9.0 CHAPTER 9 NOISE AND VIBRATION

9.1 INTRODUCTION

A noise and vibration impact assessment of the proposed Strategic Housing Development on lands at Clonminch Road, Tullamore, Co. Offaly has been undertaken. This section will provide information on the assessment of noise and vibration impacts on the surrounding environment during both the construction and operational phases. The principal objectives of the Noise and Vibration assessment will be to specify appropriate limit values and mitigation measures to ensure that the impact on the environment is minimised. A full description of the development can be found in Chapter 3.0 of this EIAR.

In terms of this site, noise and vibration will be considered in terms of the outward impact of the development *i.e.* the potential impact of the buildings and commercial activities on existing sensitive receptors in the study area.

9.2 STUDY METHODOLOGY

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken at the nearest noise sensitive properties;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development - this is summarised in the following sections;
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phases of the project at the nearest sensitive locations (NSLs) to the site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the development site, and;
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development.

Typical ambient noise levels across the local area have been measured, and these are used to identify appropriate construction phase noise criteria. Proposed construction plant are also identified and expected noise output data used to predict likely noise levels at surrounding receptors. Predicted levels are assessed in the context of identified criteria, and mitigation measures, where required, are identified.

9.3 RECEIVING ENVIRONMENT

9.3.1 Site Area Description

The proposed development comprises a mix of residential, commercial and community structures, which are proposed to be developed in two phases. The total gross site area comprises 14.3 hectares, which includes part of the Clonminch Road to enable the provision of cycle lanes and parts of the open field to the north to facilitate services infrastructure. This is a greenfield site. The residential net area is 10.1 hectares and is bounded by undeveloped lands that stretch to a railway line to the north, the R443 and residential properties to the west, residential properties to the south and undeveloped lands to the east stretching to the N52 to the east, as detailed in Chapter 3.0. This Noise and Vibration Chapter is focused on the net development area.

9.3.2 Receptors

The existing noise and vibration environments across the development site and in the vicinity of the nearest existing NSLs are dictated by transportation sources in the study area including the existing N52, R443 Clonminch Road, Dublin – Galway railway line to the north and local road movements in the adjoining estates to the north of Phase 1 and west of Phase 2 of the proposed development.

The nearest existing residential NSLs to the proposed Phase 1 development are those located in the Clonminch Wood estate some 5m beyond the northern site boundary, in the residential properties aligning the R443 some 15m beyond the north-western boundary and the cluster of residential properties offset from the R433 road some 45m from the southern boundary. The nearest permitted NSLs are located approximately 5m to the western boundary and 10m to the north-western boundary in the Oaklee Housing development (hereinafter referred to as Oaklee).

In Phase 2, the nearest existing residential NSLs are those located in Clonminch Wood some 10m beyond the western site boundary, and the residential and farmyard area some 300m to the north east.

9.3.3 Desktop Study of Published Data

9.3.3.1 Current Baseline Scenario

Reference has been made to the strategic noise maps produced by the EPA as part of the Round 3 noise mapping study in accordance with the requirements of the Environmental Noise Regulations (S.I. No. 140/2006) to review published data relating to noise sources in the area.

As part of the mapping round, roads with >3 million vehicle movements per annum are modelled and noise contours produced in terms of two noise indicators, L_{den} and L_{night}. These are defined as follows:

- L_{den} is the day-evening-night noise indicator based on year-long averages of the day (07:00-19:00), evening (19:00-23:00) and night (23:00-07:00) time periods. It is 'weighted' to account for extra annoyance in the evening and night periods.
- L_{night} is the night time noise indicator over the night-time period (23:00-07:00hrs).

As part of the noise mapping process for the Round 3 study sections of the N52 have been modelled and mapped using traffic flow data for the year 2016.

Figure 9.1 presents the noise mapping for the long-term day-evening-night (L_{den}) period in the vicinity of the development site, identified in yellow. Reference to Figure 9.1 indicates that road traffic noise across the site is in the range of <55 dB L_{den}.

Figure 9.1 Road Traffic L_{den} Noise Contours (Source epa.ie)

Figure 9.2 presents the noise mapping for the night-time period (L_{night}) period in the vicinity of the development site, identified in yellow. Reference to Figure 9.2 indicates that road traffic noise across the site is <45 dB $L_{night,}$.

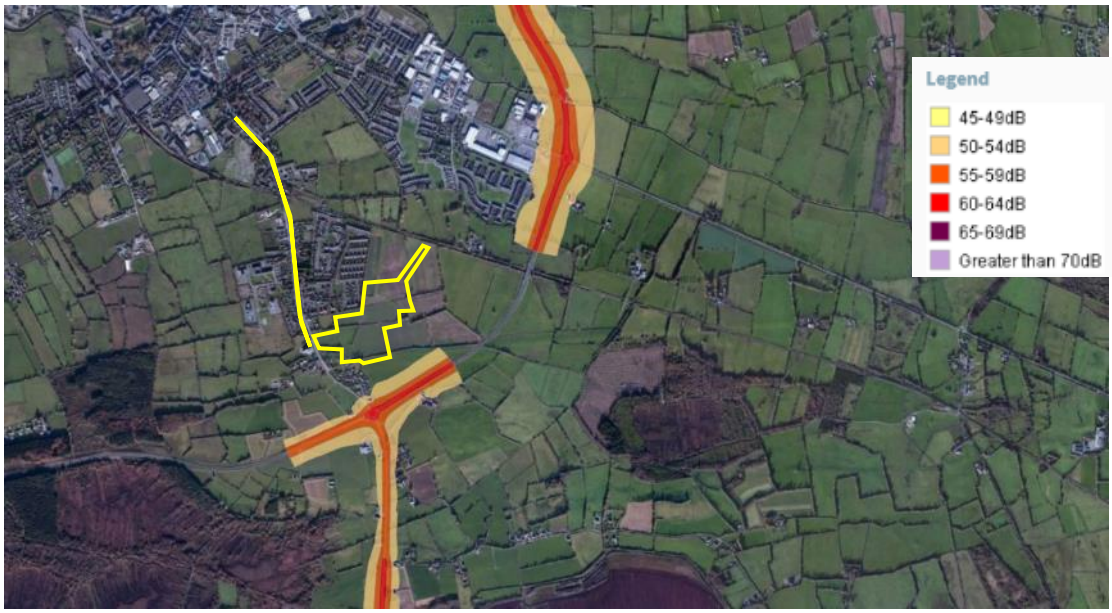

Figure 9.2 Road Traffic L_{night} Noise Contours (Source epa.ie)

As demonstrated in Figure 9.1 and 9.2, the site is not excessively influenced by the N52 and as a result an inward noise impact is not required as part of this development.

