 The sound level meter was field calibrated, using an electronic calibrator, prior to commencement and upon completion of the overall survey, no drift in calibration was observed. The external calibration documentation for the equipment used is available upon request.

3.2 Weather

3.2.1 Weather conditions during the baseline survey periods were noted and are detailed in Table 3-2.

Table 3-2: Weather Conditions

Period	Precipitation	Cloud Cover	Max. wind-speed	Temperature
Daytime	None, dry roads	90%	<5.0ms^{-1}	18°C
Night-time	None, dry roads	40%	<5.0ms^{-1}	15°C

3.3 Survey Results

3.3.1 The results of the baseline surveys are summarised in Table 3-3 and can be found in full in Appendix A.

Table 3-3: Summary of Baseline Survey Results, dB

Location	Period	$L_{Aeq,T}$	L_{Amax}	L_{A90}	L_{A10}
MP1 – Berrys Edge	Day	76.1	91.7	60.6	79.7
MP2 – Roman Gardens	Day	68.4	87.1	41.8	73.0
MP3 – Rockliffe Avenue	Day	50.4	77.3	35.8	47.3
MP4 – Howns Farm	Day	50.7	78.2	35.2	46.4

4 Assessment

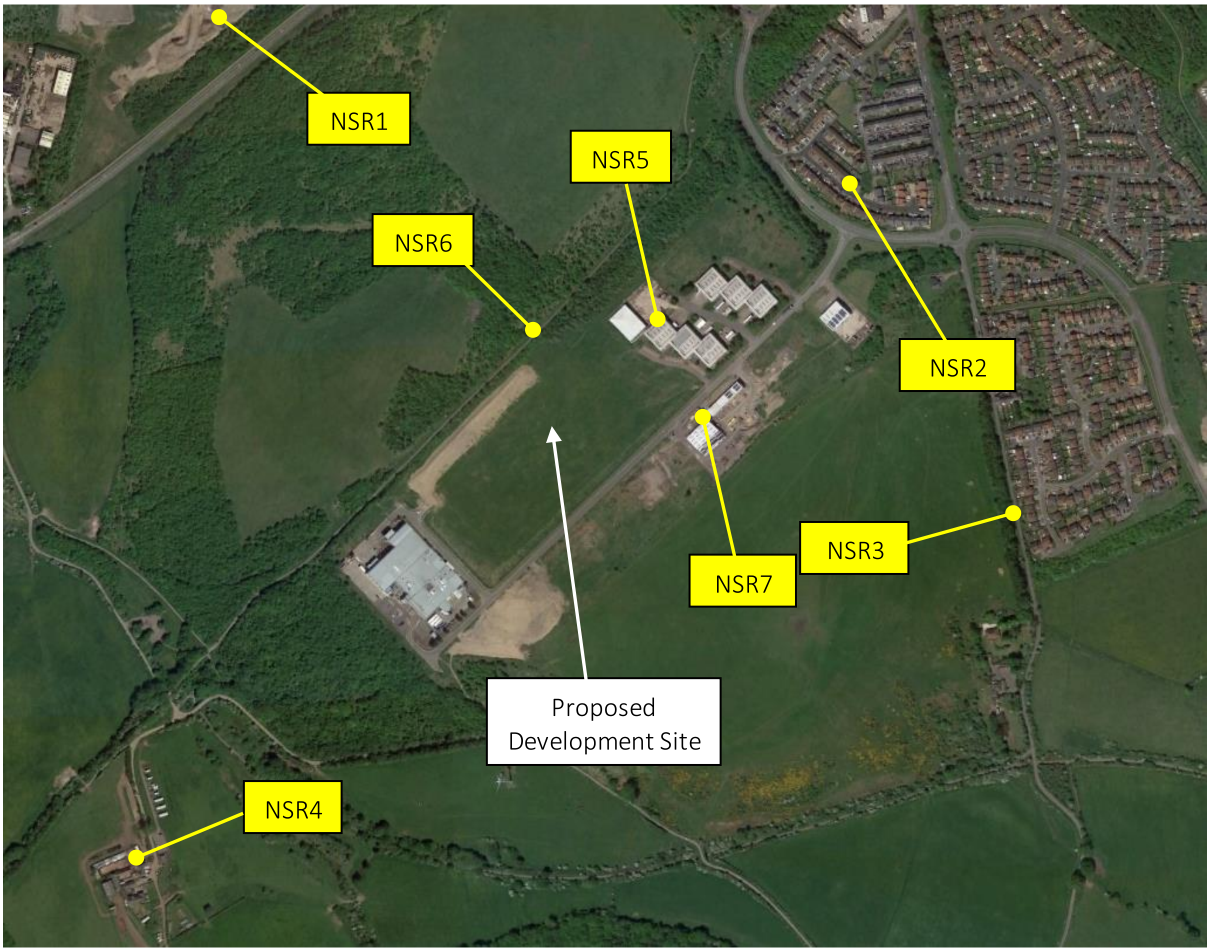
4.1 Construction Noise Assessment

4.1.1 Noise levels generated by construction works have been predicted and assessed in accordance with the guidance contained in BS5228-1.

4.1.2 It is inevitable, with developments of this nature, that construction works may cause some disturbance to those living and/or working nearby. However, disruption due to construction works is, typically, a localised phenomenon and generally temporary in nature. Only people living and/or working within approximately 100 to 200m of the site are likely to be significantly affected by construction noise.

4.1.3 An estimate of the likely effects of noise from construction activities has been made to the nearest noise-sensitive receptors, shown in Figure 4-1, over a normal working day.

Figure 4-1: Noise Assessment Location Plan



(Image Source: ©Google)

4.1.4 At this stage there are no specific details of the likely plant or equipment which will be used during the construction of the proposed development. Therefore, a generic list of construction plant is shown in Table 4-1.

