10. NOISE AND VIBRATION

10.1 Introduction

This chapter describes the potential noise and vibration impact of the Proposed Development. The Proposed Development being applied for under this planning application includes for the extraction, processing and washing of sand and gravel and the infilling and restoration of the existing and future quarry void and all related ancillary works within the planning application site. The Proposed Development also includes for the construction of a soil inspection shed, refuelling area, settlement ponds, road improvements, drainage network and berms. A full description of the Proposed Development is provided in Chapter 3 of this EIAR. Both the construction and operational phases have been assessed.

10.1.1 Statement of Authority

This chapter of the EIAR has been prepared by the following staff of AWN Consulting Ltd:

Mike Simms

Mike Simms (Principal Acoustic Consultant) holds a BE and MEngSc in Mechanical Engineering and is a member of the Institute of Acoustics and of the Institution of Engineering and Technology. Mike has worked in the field of acoustics for more than 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential.

Dominic Wright

Dominic Wright (Acoustic Consultant) holds the Institute of Acoustics Diploma in Acoustics and Noise Control, along with a Diploma in Music Technology. With a background in audio engineering, he has over 2 years' experience working in the field of acoustics, contributing to various residential, industrial and infrastructure projects. He also has experience in both environmental noise surveying and modelling.

10.1.2 The Proposed Development

The Proposed Development site comprises land in the townlands of Ballyquin More, Leitrim, Woodpark and Fahy More North, Co. Clare. It is located approximately 8 kilometres southwest of the town of Killaloe and 1.5 kilometres to the northwest of the village of Bridgetown, Co. Clare. The site comprises a quarry void area which has been used for sand and gravel extraction since c. 1954. The Grid Reference co-ordinates for the approximate centre of the site are X 562651, Y 669425 in Irish Transverse Mercator (ITM).

The Proposed Development being applied for under this planning application includes for the construction of a soil inspection shed, refuelling area, settlement ponds, road improvements, drainage network and environmental berms. The Proposed Development also includes for the extraction, processing and washing of sand from an area measuring approximately 16.3 ha which will allow for the extraction of approximately 1,428,571 tonnes of material. The Proposed Development also includes for the infilling and restoration of an existing and future quarry void with inert soil and stone over an area of approximately 34 ha. The site topography ranges between 94 metres above ordnance datum (mAOD) at its highest point to approximately 46 mAOD at its lowest point.

Construction works for the at the site will be minimal. It is estimated that the construction phase of the proposed works required will take approximately 1 month. The construction phase will include:

- Preparation of site for construction;
- Stripping of overburden soils under archaeological supervision for use in construction of environmental berms and ongoing site restoration works;
- Removal of existing internal hedgerows in greenfield extraction area,
- Pouring of concrete for soil inspection area/refuelling area foundation;
- Construction of new drainage network and fuel/oil interceptor at refuelling area;
- Erection of quarantine inspection shed;
- Road paving/improvements;
- Construction of settlement ponds;
- Construction of a fixed processing plant including water management system and ponds for the washing of aggregates; and
- Construction of a new chain-link perimeter fence on the eastern and northern boundaries of the extraction area.

Minor excavations will be required for the installation of drainage pipework. It is proposed that excavated soil material will be reused onsite.

It is anticipated that normal construction working hours will be in line with the opening hours for the existing operational quarry as set out in Section 3.5.5 of Chapter 3.

10.2 Methodology

The scope and methodology of this noise and vibration assessment was defined by the most relevant best-practice guidance documents. These primarily included:

- Environmental Protection Agency (EPA) *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2022);
- Department of Environment, *Quarries and Ancillary Activities, Guidelines for Planning Authorities* 2004 (DEHLG);
- Environmental Protection Agency (EPA) *Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* (EPA, 2006);
- EPA (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4);
- IEMA *Guidelines for Environmental Noise Impact Assessment*, 2014;
- International Organization for Standardization (ISO) *ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise* (ISO, 2017);
- British Standard Institute (BSI) BS 5228-1:2009 +A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (BSI, 2014); and
- British Standard Institute (BSI) BS 5228-2:2009+A:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (BSI, 2014).

In general, the following methodology was followed:

- Measurement of baseline noise information and identification of nearest Noise Sensitive Receptors NSRs;
- Identification of existing and proposed noise sources;
- Prediction of the likely impact on the nearest noise sensitive receptors for the proposed phases;
- Rating of the predicted impact and comparison against relevant assessment criteria; and,
- Recommendation of mitigation measures if required.

This outline methodology is described in more detail in the following sections.

10.2.1 Baseline Noise Survey

The Proposed Development will operate during daytime hours only. Baseline noise monitoring was carried out during representative daytime periods at selected noise sensitive receptors in proximity to the development. The period chosen was selected to provide a typical snapshot of the existing noise within the site boundary in the absence of any operational noise.

A description of measurement locations and the measured results are described in more detail in Section 10.3.

10.2.1.1 Measurement Locations

Four measurement locations were selected; each is described in turn and shown on Figure 10-1. The locations were selected to obtain a representative baseline noise levels within the site and at noise sensitive receptors, in this case houses, in the vicinity of the Proposed Development area.

Table 10-1 Noise Monitoring Locations

Location Reference	Description
NML 1	Noise monitoring position to the south of the site
NML 2	Noise monitoring position to the south of the site within the vicinity of the proposed shed, refuelling area and washplant.
NML 3	Noise monitoring position to the northeast of the site representative of the NSRs along the eastern boundary
NML 4	Noise monitoring position to the north of the site representative of NSRs to the north of the site.