9.3.4 Environmental Noise Survey

Baseline noise monitoring has been undertaken in the vicinity of the proposed development site to determine the range of noise levels at varying locations across the site and to establish the existing noise climate the nearest NSLs. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Specific details are set out below.

9.3.4.1 Choice of Measurement Locations

Attended noise measurements were made at three locations around the site. Monitoring location (AN1) was chosen along the western perimeter of the site, representative of the noise climate within the development site and residential properties to the west. Two residential areas (AN2 and AN3) were chosen representative of the closest residential areas to the site. The NSL's are described below and shown in Figure 9.3 and Photographs 9.1-9.3.

AN1 Representative of the nearest NSLs, situated to the west of site;

AN2 Representative of the nearest NSLs, situated to the north of site in Phase 1 and west of the site in Phase 2; and,

AN3 Representative of the nearest NSL, situated to the south of site.

Figure 9.3 Noise Monitoring Locations AN1 to AN3 (Source : Google Earth)

Plate 9.1 AN1 location, positioned near R433 looking south along western site boundary

Plate 9.2 AN2 location, looking south towards the proposed site from Limefield estate

Plate 9.3 AN3 location, looking west towards R443, the proposed site located to the north

9.3.4.2 Survey Periods

The survey was undertaken over the following surveys periods:

- Daytime measurements between 10:55hrs to 13:50hrs on 27 March 2020.

From 13 March 2020 the Irish Government stated that all schools, colleges and childcare facilities in Ireland would be shut and not reopen until at least 29 March 2020. People were also advised to work from home where possible. The extent of potential impacts on the existing baseline environment due to the Covid-19 outbreak restrictions were not expected to significantly affect the baseline survey. If there was a reduction in the road traffic noise, this would have had a positive effect for the nearest NSLs to the proposed development, as the ambient background levels would be lower and noise limits for construction and operation would be based on the lower background noise environment e.g. more onerous noise limits set for the proposed development.

The weather during the survey period was mild and dry with wind speeds up to 4 m/s from the northwest.

9.3.4.3 Monitoring Equipment

The surveys were undertaken using the following monitoring equipment:

Location	Manufacturer	Model	Serial Number
AN1 to AN3	Bruel and Kjaer	2250L	3028635

Table 9.1 Instrumentation Details

Sample periods were 15 minutes. Before and after the survey the measurement instruments were check calibrated using a Brüel & Kjaer 4231 Sound Level Calibrator.

9.3.4.4 Measurement Parameters

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

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{AFmax} is the instantaneous maximum sound level measured during the sample period using the 'F' time weighting.

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

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

9.3.4.5 Survey Results and Discussion

The results of the noise monitoring completed at the various locations are discussed in the following sections.

Location AN1

Table 9.2 reviews the measured noise levels at Location AN1. Road traffic noise from the R443 was the dominant noise source noted at this location, however background road traffic noise from the N52 was also audible during the measurements.

Date	Period	Time	Measured Noise Levels, dB		
			L_{Aeq}	L_{AFmax}	L_{A90}
27 March 2020	Day	11:15-11:30	70	90	47
		12:16-12:31	70	85	48
		13:16-13:31	70	84	48

Table 9.2 Noise Monitoring Results at Location AN1

Daytime ambient noise levels at this location were dominated by road traffic noise from the R443. Noise levels were of the order of 70 dB $L_{Aeq,15min}$ and in the range 47 to 48 dB $L_{A90,15min}$ during the measurement periods.

No significant level of vibration was noted at this location during site attendance.

Location AN2

Table 9.3 reviews the measured noise levels at Location AN2. Road traffic noise from the N52 was the dominant noise sources noted at this location, however intermittent road traffic noise from the R443 was also present during the measurement.

Date	Period	Time	Measured Noise Levels, dB		
			L_{Aeq}	L_{AFmax}	L_{A90}
27 March 2020	Day	10:55 -11:10	51	75	43
		11:56-12:11	46	61	42
		12:57-13:12	48	61	42

Table 9.3 Noise Monitoring Results at Location AN2

Daytime ambient noise levels at this location were dominated by road traffic noise from the N52. Noise levels were in the range 46 to 51 dB $L_{Aeq,15min}$ and in the range 42 to 43 dB $L_{A90,15min}$ during the measurement periods.

No significant level of vibration was noted at this location during site attendance.

Location AN3

Table 9.4 reviews the measured noise levels at Location AN3. Road traffic noise from the N52 was the dominant noise sources noted at this location, however intermittent road traffic noise from the R443 was also present during the measurement.

Date	Period	Time	Measured Noise Levels, dB		
			L_{Aeq}	L_{AFmax}	L_{A90}
27 March 2020	Day	11:35-11:50	52	68	46
		12:34-12:49	54	76	46
		13:35-13:50	51	64	46

Table 9.4 Noise Monitoring Results at Location AN3

Daytime ambient noise levels at this location were dominated by road traffic noise from the N52. Noise levels were in the range 51 to 54 dB $L_{Aeq,15min}$ and of the order of 46 dB $L_{A90,15min}$ during the measurement periods.

No significant level of vibration was noted at this location during site attendance.

9.3.5 Do Nothing Scenario

The Do Nothing scenario is expected to be largely the same as the current baseline scenario in terms of noise and vibration.