4.1.5 It is acknowledged that there may be other 'sub-phases' of construction works however, in the absence of more detailed information pertaining to the methodology and/or make and model of plant and equipment to be used, the assessment has been made for a worst-case situation where all plant is operating simultaneously and at the closest approach to the nearest identified receptors.

Table 4-1: Assumed Construction Plant and Equipment

Activity	Plant Item	No. of Plant	Plant L_{WA}, dB
Site Clearance	Tracked Excavator	2	108
	Dozer	1	109
	Articulated Dumper	2	108
	Grader	1	104
Hardstanding Preparation	Road Roller	1	108
	Vibratory Roller	1	108
	Asphalt Paver (including truck & hopper)	1	103
	Road Sweeper	1	104
Piling Operations	Piling Rig	1	115
Building Foundations & Erection	Concrete Truck – Pouring	2	108
	Concrete Pump	2	107
	Tracked Excavator	2	108
	Mobile Crane	2	110
	Mobile Work Platform	2	95
	Power Tools	2	108
	JCB Telehandler	2	99
	Delivery Trucks (5 per hour worst-case)	5	116

4.1.6 The noise model was constructed using the proprietary noise modelling software package CadnaA. The potential noise impacts at the nearby receptors have been predicted using the calculation methodology outlined in BS5228-1.

4.1.7 The noise model was constructed utilising Google Earth geo-referenced 1:1 scaled aerial photography, openstreetmap.org mapping data and DEFRA ground height data. The following assumptions have been made during the modelling process:

- All sources have a 100% operational time over the assessment period.
- Wind and temperature gradient assisted sound propagation at all receptors.

4.1.8 The predicted noise levels include the noise levels generated by construction traffic movements between the site and the A692. Average vehicle speeds of 25kph have been assumed for all traffic. It is assumed that there would be five two-way movements per hour associate with construction works.

4.1.9 Table 4-2 shows the assessment of predicted construction noise at nearby residential dwellings against the 'threshold of potential effect at dwellings' values from the 'ABC method' outlined in BS5228-1. Predicted noise levels have been rounded to the nearest whole decibel.