Figure 10-1Noise Monitoring Locations

10.2.1.2 Survey Periods

An attended noise survey was undertaken to obtain typical baseline noise levels within the site and at noise sensitive locations surrounding the site on the 19th April 2023 between 11:40hrs and 16:13hrs.

Measurements were carried out on a cyclical basis with measurement durations of 15 minutes over three rotations.

10.2.1.3 Instrumentation and Setup

The measurements were made using a RION NL - 52 Sound Level Meter. This instrument is a Class 1 instrument in accordance with IEC 651 regulations. The Time Weighting used was Fast and the Frequency Weighting was A-weighted as per IEC 651.

The instrument was calibrated with a Brüel & Kjaer Type 4231 calibrator prior to and after the measurement period. The microphone was protected using a proprietary Bruel and Kjaer windshield. The sound level meter was mounted on a tripod approximately 1.5 metres above ground level and at least 3 metres away from any reflective surfaces.

Factory calibration certificates for the noise level meter and acoustic calibrator, detailing equipment serial numbers are presented in Appendix 9-1 of this report. 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. Survey personnel noted the primary sources contributing to noise build-up during the survey.

10.2.1.4 Measurement Parameters

Several parameters were measured in order to interpret the noise levels. These included the following:

- L_{Aeq} This is the equivalent continuous A weighted sound pressure level. It is an average of the total sound energy (noise) measured over a specified time period.
- L_{A90} Noise level exceeded for 90% of measurement period (steady underlying noise level).
- L_{A10} Noise level exceeded for 10 % of measurement period. It is typically a descriptor of traffic noise.
- L_{Amax} Maximum A weighted noise level measured.

The "A" suffix denotes that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. The "F" suffix denotes that the parameter has been measured with 'Fast' time-weighting applied. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pascal (pa).

10.2.1.5 Meteorological Conditions

Weather conditions during the survey period were dry and overcast with light winds between 2 to 5 m/s and temperatures between 14 to 16°C.

10.2.2 Assessment Criteria

10.2.2.1 Construction Phase - Noise

There are no mandatory noise limits for demolition and construction noise in Ireland. Account must be taken of the technical feasibility of the proposed project, and the trade-off between the noise level, and the duration of the noise exposure when setting criteria for construction noise. The following guidance was consulted:

- BS 5228-1&2:2009 & A1 2014 Parts 1 & 2, Code of Practice for noise and vibration control construction and open sites.
- EPA Environmental Management Guidelines (2006): Environmental Management in the Extractive Industry (Non-Scheduled Activities).

ABC Method

The approach adopted in BS 5228-1 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 Construction Noise Threshold (CNT) noise value that, if exceeded at a location, indicates a potential significant noise impact is associated with the construction activities, depending on the context. Note that, in accordance with BS5228-1 guidance, these assessment criteria are only applicable to residential receptors.

Table 10-2 sets out the values which, when exceeded, signify a potential significant effect at the facades of residential receptors. These are construction noise levels only and not the cumulative noise level due to construction plus existing ambient noise.

Table 10-2 Threshold of Significant effect at Dwellings

Assessment category and threshold Value Period (L_{Aeq})	Threshold value in decibels (dB)		
	Category A [Note A]	Category B [Note B]	Category C [Note C]
Night-time (23.00 – 07.00)	45	50	55
Evening and Weekends	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00-13.00)	65	70	75

Note A: Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
Note 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.
Note C: Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are greater than Category A values.

The approach is as follows: for each period (i.e. daytime, evening and night time) the ambient noise level is determined and rounded to the nearest 5 dB. Baseline monitoring carried out as part of this assessment (Refer to Section 10.3) indicates that the threshold values for Category A are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

10.2.2.1.2 Proposed Construction Threshold Noise Levels

Taking into account the proposed documents outlined above and making reference to the baseline noise environment monitored around the development site (see Section 10.2.1), BS 5228-1 has been used to inform the assessment approach for construction noise.

It is considered appropriate to adopt 65 dB(A) CNT at NSLs for daytime periods and Saturday mornings. Construction will not take place during evening or night-time periods.

10.2.2.1.3 Interpretation of the CNT

In order to assist with interpretation of CNTs, Table 10-3 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of DMRB: Noise and Vibration and adapted to include the relevant significance effects from the EPA Guidelines[1] (EPA 2022).

Table 10-3 Description of the magnitude of impacts

Construction Noise Level	Magnitude of Impact (DMRB)	EPA Significance of Effect	Determination
Below or equal Baseline Noise Level	Negligible	Not Significant	Depending on range of Construction Noise Level and baseline noise level
Above Baseline and below or equal to CNT	Minor	Slight – Moderate	
Above CNT and below or equal to CNT + 5dB	Moderate	Moderate – Significant	
Above CNT + 5dB	Major	Significant – Very Significant	

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely effects during the construction stages.

10.2.2.2 Potential Significant Impacts – Consideration of Duration

In accordance with the DMRB Noise and Vibration Guidance, construction noise and construction traffic noise effects shall constitute a significant effect where it is determined that a major or moderate magnitude of effect will occur for a duration exceeding:

- Ten or more days or night in any 15 consecutive day or nights, or
- A total number of days exceeding 40 in any six consecutive months.

10.2.2.3 Construction Phase – Vibration

There is no published Irish guidance relating to vibration during construction activities. Common practice in Ireland has been to use guidance from internationally recognised standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or

[1] *Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).*

structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimetres per second (mm/s).

The National Roads Authority recommends that vibration from road construction activities be limited to the values set out in Table 10-4 in order to ensure that there is no potential for vibration damage during construction. These values have been derived through consideration of the various standards discussed above; compliance with this guidance should ensure that there is little to no risk of even cosmetic damage to buildings.