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development comprises a mixed-use development of residential units as semi-detached, terraced housing and apartments, commercial units including a creche building in Phase 1 and two neighbourhood centre buildings in Phase 2. The development also includes ancillary developments including car and bicycle parking areas, internal road layouts and landscaping, which includes four public park areas. The proposed SHD also includes for works to Clonminch Road including the provision of 2no. new bus stops and segregated cycle tracks. A full description of the development can be found in Chapter 3.0.

The potential noise and vibration impact on the surroundings are considered for the construction and operational phases of this development.

During the construction phase the main site activities will include site clearance, foundation works, building construction, road works, and landscaping. This phase has the greatest potential noise and vibration impacts on its surrounding environment. Potential vibration impacts are associated with ground excavation works and piling if required. The construction will be short-term carried out in two phases, over a 5 year planning permission period.

During the operational phase of the development, the primary source of outward noise in the operational context relates to any changes in traffic flows along the local road network, operational plant noise and noise breakout from Creche Playground activities.

The potential associated with each phase is assessed in the following sections.

9.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

9.5.1 Noise Criteria

9.5.1.1 Construction Phase

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phases of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

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

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

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 9.5 sets out the values which, when exceeded, signify a potential significant effect at the facades of residential receptors as recommended by BS 5228-1:2009+A1:2014.

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 to 07:00hrs)	45	50	55
Evenings and weekends Note D	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 higher than category A values.

Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

Table 9.5 Example Threshold of Potential Significant Effect at Dwellings

It should be noted that this assessment method is only valid for residential properties.

This assessment process determines if a significant construction noise impact is likely. Notwithstanding the outcome of method above, overall acceptable levels of construction noise are set out in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[1], which should not be exceeded at NSLs during the construction phase of the development. Table 9.6 presents these levels:

Days and Times	Noise Levels (dB re. 2x10-5 Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Table 9.6 Maximum Permissible Noise Levels at the Facade of Dwellings during Construction

Based on the above the following day-time construction noise criteria are proposed for the site:

65 dB $L_{Aeq,1hr}$ at NSL

In exceptional circumstances there may be a requirement that certain construction works are carried out during night-time periods, which would be agreed in advance with the Council. Therefore, no night-time noise limit has been identified *i.e.* to be determined by the Council, if and when construction works are required to be carried out outside of day-time hours.

Construction Vehicular Traffic

In the absence of specific Irish guidelines on noise associated with additional vehicular traffic on public roads it is considered common practice to utilise the Design Manual for Roads and Bridges (DMRB), Highways England Company Limited, Transport Scotland, The Welsh Government and The Department

1 Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004, Transport Infrastructure Ireland

for Regional Development (Northern Ireland), 2020, which offers guidance as to the likely impact in the short-term associated with any change in traffic noise level. Table 9.7 below presents a summary taken from DMRB, which offers guidance as to the likely impact in the short-term associated with any change in traffic noise level.

Change in Sound Level (dB L_{A10})	Magnitude of Impact	Significance
Less than 1.0	Negligible	Not Significant
1-2.9	Minor	Not Significant
3 – 4.9	Moderate	Significant
5+	Major	Significant

Table 9.7 Likely Impacts Associated with Short-Term Change in Traffic Noise Level (Source DMRB, 2020)

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

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

The guidance outlined in Table 9.7 will be used to assess the predicted increases in construction traffic levels on public roads associated with the proposed development and comment on the likely short-term impacts during the construction phase.

9.5.1.2 Operational Phase

The main potential source of outward noise from the proposed development will relate to traffic flows to and from the development site onto the public roads, mechanical and electrical services used to service the various commercial and creche external play area. The relevant guidance documents used to assess potential operational noise and vibration impacts are summarised in the following section.

Change in Traffic Noise Levels

A potential source of outward noise impact associated with the proposed development relates to additional traffic flows on the surrounding road network. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development.

In order to assist with the interpretation of the long-term magnitude of noise associated with vehicular traffic on public roads, Table 9.8 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2020).

Change in Sound Level, dB(A)	Magnitude of Impact
0	Neutral
0.1 – 2.9	Negligible

Change in Sound Level, dB(A)	Magnitude of Impact
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

Table 9.8 Likely Impact Associated with Long-term Change in Traffic Noise Level Source (DMRB 2020)

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

Table 9.8 has previously presented the DMRB (2020) likely impacts associated with change in traffic noise level, the corresponding significance of impact presented in *the 'EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR),* Draft, August 2017 is presented in Table 9.9 for consistency in wording and terminology for the assessment of impact significance.

Change in Sound Level DMRB, 2019 (dB L_{A10})	Subjective Reaction	Impact Guidelines for Noise Impact Assessment Significance (DMRB)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	Neutral	Imperceptible
0.1 – 2.9	Barely perceptible	Negligible	Not Significant to Slight
3.0 – 4.9	Noticeable	Minor	Slight to Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Moderate	Moderate to Significant
10.0 or more	More than a doubling or halving of loudness	Major	Significant to Very Significant

Table 9.9 Likely Impact Associated with a Long-Term Change in Traffic Noise Level (updated)

Offsite Noise Impacts

Once a development of this nature becomes fully operational, a variety of electrical and mechanical plant will be required to service the development. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (*i.e.* overnight). Noisy plant with a direct line-of-sight to noise sensitive properties would potentially have the greatest impact. Plant contained within plantrooms has the least potential for impact once consideration is given to appropriate design of the space.

The following wording would be considered typically suitable for a planning condition related to operational noise (plant) associated with a development of this nature:

"Noise levels from the proposed development should not be so loud, so continuous, so repeated, of such duration or pitch or occurring at such times as to give reasonable cause for annoyance to a person in any premises in the neighbourhood or to a person lawfully using any public space. In particular the rated noise levels from the proposed development shall not constitute reasonable grounds for complaint as provided for in B.S. 4142. Method for rating industrial noise affecting mixed residential and industrial area.

Reason: In order to ensure a satisfactory standard of development, in the interests of residential amenity."