4.1.10 Table 4-2 shows that predicted noise levels generated by all construction works being undertaken simultaneously at their closest approach to the nearby residential dwellings would meet the noise limits derived in accordance with the guidance contained in BS5228-1 without the need for specific mitigation measures being applied.

Table 4-2: Construction Noise Assessment – Residential Dwellings

Receptor	Measured Ambient Noise Level dB $L_{Aeq,T}$	Ambient Noise Level Rounded to the Nearest 5dB	Predicted Noise Level from Construction Operations dB $L_{Aeq,1hr}$	ABC Category and/or Derived Limit based on Ambient Noise Levels, dB(A)	Difference dB(A)
NSR1 – Berry Edge	76	75	52	C (75)	-23
NSR2 – The Chequers	68	70	59	B (70)	-11
NSR3 – Knitsley Lane	50	50	55	A (65)	-10
NSR4 – Howns Farm	51	50	51	A (65)	-14

4.1.11 Table 4-3 shows the assessment of predicted construction noise at nearby offices using the 'potential significance based on fixed noise limits' method outlined in BS5228-1. The assessment uses the fixed value of 75dB(A) for urban areas near main roads and industrial areas.

Table 4-3: Construction Noise Assessment – Non-residential Receptors

Receptor	Predicted Noise Level from Construction Operations dB $L_{Aeq,1hr}$	Derived Limit based on Fixed Noise Limits dB(A)	Difference dB(A)
NSR5 – Tanfield Food Offices	69	75	-6
NSR6 – Offices on Hownsgill Park (opp)	70		-5

4.1.12 Table 4-3 shows that worst-case predicted noise levels generated by construction works would be below the fixed noise limit at all office receptors assessed.

4.1.13 The proposed development site is located within an existing industrial park, close to significant transport infrastructure and other industrial development currently under construction. It is therefore considered that the results of the assessments of construction noise show that there would be no significant effects from construction noise associated with the proposed development.

4.1.14 Based on the results of the assessment, it is considered that specific mitigation measures are not necessary.

4.2 Construction Vibration Assessment

4.2.1 BS5228-2 gives recommendations for controlling vibration on construction sites. It is considered that that the main source of vibration during construction works would relate to piling activities.

4.2.2 Table 4-4 shows the predicted vibration levels generated by piling operations during construction of the building foundations at the nearest sensitive receptor locations and provides an indication of the probable perception levels as described in BS5228-2. The predictions are based on the use of vibratory piling techniques.

Table 4-4: Vibration Assessment

Receptor	Distance from Source to Receptor m	Predicted Vibration Level mms^{-1}ppv	Perception Level
NSR1 – Berry Edge	620	0.06	Vibration might just be perceptible in the most sensitive situations.
NSR2 – The Chequers	465	0.09	
NSR3 – Knitsley Lane	650	0.06	
NSR4 – Howns Farm	675	0.02	
NSR5 – Tanfield Food	180	0.31	Vibration might be just perceptible in residential environments
NSR6 – Offices (opp)	190	0.29	

4.2.3 Table 4-4 shows that predicted vibration levels due to piling operations associated with the construction of the building foundations are at a level better than that which '*might be just perceptible in the most sensitive situations*' at the nearby residential receptors.

4.2.4 At the adjacent offices, predicted vibration levels due to piling operations are at a level that is below that which '*might be just perceptible in residential environments*'.

4.2.5 Based on the results of the vibration assessment, it is considered that mitigation measures to reduce the likelihood of complaints due to vibration from construction operations are not required.

5 Mitigation Measures

5.1 Construction Noise

5.1.1 The construction noise assessment has shown that the predicted noise levels would be well within the limits derived in accordance with the guidance contained in BS5228-1 and therefore specific mitigation measures to control construction noise are not required.