Table 10-4 Allowable vibration in order to minimise the risk of building damage

Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50 Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes in the case of nominally continuous sources of vibration such as traffic. However, higher levels of vibration are typically tolerated for single events or events of short duration.

No significant vibration is anticipated from the construction phase of the development, given the distances to NSRs.

10.2.2.4 Overburden Removal, Extraction and Restoration

The Department of Environment, *Quarries and Ancillary Activities, Guidelines for Planning Authorities 2004* and the EPA *Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (2006)* notes the following in relation to recommended Emission Limit Values (ELV's) for quarry sites:

In relation to quarry developments and ancillary activities, it is recommended that noise from the activities on site shall not exceed the following ELV's at the nearest noise sensitive receptor.

- Daytime (08:00hrs to 20:00hrs) 55dB $L_{Aeq,(1\ hour)}$
- Night-time (20:00hrs to 08:00hrs) 45dB $L_{Aeq,\ (1\ hour)}$

This document also states that *95% of all noise levels shall comply with the specified limit value(s). No noise level shall exceed the limit value by more than 2 dBA.*

This Guidance acknowledges the variability of operational intensity from time to time.

10.2.2.5 Additional Vehicular Activity on Public Roads

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated change in traffic noise levels that will arise as a result of vehicular movements associated with the Proposed Development. To assist with the interpretation of the noise associated with additional vehicular traffic on public roads, it is proposed to adopt guidance from *Design Manual for Roads and Bridges LA111 (DMRB), Highways England, Transport Scotland, The Welsh Government and The Department of Infrastructure 2020.*

Table 10-5 taken based on guidance in DMRB presents guidance as to the likely impact associated with any long-term change in the traffic noise level ($L_{A10,18hr}$) at a noise sensitive receiver.

Table 10-5 Classification of magnitude of traffic noise changes in the long term

Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Long-term)	EPA Significance of Effect
0.0 – 0.9	Inaudible	Negligible	Imperceptible
0.1 – 2.9	Barely Perceptible	Not Significant	
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Significant
10+	Doubling of loudness and above	Major	Very Significant

The DMRB guidance outlined above will be used to assess the predicted increases in traffic levels on public roads associated with the Proposed Development and comment on the likely impacts.

10.2.2.6 Vibration

The Proposed Development does not include blasting or rock breaking, therefore no significant off-site vibration effects are expected.

10.2.3 Forecasting Methods

Noise prediction calculations for both the construction and operational phases have been conducted in accordance with BS 5228: 2009+A1:2014: Code of practice for noise control on construction and open sites - Noise.

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise, calculates noise levels in accordance with ISO 9613:2024 Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 2024. DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources.

Changes in road traffic noise on the local road network have been considered using prediction guidance contained within Calculation of Road Traffic Noise (CRTN) issued by the Department of Transport in 1988.

10.3 Existing Environment

The site is set in a rural location in Ballyquin, Co. Clare. The site is north of the R466 and is bound by farm and agricultural lands to the north and west. To the east the site is bound by Jim Bolton Sand and Gravel.

The survey was conducted on 19th April 2023 between 11:40hrs and 16:13hrs. The period chosen was selected in order to provide a typical snapshot of the existing noise within the site boundary in the absence of any operational noise.

10.3.1 Results of Baseline Survey

The results of the baseline noise survey are described in the following sections.

10.3.1.1 Noise Monitoring Location 1 (NML 1)

Table 10-6 presents a summary of the baseline noise levels measured at NML 1.

Table 10-6 Noise Survey Results at NML 1

Start Time	Measured Noise Levels [dB re. 2×10^{-5} Pa]			
	$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
11:40	38	55	41	29
13:17	52	73	52	31
14:39	40	56	44	30
15:58	33	49	37	27

During the baseline measurements, the main noise source observed at this location was birdsong and distant road traffic from the R466. Other noise sources included intermittent aircraft overhead. Noise from Jim Bolton Sand and Gravel to the east of the site was audible during the second measurement period. Ambient noise levels were in the range of 38dB to 52dB L_{Aeq} and background levels were in the range of 27 to 31dB L_{A90}.

No significant source of vibration was noted at this location.

10.3.1.2 Noise Monitoring Location 2 (NML 2)

Table 10-7 presents a summary of the baseline noise levels measured at NML 2.

Table 10-7 Noise Survey Results at NML 2

Start Time	Measured Noise Levels [dB re. 2×10^{-5} Pa]			
	$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
12:00	44	76	44	32
13:35	42	65	45	32
14:56	42	68	45	33

During the baseline measurements, the main noise sources observed at this location were birdsong, with occasional intermittent aircraft movements. Other noise sources included distant road traffic as well as intermittent works from the site to the east and cattle noise. Ambient noise levels were in the range of 42dB to 44dB L_{Aeq} and background levels were in the range of 32 to 33dB L_{A90}.

No significant source of vibration was noted at this location.

10.3.1.3 Noise Monitoring Location 3 (NML 3)

Table 10-8 presents a summary of the baseline noise levels measured at NML 3.

Table 10-8 Noise Survey Results at NML 3

Start Time	Measured Noise Levels [dB re. 2×10^{-5} Pa]			
	$L_{Aeq,15min}$	LAmax	$L_{A10,15min}$	$L_{A90,15min}$
12:34	41	61	45	31
13:57	41	70	42	31
15:17	41	59	45	31

The main sources of noise at this location were birdsong as well as intermittent aircraft movements. Other noted noise sources were vehicle movements and unloading from the site to the east of Ballyquin. Ambient noise levels were in the range of 41 L_{Aeq} and background levels were in the range of 31 L_{A90}.

No significant source of vibration was noted at this location.