The typical planning condition outlined above related to noise emissions from mechanical plant items makes reference to the British Standard BS 4142: 2014+A1:2019: *Methods for Rating and Assessing Industrial and Commercial Sound.* This document is the industry standard method for analysing building services plant noise emissions to residential receptors and is the document used by Councils in their standard planning conditions and also in complaint investigations.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 assessment, it is necessary to compare the measured external background noise level (*i.e.* the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 recommends the application of a 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

The following definitions as discussed in BS 4142 as summarised below:

"ambient noise level, $L_{Aeq,T}$"	is the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"residual noise level, $L_{Aeq,T}$"	is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"specific noise level, $L_{Aeq,T}$"	is the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the

	equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"rating level, $L_{Ar,T}$"	is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);
"background noise level, $L_{A90,T}$"	is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

Commercial Noise Impacts

In outlining appropriate operational noise levels, consideration is given to the content of British Standard BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*. This document recommends the following indoor ambient noise levels for dwellings as follows:

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living Room	35 dB $L_{Aeq, 16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq, 16hr}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq, 16hr}$	30 dB $L_{Aeq, 8hr}$

Table 9.10 Indoor ambient noise levels for dwellings from BS8233:2014

For the purposes of this study, it is appropriate to derive external assessment criteria based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window. This is nominally deemed to be 15 dB[2].

Based on the guidance outlined the *BS8233* standard, the following external noise levels would be considered reasonable in order to achieve suitable internal noise levels within the nearest residential properties:

- Daytime (07:00 to 23:00 hrs) 50 dB $L_{Aeq,15mins}$
- Night (23:00 to 07:00 hrs) 45 dB $L_{Aeq,15mins}$

[2] Ref BS8233 "If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB".

Vibration Criteria

9.5.1.3 Construction Phase

Guidance relevant to acceptable vibration within buildings during construction works is contained in the following documents:

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;
- British Standard BS 5228: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS5228-2).*

Both standards contain the same guidance relating to building damage criteria for intermittent vibration such as those generated during construction. The standards note that the risk of cosmetic damage to residential buildings starts at a Peak Particle Velocity (PPV) of 15mm/s at 4Hz rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above for unreinforced or light framed structures. The standard also notes that below 12.5mm/s PPV the risk of damage tends to zero. Taking the above into consideration the vibration criteria in Table 9.11 are recommended.

Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
4 to 15 Hz	**15 to 40Hz**	**40Hz and above**
15 mm/s	20 mm/s	50 mm/s

Table 9.11 Transient Vibration Guide Values for Cosmetic Damage

9.5.1.4 Operational Phase

It is considered that the proposed development will not give rise to any significant levels of vibration in the receiving environment. Vibration criteria are therefore not deemed to be necessary for the operational phase of this development and therefore not been addressed further in this chapter.

9.6 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

9.6.1 Do Nothing Impact

The Do Nothing scenario includes retention of the current site without the proposed mixed-use development in place. In the absence of the proposed development being constructed, the noise environment at the nearest NSLs and across the development site itself will remain largely unchanged. The noise and vibration levels measured/noted during the baseline studies are considered representative of the Do-Nothing scenario. The Do-Nothing scenario is therefore considered neutral impact.

9.6.2 Construction Phase

9.6.2.1 Construction Noise Impacts

As the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set out in BS 5228-1: 2009 +A1 2014. Table 9.12 outlines typical plant items and associated noise levels that are anticipated for the construction programme.

Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB $L_{Aeq(1hour)}$)	Item of Plant (BS 5228-1 Ref.)	No. of Items Assumed
Site Preparation/ Clearance	Track Excavator (C2 22)	72	3
	Wheeled Loader Lorry (C2.28)	76	2
	Dozer (C2.13)	78	2
	Dump Truck (C4.2)	78	2
	Generator (C4.78)	66	2
	Water pump (C2.45)	65	2
Piling	Crane mounted auger (C3.16)	79	4
	Tracked excavator (C3.23)	68	2
	Concrete pump (C3.25)	78	2
	Tracked mobile crane (C3.28)	67	2
	Concrete mixer truck (C4.20)	80	2
Foundation	Tracked Excavator (C3.24)	74	4
	Concrete Pump (C3.25)	78	2
	Compressor (D7 6)	77	2
	Poker Vibrator (C4 33)	78	2
Substructure	Dump truck (tipping fill) C2.30	79	2
	Tracked Excavator (C3.24)	74	3
	Concrete Pump (C3.25)	78	2
	Compressor (D7 6)	77	2
	Poker Vibrator (C4 33)	78	2
Steel Erection	Mobile Telescopic Crane 100T (C4.41)	71	2
	Telescopic Handler 4T (C.4.54)	70	2
	Articulated lorry (C11.10)	77	2
General Construction	Hand tools	81	4
	Pneumatic Circular Saw (D7.79)	75	3
	Internal fit – out	70	2
Road Construction Works	Road Roller (C5.19)	80	1
	Asphalt Paver (+Tipper Lorry) (C5.30)	75	1
Landscaping	Dozer (C2.13)	78	4
	Dump Truck (C4.2)	78	4
	Surfacing (D8.25)	68	2

Table 9.12 Typical Noise Levels Associated with Construction Plant Items

The closest NSL façade (existing or permitted) to the construction works is Oaklee to the northwest, at a distance of approximately 15m between Block 7.4 and the side gable façade to one dwelling in Oaklee. The next nearest NSLs are located in Clonminch Wood estate to the northwest and cluster of properties to the south, which are all at a distance of approximately 20m to the nearest Phase 1 construction works on site. The closest NSLs to the Phase 2 construction are those located at 20m distance in Clonminch Wood estate. The remainder of construction works will take place across the site at varying distances. Reference to the noise baseline survey results (Section 9.3) and guidance contained in BS 5228 Part 1 for construction noise levels discussed in Table 9.5, the threshold for significance from construction activities is set as follows for the closest residential NSLs facades is Category A:

Daytime (08:00 – 19:00hrs)/ Saturdays (08:00 – 14:00hrs)	65 dB $L_{Aeq,1hr}$
Evening and Weekends	55 dB $L_{Aeq,1hr}$

Predictions have been presented for the two phased construction works associated with the key phases of the proposed development at the closest residential dwellings, located to the northwest (N1), north (N2), west (N3) and south (N4) in Phase 1 and located to the west (N5) and northeast (N6) in Phase 2, illustrated in Figure 9.4.