5.1.2 However, it is recommended that good site practice methods are followed during construction operations. There are several safeguards which exist to minimise the effects of construction noise, including:

- The various EC Directives and UK Statutory Instruments that limit noise emissions from construction plant.
- The guidance contained in BS5228-1:2009+A1:2014.
- The powers that exist for local planning authorities, under the relevant sections of the current version of the Control of Pollution Act, to control environmental noise and pollution on construction sites.

5.1.3 The following generic measures are given to illustrate the range of best practice techniques available. The adoption of Best Practicable Means, as defined by COPA, is usually the most effective means of controlling noise from construction sites. In addition, the following measures should be considered where appropriate:

- Strategic phasing of construction works to minimise potential impacts.
- Any compressors, etc., used on site should be silenced and fitted with acoustic enclosures or sound reduced models used.
- All pneumatic tools should be fitted with silencers/mufflers.
- Delivery vehicles should be routed to minimise disturbance to nearby residents and delivers should be programmed to arrive during the least sensitive times of day.
- Delivery vehicles should be prohibited from waiting with the site with their engines running.
- Care should be taken when unloading vehicles to avoid creating unnecessary noise.
- All plant items should be properly maintained and operated according to the manufactures' recommendations.
- Potential problems concerning construction noise can sometimes be avoided by taking a considerate and neighbourly approach to relations with nearby residents.
- Construction works should not be undertaken outside of the hours agreed with the Local Planning Authority.

5.2 Construction Vibration

5.2.1 The nearest vibration-sensitive residential dwelling, to any area of the proposed development where perceptible levels of vibration may occur, is over 450m from the location where plant may give rise to vibration. At this distance vibration levels, due to piling operations, are likely to be well below the level which might be just perceptible in the most sensitive situations.

5.2.2 It is considered that, due to the short-term nature of piling operations at the site and the relatively low levels of vibration perceptible, further mitigation measures are unnecessary.

6 Conclusion

6.1 Background

6.1.1 Enzygo Limited (Enzygo) has been commissioned by Project Genesis Limited (PGL) to undertake a construction noise and vibration impact assessment, as part of an Environmental Statement, to support a planning application for a new energy facility at Hownsgill Park, Consett, Durham.

6.1.2 The construction noise and vibration assessment has been undertaken to assess the potential impacts, in accordance with the relevant standards and guidance, at the nearest noise-sensitive properties to the site and to provide outline mitigation advice where considered necessary.

6.2 Construction Noise and Vibration Assessment Conclusions

6.2.1 The construction noise assessment has shown that predicted noise levels would remain below the noise limits derived in accordance with the guidance contained in BS5228-1 at all residential and non-residential receptors assessed.

6.2.2 The construction vibration assessment has shown that levels of vibration due to piling operations, the main source of construction vibration, would be below levels that may just be perceptible in in the most sensitive situations at the residential receptors assessed. At nearby offices, vibration levels would be at below a level which may be just perceptible in residential environments.

6.2.3 Based on the findings of the assessment, specific mitigation measures to reduce the potential impacts of construction noise and vibration are considered unnecessary.

6.3 General Conclusion

6.3.1 Based on the findings of the assessment, against the guidance contained in the relevant standards, it is considered that construction operations can be undertaken without adversely affecting nearby sensitive receptors in terms of acoustic impact.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
$L_{A10,T}$	The 10th statistical percentile of a measurement period, i.e. the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
$L_{A90,T}$	The 90th statistical percentile of a measurement period, i.e. the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present).*
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.

Term	Definition
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of ±1dB;
- Meteorology – allowance of ±1.9dB; and
- CadnaA noise propagation modelling software – operational accuracy of ±2.1dB

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of ±3dB.