10.3.1.4 Noise Monitoring Location 4 (NML 4)

Table 10-9 presents a summary of the baseline noise levels measured at NML 4.

Table 10-9 Noise Survey Results at NML 4

Start Time	Measured Noise Levels [dB re. 2×10^{-5} Pa]			
	$L_{Aeq,15min}$	LAmax	$L_{A10,15min}$	$L_{A90,15min}$
12:56	43	62	47	32
14:17	44	70	47	34
15:56	40	60	43	29

The main sources of noise at this location were birdsong as well as occasional vehicle movements and site operations from Jim Bolton Sand and Gravel. Other noted noise sources were intermittent aircraft movements. Ambient noise levels were in the range of 40dB to 44dB L_{Aeq} and background levels were in the range of 29 to 34dB L_{A90}.

No significant source of vibration was noted at this location.

10.3.2 Historical Noise Monitoring

BHP Ltd has been carrying out annual noise surveys at the Roadstone facility within Ballyquin, Co. Clare. Noise monitoring was carried out for a period of 15 minutes at each of these locations on a biannual basis. Although the EPA criterion is for noise measurements of 1 hour, the measurements presented in Table 10-10 are considered representative, given that they are broadly consistent from survey to survey.

Results of previous surveys have been provided by Roadstone and the results of the most recent historic surveys (2020 and 2021) are presented in Table 10-10. The measured levels broadly show compliance with the 55 dB(A) noise level limit.

Table 10-10 Summary of Previous Compliance Noise Survey Results

Location	Measured Noise Levels [dB re. 2x10-5 Pa]					
	June 2020			February 2021		
	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,5min}$	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,5min}$
A	42	34	45	37	26	41
B	42	36	45	37	28	40
C	38	34	41	36	24	39
D	42	33	43	33	23	35

The noise historic noise monitoring positions are shown below in Figure 10-2.

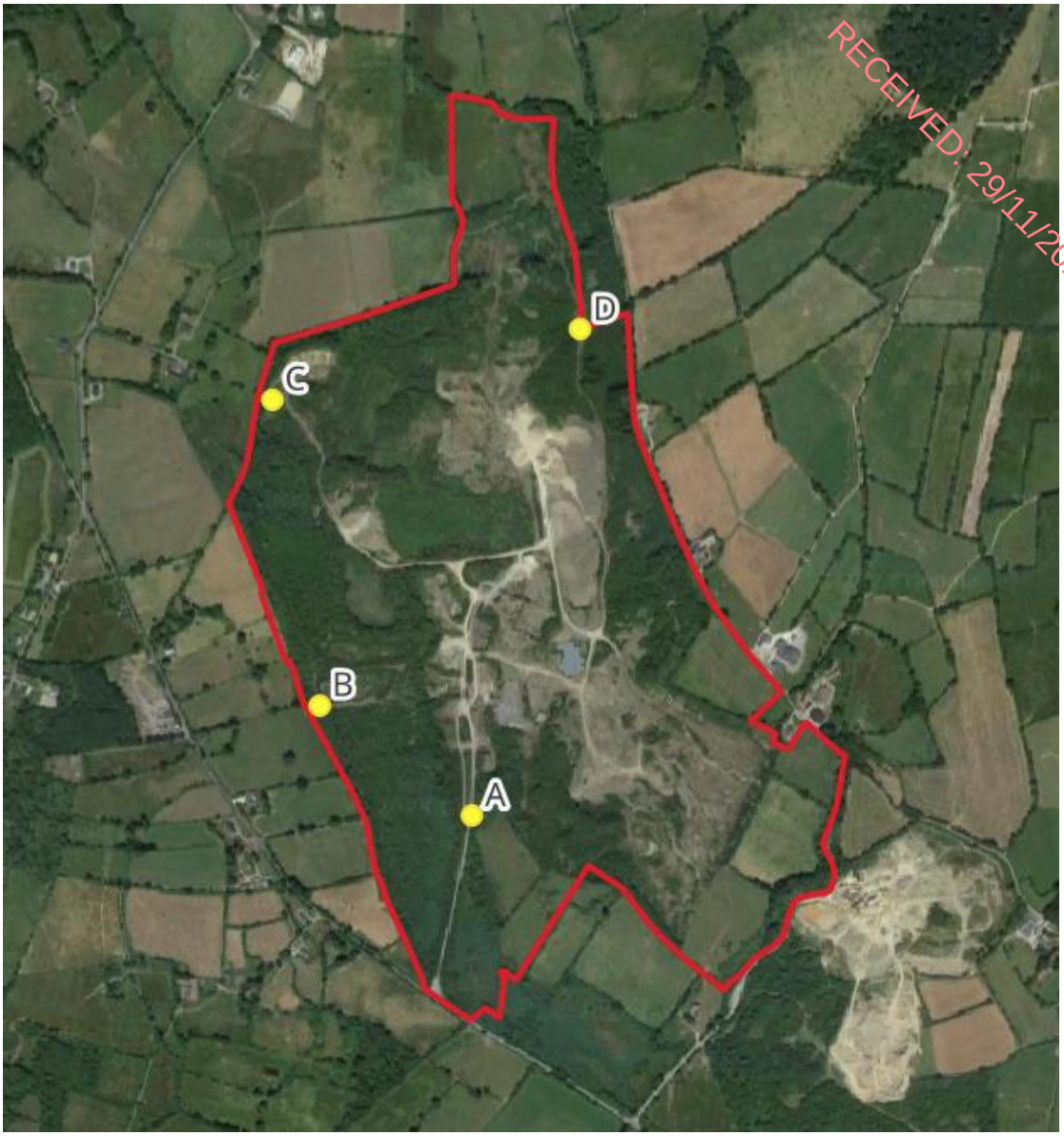

Figure 10-2 Compliance Noise Monitoring Locations A, B, C D,

10.4 Likely Significant Effects and Associated Mitigation Measures

This section describes and assesses the potential noise and vibration impact from the construction and operation of the Proposed Development. The main noise sources associated with the Proposed Development are identified and their impact at the nearest residential receptors is assessed. The noise emission values are compared against existing noise levels and the noise limit criteria as described in Section 10.2.2

10.4.1 Do-Nothing Scenario

If the Proposed Development is not permitted, the site would remain largely unaltered as a result of the Do-Nothing Scenario. There would be no change to existing noise conditions in the area. The potential for additional investment and employment in the area in relation to the operation of the Proposed Development would be lost.