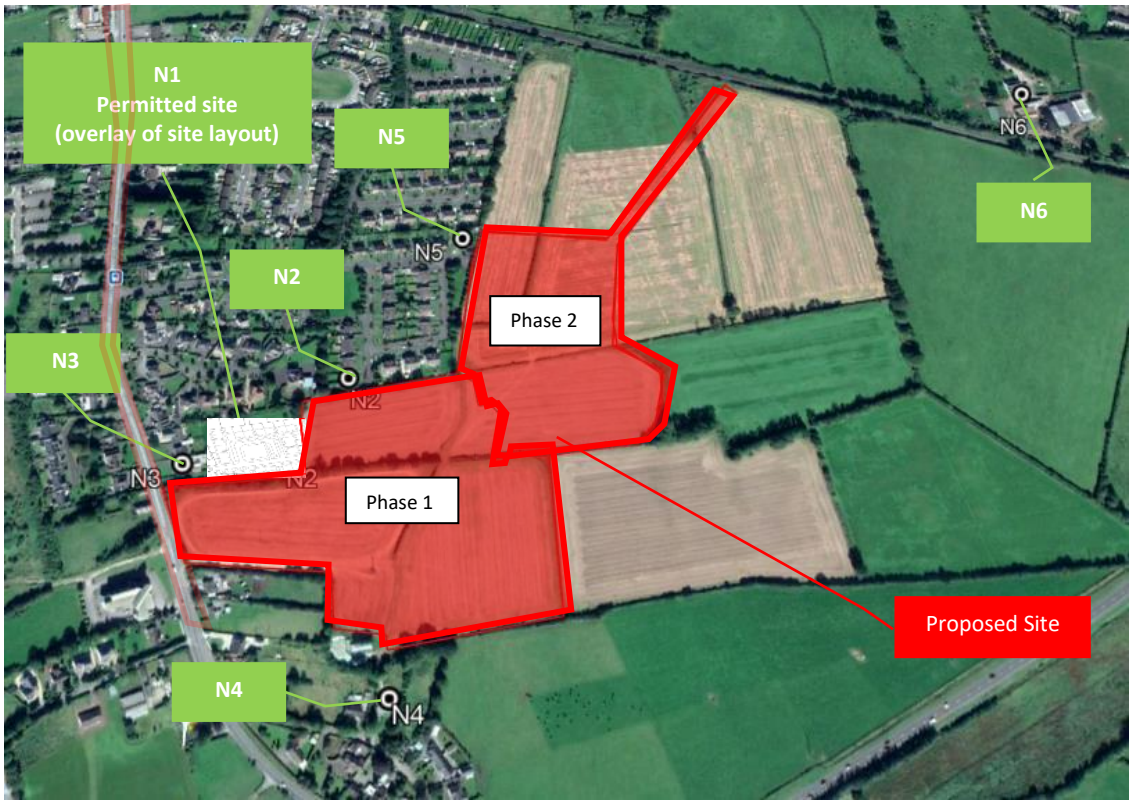

Figure 9.4 Residential Noise Assessment Locations (Source: Google Earth)

Predictions are based on the utilisation of plant for 66% of a working day. The distances used in the calculations for all construction works are based on the closest proposed construction facades and the nearest permitted or existing NSL façade assessed. For the purpose of the assessment, a standard site hoarding of 2.4m high has been included in the calculations for noise sensitive boundaries.

Activity	Predicted Construction Noise Level $L_{Aeq(1hour)}$ (dB) at the nearest permitted or existing facades				
	15m	**20m**	**30m**	**40m**	**400m**
Site Clearance /Preparation	70	66	65	62	57
Piling	72	69	68	64	59
Foundation	70	67	66	63	58
Substructure	71	68	67	64	59
General Construction	72	69	67	64	59
Road Construction	65	62	60	57	52
Landscaping	71	68	66	63	58

Table 9.13 Predicted Potential Construction Noise Levels

Based on the information presented above the noisiest construction work is during piling and general construction phases.

Residential Location	Predicted Construction Noise Level $L_{Aeq(1hour)}$ (dB)	Daytime Construction Noise Criteria $L_{Aeq(1hour)}$ (dB)	Complies
N1 (15m to north - Phase 1)	65-72	65	N
N2 (20m to north - Phase 1)	62-69	65	N
N3 (20m to west – Phase 1)	62-69	65	N
N4 (20m to south – Phase 1)	62-69	65	N
N5 (20m to west – Phase 2)	62-69	65	N
N6 (400m to northeast- Phase 2)	52-59	65	Y

Table 9.14 Review of Potential Construction Noise Impacts

At N1- N5 facades the main works activities are in excess of the significance threshold of 65 dB $L_{Aeq,1hr.}$Given the variations of on-site activities and number of plant items during any one phase and the location of works only operating along the closest facades for a limited the duration of the entire construction works, the calculated noise levels presented are considered to present a worst-case scenario.

Given that these noise levels constitute worst-case conditions with the listed construction activities all being conducted at the closest development area to the nearest NSL, actual construction noise level emission will likely be lower than the levels listed above. Notwithstanding, suitable noise mitigation measures must be adopted to reduce the noise exposure at locations less than 30m from the site works. Based on the set distances calculated in Table 9.14 there is a potential for the adopted criteria to be exceeded when a residential NSL is within 30m of the site boundary.

The results of the initial assessment indicate that under the 'worst-case' assessment scenarios construction activities are likely to exceed the recommended noise threshold levels at the closest NSLs when occurring along the closest facades (i.e. adjacent to N1-N5). Noise mitigation measures will therefore be required to reduce potential impacts at these residential properties to avoid significant impacts. Further discussion on mitigation measures are included in Section 9.7.