Appendix A – Baseline Noise Data

Table A-1: Location MP1, Consett Road/Berry Edge Development

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 14:03	75.6	88.7	60.2	79.5
06/08/2020 14:18	75.9	91.7	60.1	80.1
06/08/2020 14:33	69.2	83.1	53.3	72.3
06/08/2020 14:48	76.1	87.7	60.4	80.3
06/08/2020 16:28	76.9	86.3	63.5	80.9
06/08/2020 16:43	76.6	87.3	61.5	81.2
06/08/2020 16:58	77.4	87.5	62.7	81.7
06/08/2020 17:13	77.1	85.9	62.9	81.4
Overall (Daytime)	**76.1**	**91.7**	**60.6**	**79.7**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
07/08/2020 00:45	65.4	86.1	23.5	61.6
07/08/2020 01:00	64.6	83.9	25.3	60.5
07/08/2020 02:12	65.9	90.7	28.3	60.3
07/08/2020 02:27	60.1	82.4	24.9	53.3
Overall (Daytime)	**64.5**	**90.7**	**25.5**	**58.9**

Table A-2: Location MP2, The Chequers

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 12:26	68.8	87.1	42.8	73.1
06/08/2020 12:41	69.4	81.3	43.3	74.1
06/08/2020 12:56	69.1	83.0	43.3	73.8
06/08/2020 13:11	68.3	81.6	41.0	73.1
06/08/2020 15:13	68.1	83.6	45.4	73.0
06/08/2020 15:28	67.6	83.7	40.5	72.2
06/08/2020 15:43	67.5	80.4	36.9	72.2
06/08/2020 15:58	68.0	81.8	41.3	72.5
Overall (Daytime)	**68.4**	**87.1**	**41.8**	**73.0**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
06/08/2020 23:58	47.7	74.0	31.5	36.7
07/08/2020 00:13	56.2	78.0	31.0	41.7
07/08/2020 01:28	54.3	79.4	33.3	38.2
07/08/2020 01:43	45.7	70.3	30.3	34.0
Overall (Daytime)	**53.0**	**79.4**	**31.5**	**37.7**

Table A-3: Location MP3, Knitsley Lane

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 12:20	48.6	71.3	32.0	43.4
06/08/2020 12:35	46.8	70.2	33.7	42.5
06/08/2020 12:50	49.5	71.1	31.6	46.6
06/08/2020 13:05	51.5	77.3	33.0	45.9
06/08/2020 15:08	49.8	71.7	36.9	49.8
06/08/2020 15:23	46.7	68.2	34.3	46.9
06/08/2020 15:38	51.7	69.2	44.0	53.0
06/08/2020 15:53	53.7	76.0	40.9	50.4
Overall (Daytime)	**50.4**	**77.3**	**35.8**	**47.3**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
06/08/2020 23:53	43.8	56.3	37.7	46.0
07/08/2020 00:08	41.3	51.6	26.5	45.9
07/08/2020 01:25	30.0	36.4	22.1	33.0
07/08/2020 01:40	22.4	30.5	20.4	23.9
Overall (Daytime)	**39.8**	**56.3**	**26.7**	**37.2**

Table A-4: Location MP3, Howns Farm

Start Time	$L_{Aeq,T}$	L_{AFmax}	L_{A10}	L_{A90}
06/08/2020 13:40	57.0	78.2	31.7	46.8
06/08/2020 13:55	42.2	62.0	33.5	44.8
06/08/2020 14:10	44.9	62.3	34.9	45.2
06/08/2020 14:25	50.8	71.8	34.8	48.3
06/08/2020 16:21	51.1	70.7	37.9	52.0
06/08/2020 16:36	50.0	69.8	38.6	47.8
06/08/2020 16:51	42.2	60.9	35.8	42.5
06/08/2020 17:06	43.7	65.0	34.5	43.4
Overall (Daytime)	**50.7**	**78.2**	**35.2**	**46.4**
Start Time	**$L_{Aeq,T}$**	**L_{AFmax}**	**L_{A10}**	**L_{A90}**
07/08/2020 00:40	41.9	63.9	25.1	33.5
07/08/2020 00:55	51.9	78.4	24.6	36.7
07/08/2020 02:07	38.7	51.3	36.4	40.2
07/08/2020 02:22	39.0	42.1	35.8	40.7
Overall (Daytime)	**46.7**	**78.4**	**30.5**	**37.8**

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