10.4.2 Construction Phase Noise

10.4.2.1 Upgrade of Site Facilities

The construction works at the Proposed Development are expected to be minimal and will utilise the existing quarry infrastructure including internal roads, wheel wash, site office, welfare facilities and other ancillaries to complete the works, the weighbridge will be upgraded as part of the development proposals. It is estimated that the construction phase of the proposed works required will take approximately 1 month.

A quarantine area and refuelling area will be provided as part of the Proposed Development. The quarantine area will comprise of a concrete foundation slab and inspection shed.

The construction phases outlined within section 10.1.2 will include the following processes.

- Preparation of site for construction;
- Stripping of overburden soils under archaeological supervision for use in construction of environmental berms and ongoing site restoration works;
- Removal of existing internal hedgerows in greenfield extraction area,
- Pouring of concrete for soil inspection area/refuelling area foundation;
- Construction of new drainage network and fuel/oil interceptor at refuelling area;
- Erection of quarantine inspection shed;
- Road paving/improvements;
- Construction of settlement ponds;
- Construction of a fixed processing plant including water management system and ponds for the washing of aggregates; and
- Construction of a new chain-link perimeter fence on the eastern and northern boundaries of the extraction area.

For preparation of the site, stripping of overburden soils, and general landscaping works (excavators, loaders, dozers, concreting works, mobile cranes, generators and augured piling), noise source levels are quoted in the range of 70 to 80 dB L_{Aeq} at distances of 10 m within BS 5228-1. For the purposes of this assessment, a combined sound pressure level of 85 dB L_{Aeq} at 10m has been used for construction noise calculations during the above activities. This would include, for example, 2 no. items of construction plant with a sound pressure level of 80 dB L_{Aeq} at 10m and 3 no. items of plant with a sound pressure level of 75 dB L_{Aeq} at 10m, resulting in a total noise level of 85 dB L_{Aeq} at 10m along the closest works boundary. This is a conservative value on the basis that it is unlikely that more than 5

no. items of such plant/equipment would be operating simultaneously in such close proximity to each other at all times. In reality items of construction plant and machinery will be operating at varying distances from any one NSL.

Once the site has been cleared, the construction works will involve cranes and mobile plant with lower overall noise levels in addition to the construction of fixed processing plant. For the purpose of this assessment a total sound pressure level of 78 dB L_{Aeq} along the closest works boundary has been used for construction noise calculations during ongoing site works and compounds. This would include, for example, one item of plant at 75 dB L_{Aeq} and three items of plant at 70 dB L_{Aeq} operating simultaneously within a work area simultaneously.

Construction noise levels have been calculated at the closest NSLs, assuming the construction noise levels discussed above. The calculations assume that the equipment will operate for 66% of the working time over a construction working day. No account of screening has been included from any site hoarding or boundary treatments. Figure 10-3 identifies the nearest NSRs for the purpose of the construction assessment whilst Table 10-11 and Table 10-12 present the predicted noise levels.