9.6.2.2 Construction Traffic

Based on the information provided by DBFL Consulting Engineers no more than 5 HGV movements will arrive in a one hour period. An increase of 25% in traffic is required to increase overall traffic noise levels by 1 dB, which is insignificant in the overall context of the noise environment along the wider road network (links A-F, as labelled in Chapter 10 Traffic) in the vicinity of the site. Therefore, the short-term noise environment assumed for this project is expected to be within at least 1 dB of the baseline scenario, which would give a magnitude of increase in traffic noise that is not significant.

Based on the scenario HGV figures identified above, it is assumed that as a worst-case scenario no more than 10 truck movements (in or out of the site) will occur in a 1 hour period. HGV's will enter/exit the site along the newly proposed Link G road-link connecting the site to the existing R443 Clonminch Road. The nearest noise sensitive locations are N1 and N3, previously identified in Section 6.1, at varying distances of 45m-50m to the Link G road-link haul route.

A calculation distance of 45 m from the road has been used to assess noise levels at the closest buildings along the Link G road-link construction routes. The mean value of Sound Exposure Level for truck moving at low to moderate speeds (i.e. 15 to 45 km/hr) is in the order of 82 dB LAX at a distance of 8 m from the vehicle. This figure is based on a series of measurements conducted under controlled conditions. Assuming that no more than 10 trucks will pass per hour (a haul truck arriving or leaving site every 5 minutes), below summarises the calculated noise level associated with passing haul vehicles.

The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (L_{AX}). The mean value of Sound Exposure Level for a truck at low to moderate speeds (i.e. 15 to 45km/hr) is of the order of 85 dB L_{AX} at a distance of 10 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions. The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period.

The appropriate formula is given below.

$$L_{Aeq,T} = L_{AX} + 10Log_{10}(N) - 10Log_{10}(T) + 20Log_{10}\left(\frac{r_1}{r_2}\right) dB$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds);

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered(dB);

N is the number of events over the course of time period T;

r_1 is the distance at which L_{AX} is expressed;

r_2 is the distance to the assessment location.

It is assumed that up to ten truck movements may occur in any 1 hour period. Using the equation detailed above, the predicted noise level at the nearest NSLs is in the order of 41 dB $L_{Aeq,1hr.}$ Levels of this order would be significantly below the baseline noise environment. Therefore, it is expected in the absence of specific mitigation measures that there will be a negative, not significant and short-term impact at the closest receptors.

No mitigation measures would therefore be required.

9.6.2.3 Construction Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given the distances to the receptor locations, with the exception of NSLs N1-N4. Expected vibration levels during piling assuming augured or bored piles have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: Vibration, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54mm/s at a distance of 5m, for auguring;
- 0.22mm/s at a distance of 5m, for twisting in casing;
- 0.42mm/s at a distance of 5m, for spinning off, and;
- 0.43mm/s at a distance of 5m, for boring with rock auger.

Taking into account the distance to the receptors vibration emissions from this activity will be significantly reduced. Vibration levels at the closest neighbouring buildings are expected to be below the limits set out in Table 9.11. The range of vibration levels have the potential, however, to be perceptible to occupants of nearby buildings at distances of 15 to 30m (i.e. N1 to N5).

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 9.11 during all activities. Further discussion on mitigation measures during this phase are discussed in Section 9.7.

9.6.3 Operational Phase

9.6.3.1 Noise

Due consideration must be given to the nature of the primary noise sources when setting criteria. Potential noise impacts during the operational phase include the following:

- Vehicular traffic accessing and moving around the site;
- Building and mechanical services plant;

- Car parking on site; and
- Creche playground noise breakout.

Each is assessed in the following sections.

Additional Traffic on Surrounding Roads

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development given that traffic from the development will make use of the existing road network.

A traffic impact assessment relating to the proposed development has been prepared by the traffic consultants as part of this EIAR. Figure 9.5 presents the road links A-G, as labelled in Chapter 10 Traffic).

Figure 9.5 Road Links for Presented for Traffic Assessment (Source: DBFL Consulting Engineers)

The results of this assessment have been reviewed to predict any impact of the development on traffic flows in the area. The calculated change in noise levels during Opening Year (2023) and Future Design Year (2038) are summarised in Tables 9.15 and 9.16.

Location	AADT Do Nothing	AADT Do Something	Change in Noise Level, dB (all vehicles)
	Opening Year		
A	15,712	15,820	0.0
B	13,688	13,951	+ 0.1
C	8,157	8,224	0.0

Location	AADT Do Nothing	AADT Do Something	Change in Noise Level, dB (all vehicles)
	Opening Year		
D	8,964	9,402	+ 0.2
E	8,803	9,241	+ 0.2
F	8,803	9,030	+ 0.1
G	-	501	-

Table 9.15 Summary of Change in Noise Level (Opening Year 2023)

Location	AADT Do Nothing	AADT Do Something	Change in Noise Level, dB (all vehicles)
	Future Design Year		
A	17,505	17,975	+ 0.1
B	15,248	16,359	+ 0.3
C	9087	9377	+ 0.1
D	9,983	11,858	+ 0.7
E	9,808	11,682	+ 0.8
F	9,808	10794	+ 0.4
G	-	2861	-

Table 9.16 Summary of Change in Noise Level (Future Design Year 2038)

The G road-link will be further assessed in the Car Park assessment as this is a proposed new road internally within the proposed development with no HGV's to be added to this road link.

The predicted increase in AADT traffic levels associated with the development is between 0.0-0.2 dB(A) in the vicinity of the roads assessed for the opening year and between 0.1-0.8 dB(A) during the future design year. This is largely due to the existing volume of traffic along the surrounding road network onto which the development traffic will travel. Reference to Table 9.9 confirms that this increase is barely perceptible and not significant effect.

In summary, the predicted increase in noise levels associated with vehicles at road junctions in the vicinity of the proposed development is of long-term not significant impact.

Building Services Plant

Once operational, there will be building services plant items required to serve the commercial and residential aspect of the development. The specific requirements for mechanical and electrical plant items for each element of the commercial, residential buildings or creche / community buildings has

not yet been progressed at this stage of the design. Most of this plant will be capable of generating noise to some degree and may operate 24 hours a day. It would therefore be most noticeable during quiet periods (i.e. overnight). Noisy plant with a direct line-of-sight to noise sensitive properties as well as louder plant areas on roof would potentially have the greatest impact.

Whilst general locations for residential plant (air source heat pumps), commercial plant (mainly at roof level in Neighbourhood Centres), and 6no. substations have been established (ground level) particular details of items of plant are as yet unknown, therefore it is not possible to calculate noise levels to the surrounding environment. Depending on the operational plant requirements plant rooms will likely require ventilation to atmosphere via louvered areas and or wall ventilation. In this instance, it is best practice to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for the development.

As the plant will be selected at a later stage, they will be designed and located so that there is no negative impact on sensitive receivers within the development itself. The cumulative operational noise level from building services plant at the nearest NSL within the development (e.g. houses / apartments, etc.) will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods as set out in this assessment.

Based on the baseline noise data collected for this assessment it is considered an appropriate design criterion is the order of **35 dB $L_{Aeq,15min}$** during daytime periods and **30 dB $L_{Aeq,15min}$** at night at the nearest sensitive receptors. This limit is set in order to achieve acceptable internal noise levels within residential spaces based on prevailing noise levels in the area.

Taking into account that sensitive receivers within the development are much closer than off-site sensitive receivers, once the relevant noise criteria is achieved within the development it is expected that there will be no negative impact at sensitive receivers off site.

Car parking on site

The closest car parking space is Block A, approximately 20m from the Oaklee dwellings (N1) to the northwest in Phase 1 and car parking space at Block 7.4, approximately 30m from the Clonminch Wood estate dwellings (N5) to the west in Phase 2.

Typical noise levels 10m beyond the boundary of a busy car park during peak periods are of the order of 48 dB $L_{Aeq,T}$. Allowing for distance and estimated frequency of usage, the noise levels due to car parking activity would be of the order of 42 dB and 38 dB $L_{Aeq,15\ min}$ for the residences located closest to the car park at N1 and N5 respectively. These levels are within the daytime criterion of 50 dB $L_{Aeq,15min}$ and lower than the measured ambient noise levels at these locations.

It is envisaged that activity levels in the car park during the night-time period would be significantly less. Assuming that there are half as many car park movements during the night time period as during the daytime period, the noise levels due to car parking activity would be of the order of 39 dB and 35 dB$L_{Aeq,15min}$ for the residences located closest to the car park at N1 and N5 respectively. These levels are within the night time criterion of 45 dB $L_{Aeq,15min}$ and estimated ambient noise levels at these locations.

ln summary, the likely noise impact of car park activities on the local environment is not considered to be significant for NSLs.

Creche playground noise breakout

Measurement of noise levels generated by children playing outdoors made at several crèches and kindergartens indicate typical noise levels are of the order of 56 dB $L_{Aeq,1hr}$ at distance of 5m. The nearest off-site NSLs to the northwest (N1, N2) and south (N4), at approximately 100m, 160m and 130m respectively from the Phase 1 Crèche play area. Considering the distance and screening from proposed operational activities from the crèche are calculated to be below 30 dB $L_{Aeq,1hr}$ at the nearest NSLs (N1, N2, N4). The predicted values are also below the range of baseline noise levels recorded to the south of the site (Location AN3). The resultant noise impact is therefore not significant.

Within the development Block 11 Unit 29 and Block 3 Unit 30 dwellings are directly adjacent to the creche play area. Considering a minimum 10m distance between residential facades and creche play area and screening from the perimeter walls, the proposed operational activities from the crèche are calculated to be at or below 50 dB $L_{Aeq,1hr}$at the nearest onsite residential development (Block 3 and 11) and hence, is within the recommended daytime criterion of 50 dB $L_{Aeq,1hr}$.

Cumulative Impact

In order to present the worst-case assessment the cumulative impact at the nearest NSLs has been assessed which assumes that all noise sources associated with the development are in operation simultaneously. It should be noted that this is a very conservative assessment as it is highly unlikely that the peak hour traffic volumes would coincide with a busy period in creche playground. Table 9.17 summarises the individual noise level at each NSL considered for the sources associated with the development and also presents the resulting cumulative noise level. N6 has not been included due to the distance between the NSL and the proposed development.

Source	Predicted Noise Level, dB $L_{Aeq, 15min}$									
	Daytime					Night-time				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
Building Services Plant	35	35	35	35	35	30	30	30	30	30
Car Parking	42	--	40	--	38	39	--	37	--	35
Creche Playground	30	26	25	28	19	--	--	--	--	--
Cumulative	43	36	41	36	40	40	30	38	30	36

Table 9.17 Cumulative Noise Impact

The worst-case cumulative noise impact is within both the daytime and night-time criterion at each NSL assessed.

Notwithstanding the above, all plant items selected for the site is required to operate below the recommended noise criteria outlined in Section 9.6.3.2 *e.g.* mechanical plant should be selected to have cumulative noise emissions lower than 40 dB $L_{Aeq,15min}$ during daytime periods and 35 dB $L_{Aeq,15min}$ at night at the facades of the nearest NSLs. Further discussion on mitigation measures during this phase are discussed in Section 9.7.

9.7 MITIGATION MEASURES

9.7.1 Construction Phase

Mitigation measures for the construction phase are set out below in order to reduce potential impacts as far as practicable to within the adopted design goals for noise and vibration.

9.7.1.1 Noise and Vibration

Best practice noise and vibration control measures will be employed by the contractor during the construction phase in order to avoid significant impacts at the nearest sensitive NSLs. The best practice measures set out in BS *5228 (2009 +A1 2014)* Parts 1 and 2 will be complied with. This includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- noise control at source;
- screening, and;
- liaison with the public.