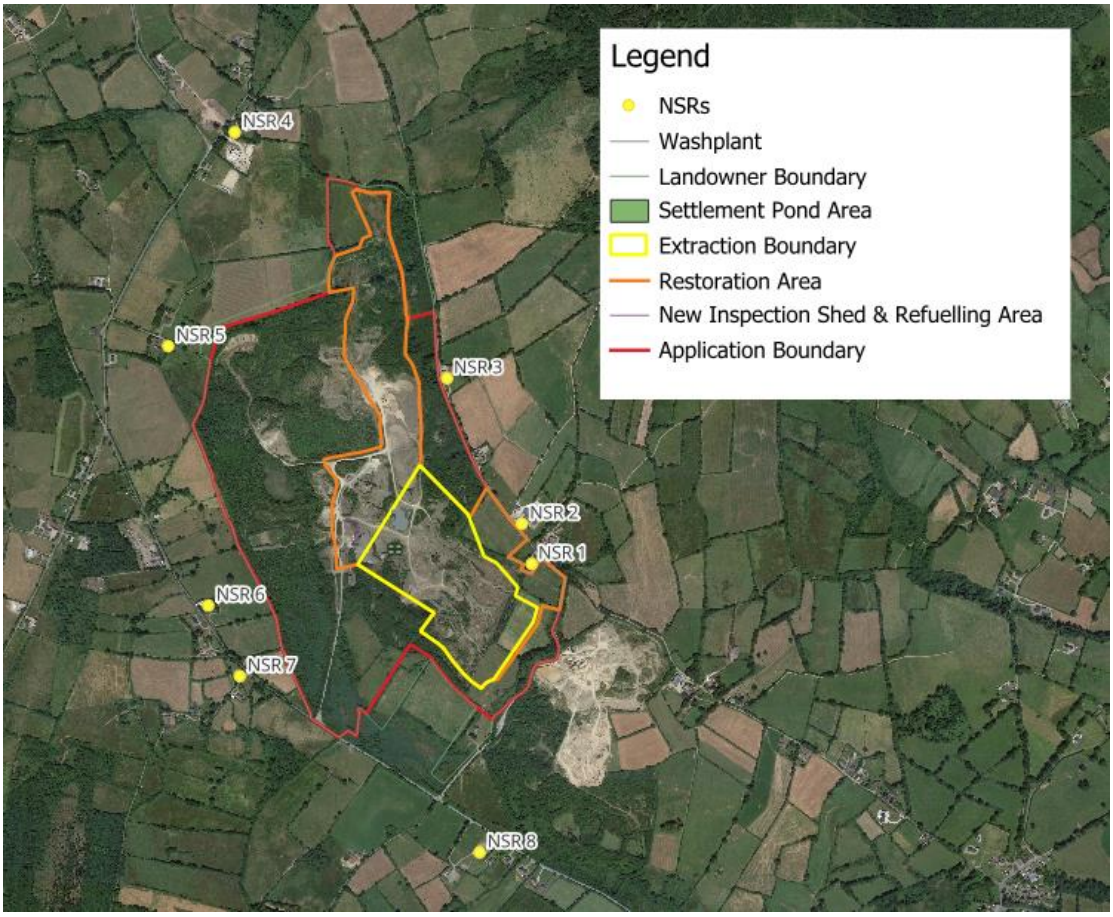

Figure 10-3Nearest NSRs

Table 10-11 Noise levels at NSRs due to construction noise works at Extraction and Restoration Boundary

Sound Pressure Level at 10m	Calculated Noise Levels at NSLs dB $L_{Aeq,T}$							
	NSR 1 (55 m)	NSR 2 (90 m)	NSR 3 (86 m)	NSR 4 (320 m)	NSR 5 (530 m)	NSR 6 (400 m)	NSR 7 (555 m)	NSR 8 (462 m)
85	65	61	61	48	43	46	43	44

Table 10-12 Noise levels at NSRs due to construction noise works at Fixed Site Installations

Sound Pressure Level at 10m	Calculated Noise Levels at NSLs dB $L_{Aeq,T}$							
	NSR 1 (381 m)	NSR 2 (348 m)	NSR 3 (421 m)	NSR 4 (1.2 km)	NSR 5 (730 m)	NSR 6 (460 m)	NSR 7 (560 m)	NSR 8 (900 m)
78	39	40	39	28	33	38	36	31

The calculated noise levels in Table 10-11 and Table 10-12 show that the CNT of 65 dB $L_{Aeq,T}$ is unlikely to be exceeded at the closest NSRs during either construction phase.

It is worth noting that these calculations are highly conservative and are calculated on the assumption that the works will take place on the immediate boundary of the restoration area. The only works likely to occur on the immediate extraction and restoration boundary will be in relation to the construction of berms and a new chain link fence entailing a limited number of plant items. Part of this boundary will be an acoustic barrier (See Figure 10-4).

All calculations relating to the construction and installation of onsite services and buildings are calculated at distances where likely works will take place. Based on the calculations within Table 10-12 it is predicted that the construction noise in relation to the onsite fixed installations will be well below the adopted construction noise threshold.

Based on the calculated noise levels, the likely effects at the closest residences in relation to construction noise are determined to be negative, slight to moderate and temporary. For locations at distances of 350m or greater the likely effects are negative, not significant and temporary.

In the event of works taking place closer to the site boundary construction levels will need to comply with the adopted CNT of 65 dB (A) at the noise-sensitive locations.

10.4.2.2 Mitigation Measures

Typical construction noise thresholds are not expected to be exceeded therefore no specific mitigation measures are proposed. However, best practice in accordance with BS 5228 should be adhered to. BS5228 includes guidance on several aspects of construction site practices, including, but not limited to:

- Selection of quiet plant;
- Control of noise sources;
- Screening (boundary, and or localised plant screening);
- Hours of work;
- Liaison with the public, and;
- Monitoring.

10.4.2.3 Residual Effects

The expected construction phase noise effects at the nearest NSRs to the site are summarised as follows:

Negative Quality, Not Significant to Moderate Effect and of Temporary Duration.

10.4.3 Construction Vibration

Significant vibration is not expected from the types of equipment to be used; there will be no significant vibration effect associated with the construction activities.

10.4.3.1 Residual Effects

The expected construction phase vibration effects at the nearest NSRs to the site are summarised as follows:

Neutral Quality, Imperceptible and of Temporary Duration.

10.4.4 Operational Phase Noise

10.4.4.1 Overburden Removal

10.4.4.1.1 *Potential Pre-mitigation Effects*

Prior to extracting the underlying sand material, internal hedgerows and vegetation in the extraction area will be removed and overburden will be stripped. This activity will only be carried out within the southeast portion of extraction boundary which is currently grassland. Table 10-13 presents the plant items which will be used to strip the extraction area, along with associated noise levels.

Table 10-13 Plant Items and Associated Noise Levels – Overburden Removal

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB LAeq,T)
Tracked Excavator (C.4.64)	77
Dozer (C.2.1)	75

Noise levels have been calculated at the each NSR, assuming the plant noise levels discussed above and that both plant items are working at the closest distance to each NSR. The calculations assume that the equipment will operate for 66% of the working time over a working day. With reference to the noise-sensitive receptors in Figure 10-3, predicted noise levels are presented in Table 10-14.

Table 10-14 Noise levels at NSRs due to overburden removal at extraction boundary

NSR Ref	Noise Level	Criterion	Exceedance
NSR01	54	55	–
NSR02	47	55	–
NSR03	35	55	–
NSR04	23	55	–

NSR Ref	Noise Level	Criterion	Exceedance
NSR05	29	55	–
NSR06	32	55	–
NSR07	35	55	–
NSR08	38	55	–

The calculated noise levels in Table 10-14 show that the operational noise limit of 55 dB $L_{Aeq,T}$ is unlikely to be exceeded at any NSR during this phase.

10.4.4.1.2 Mitigation Measures

Mitigation measures in respect of environmental noise during overburden removal are not required.

10.4.4.1.3 Residual Effects

Based on the calculated noise levels, the likely effects at the closest residences in relation to noise from overburden stripping are determined to be negative, not significant and short-term.

10.4.4.2 Sand Extraction

10.4.4.2.1 Potential Pre-mitigation Effects

Sand extraction will take place only within the 16.3 ha area indicated in Figure 10-3. Table 10-15 presents the plant items which will be used to strip the extraction area, along with associated noise levels at the reference distance of 10 metres.

Table 10-15 Plant Items and Associated Noise Levels – Sand Extraction

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB LAeq,T)
Tracked Excavator (C.4.64)	77
Dozer (C.2.1)	75
JCB (D.8.13)	82
Dumper Truck (C.4.4)	76
Semi Mobile Screener (C.10.14)	81
Tractor Towing Water Bowser (C.6.38)	83

Similarly, noise levels have been calculated at the each NSR, assuming the plant noise levels listed above and that all of the plant items are working at the closest distance to each NSR. The calculations assume that the equipment will operate for 66% of the working time over a working day. With reference to the noise-sensitive receptors in Figure 10-3, predicted noise levels are presented in Table 10-16.

Table 10-16 Noise levels at NSRs due to sand extraction

NSR Ref	Noise Level	Criterion	Exceedance
NSR01	57	55	+2
NSR02	49	55	–
NSR03	47	55	–
NSR04	29	55	–
NSR05	31	55	–
NSR06	45	55	–
NSR07	44	55	–
NSR08	44	55	–

The calculated noise levels in Table 10-16 show that under the worst-case assumptions (i.e. where all plant items are located at the extraction boundary) the operational noise limit of 55 dB $L_{Aeq,T}$ has the potential to be exceeded at the closest NSR during this phase, i.e. NSR 1, to the east of the site.

Based on the calculated noise levels, the likely effects at the closest residences in relation to noise from sand extraction are as follows:

- At NSR01: negative, significant and long-term.
- At all other NSRs: negative, not significant and long-term.

10.4.4.2.2 Mitigation Measures

In order to reduce the noise levels at NSR1, an acoustic barrier of 3 metres height is proposed, as shown in Figure 10-4. To serve as an acoustic barrier, the structure shall have a minimum surface mass of 10 kg/m^2.

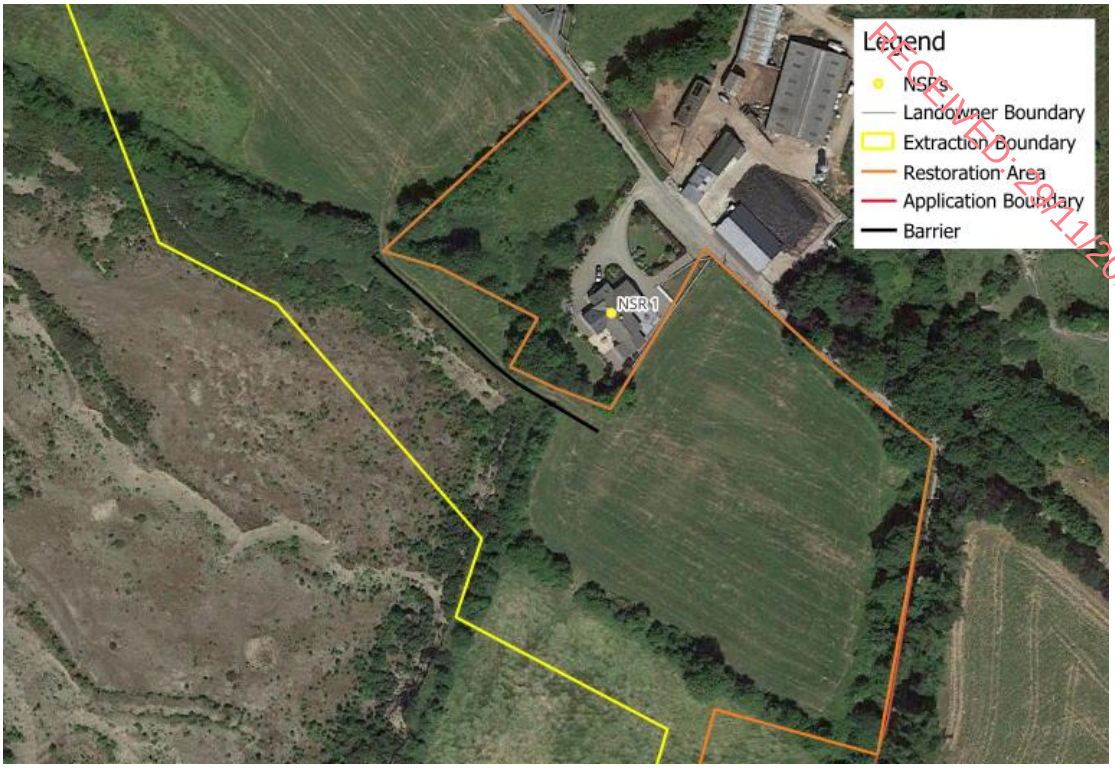

Figure 10-4Location of Acoustic Barrier

With this mitigation measure in place the predicted noise levels are as presented in Table 10-17. Predicted Noise levels at all locations are within the operational noise limit of 55 dB $L_{Aeq,T}$.

Table 10-17 Noise levels at NSRs due to sand extraction – with mitigation measures

NSR Ref	Noise Level	Criterion	Exceedance
NSR01	53	55	–
NSR02	48	55	–
NSR03	47	55	–
NSR04	30	55	–
NSR05	31	55	–
NSR06	47	55	–
NSR07	46	55	–
NSR08	46	55	–

10.4.4.2.3 Residual Effects

With this mitigation measure in place, the likely effects at the closest residences in relation to noise from sand extraction are determined to be negative, not significant and long-term.

10.4.4.3 Infilling and Restoration

10.4.4.3.1 *Potential Pre-mitigation Effects*

Table 10-18 presents the plant items which will be used to carry out infilling and restoration, along with associated noise levels at the reference distance of 10 metres.

Table 10-18 Plant Items and Associated Noise Levels – Sand Extraction

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB LAeq,T)
Tracked Excavator (C.4.64)	77
Dozer (C.2.1)	75
Dumper Truck (C.4.4) (Infilling areas only)	76

Noise levels have been calculated at the each NSR, assuming the plant noise levels discussed above and that all of the plant items are working at the closest distance to each NSR. The calculations assume that the equipment will operate for 66% of the working time over a working day. With reference to the noise-sensitive receptors in Figure 10-3, predicted noise levels are presented in Table 10-19.

Table 10-19 Noise levels at NSRs due to infilling and restoration

NSR Ref	Noise Level	Criterion	Exceedance
NSR01	56	55	+1
NSR02	51	55	–
NSR03	54	55	–
NSR04	38	55	–
NSR05	37	55	–
NSR06	39	55	–
NSR07	38	55	–
NSR08	39	55	–

The calculated noise levels in Table 10-19 show that under the worst-case assumptions (i.e. where all plant items are located at the extraction boundary) the operational noise limit of 55 dB $L_{Aeq,T}$ has the potential to be exceeded at the closest NSR during this phase, i.e. NSR 1, to the east of the site.

Based on the calculated noise levels, the likely effects at the closest residences in relation to noise from infilling and restoration are as follows:

- At NSR01: negative, significant and long-term.
- At all other NSRs: negative, not significant and long-term.

10.4.4.3.2 Mitigation Measures

The acoustic barrier proposed for reducing noise levels from sand extraction, as shown in Figure 10-4, also serves to reduce noise levels at NSR1 also for the infilling and restoration phase.

With this mitigation measure in place the predicted noise levels are as presented in Table 10-20. Predicted Noise levels at all locations are within the operational noise limit of 55 dB $L_{Aeq,T}$.

Table 10-20 Noise levels at NSRs due to infilling and restoration – with mitigation measures

NSR Ref	Noise Level	Criterion	Exceedance
NSR01	53	55	–
NSR02	50	55	–
NSR03	54	55	–
NSR04	38	55	–
NSR05	37	55	–
NSR06	39	55	–
NSR07	38	55	–
NSR08	39	55	–

10.4.4.3.3 Residual Effects

With the 3m high acoustic barrier in place, the likely effects at the closest residences in relation to noise from sand extraction are determined to be negative, not significant and long-term.

10.4.4.4 Additional vehicular traffic on public roads

There will be additional traffic along public roads as a result of the Proposed Development. Please refer to Chapter 13 Material Assets for full details in relation the traffic assessments prepared for the development. Based on traffic flow values presented therein for the Existing Development and Proposed Development scenarios, the changes in traffic noise levels have been calculated for the opening year 2026 and the design year 2046 and are shown in Table 10-21. The noise effects are imperceptible to not significant, therefore no mitigation measures are required in respect of noise additional vehicular traffic on public roads.

Table 10-21 Predicted changes in traffic noise level

Year	Time Period	Road Link	Change in noise level, dB(A)	Change in noise level, dB(A)
2026	AM peak hour	R466 west	+0.9	Imperceptible
		R466 east	+2.3	Not Significant
	PM peak hour	R466 west	+0.7	Imperceptible
		R466 east	+1.8	Not Significant
2046	AM peak hour	R466 west	+0.6	Imperceptible
		R466 east	+1.7	Not Significant

Year	Time Period	Road Link	Change in noise level, dB(A)	Change in noise level, dB(A)
	PM peak hour	R466 west	+0.5	Imperceptible
		R466 east	+1.4	Not Significant

10.4.4.4.1 *Residual Effects*

The expected noise and noise effects in relation to vehicular traffic on public roads can be summarised as follows:

Negative quality, Imperceptible to Not Significant, and of Long-Term duration.

10.5 Cumulative Impacts

10.5.1 Jim Bolton Quarry (ABP Case SU0127)

This application relates to the substitute consent for the quarry to the southwest of the Proposed Development, granted in 2016. This site was understood to be operational during the baseline noise survey and indeed noise from the quarry was audible at certain noise survey locations. As noise measured noise levels were generally well below the operational noise criteria, it is not considered likely that a significant cumulative noise effect would occur.

10.5.2 Fahybeg Wind Farm (ABP Case 317227)

This application relates to the construction of an 8-turbine wind farm to the northeast of the Proposed Development. In the case of wind farms, environmental noise impact is assessed using the LA990 acoustic parameter, where the noise criterion is in the range 40 to 45 dB L_{A90}. Considering the predicted noise levels in section 10.4.4, it is not likely that noise due to the operation of Fahybeg Wind Farm would increase noise levels at the NSRs to the point where the criterion adopted in this assessment would be exceeded.

10.5.3 Summary

Taking the above into account, it is not considered that a significant cumulative noise effect is associated with the Proposed Development.