Further comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring, where required.

Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

The following best practice migration measures should be considered:

- Site compounds should be located away from noise sensitive boundaries within the site constraints. The lifting of bulky items, dropping and loading of materials within these areas should be restricted to normal working hours.
- For mobile plant items such as cranes, dump trucks, excavators and loaders, maintaining enclosure panels closed during operation can reduce noise levels over normal operation. Mobile plant should be switched off when not in use and not left idling.
- For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system.
- For percussive tools such as pneumatic breakers, noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Localised screens should be erected around breaker or drill bits when in operation in close proximity to noise sensitive boundaries.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Compressors, generators and pumps should be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. Standard construction site hoarding (2.4m in height) with a mass per unit of surface area greater than 7 kg/m^2 can provide adequate sound insulation. This is recommended, as a minimum, around the site perimeter.

Liaison with the Public

A designated noise liaison officer will be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, prior to particularly noisy construction activity, the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to ensure noise limits are not exceeded due to cumulative activities. This will be reviewed in relation to other potential cumulative works occurring on adjacent construction sites in close proximity to noise sensitive properties, which have the potential to lead to significant construction noise impacts. To date no other construction sites nearby have been identified.

9.7.2 Operational Phase

9.7.2.1 Additional Traffic on Adjacent Roads

During the operational phase of the development, noise mitigation measures with respect to the outward impact of traffic from the development are not deemed necessary.

9.7.2.2 Building Services Plant

The noise impact assessment outlined previously has demonstrated that once the mechanical plant is selected to have cumulative noise emissions lower than 40 dB $L_{Aeq,15min}$ during daytime periods and 35 dB $L_{Aeq,15min}$ at night at the facades of the nearest NSLs, specific mitigation measures are not required in order to avoid a significant noise impact at the nearest noise sensitive locations.

Notwithstanding this, the following practices are recommended for all plant items in order to minimise potential noise disturbance for neighbours:

- all mechanical plant items shall be regularly maintained to ensure that excessive noise generated by any worn or rattling components is minimised;

- any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document; and,
- Installed plant will have no tonal or impulsive characteristics when in operation.

9.7.2.3 Car Parking On Site

During the operational phase of the development, noise mitigation measures with respect to the car parking activities on site is not deemed necessary.

9.7.2.4 Creche playground noise breakout

During the operational phase of the development, noise mitigation measures with respect to the outward impact of creche playground activity from the development are required for Block 3 and Block 11 residential receptors. The noise impact assessment outlined previously has demonstrated that once the minimum distance between the Block 3 and Block 11 residential units is greater than 10 with a 2.4m perimeter solid perimeter wall, the proposed operational activities from the crèche are calculated to be at or below 50 dB $L_{Aeq,1hr}$ at the nearest onsite residential development (Block 3 and 11).

At all off-site noise sensitive receptors noise mitigation measures within respect to the outward impact of creche playground activity are not deemed necessary.

9.7.2.5 Vibration

Operational vibration impacts are expected to be within acceptable levels, therefore no mitigation measures are required.

9.8 RESIDUAL IMPACTS

9.8.1 Construction Phase

During the construction phase of the project there is the potential for short-term noise impacts on nearby noise sensitive properties due to noise emissions from site activities. The application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum as far as practicable.

For the duration of the construction period, construction noise impacts will be short-term and negative, depending on the proximity of the works to the site boundary.

Noise impacts during the construction phase will be short-term and moderate.

Quality	*Significance*	*Duration*
Negative	Moderate	Short-term

Vibration impacts during the construction phase will be short-term and significant.

Quality	*Significance*	*Duration*
Negative	Significant	Short-term

9.8.2 Operational Phase

9.8.2.1 Additional Traffic on Roads

The predicted change noise levels associated with additional traffic is predicted to be not significant impact along the existing road network.

The impacts are predicted to be as follows:

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

9.8.2.2 Operational Outward Noise Impact

Cumulative noise levels associated with outward noise from the development are expected to be well within the adopted day and night-time noise limits at the nearest noise sensitive properties taking into account the site layout, the nature and type of units proposed and distances to nearest residences.

The impacts are predicted to be as follows:

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

9.9 MONITORING

9.9.1 Construction Phase

During the construction phase noise monitoring will be undertaken at the nearest sensitive locations to ensure construction noise limits outlined in Table 9.5 are not exceeded. Noise monitoring will be conducted in accordance with the International Standard ISO 1996: *Acoustics – Description, measurement and assessment of environmental noise Part 1 (2016) and Part 2 (2017).* The selection of monitoring locations will be based on the nearest sensitive buildings to the working areas.

It is recommended that noise control audits are conducted at regular intervals throughout the construction programme in conjunction with noise monitoring. The purpose of the audits will be to ensure that all appropriate steps are being taken to control construction noise emissions and to identify opportunities for improvement, where required.

9.9.2 Operational Phase

There is no monitoring recommended for the operational phase of the development as impacts to noise and vibration are predicted to be imperceptible.

9.10 DIFFICULTIES ENCOUNTERED

There were no difficulties encountered in the compilation of this chapter.

9.11 REFERENCES

The following documents were consulted during the preparation of this chapter:

- British Standard BS 8233: 2014: Guidance on sound insulation and noise reduction for buildings;
- British Standard BS 4142: 2014+A1:2019: Methods for Rating and Assessing Industrial and Commercial Sound;
- British Standard BS 5228: 2009 +A1:2014: Code of Practice for Control of Noise and Vibration on Construction and Open Sites Part 1: Noise & Part 2: Vibration;
- British Standard BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration;
- Calculation of Road Traffic Noise, Department of Transport Welsh Office, HMSO, 1988;
- Design Manual for Roads & Bridges – Volume 11 Section 3 Revision 2, 2020;
- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017);
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015);
- EPA: Guidance Note for Noise – Licence Applications, Surveys and Assessments in Relation to Scheduled Activities NG4 (2012);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (EPA, 2003);
- EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002);
- ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise, and;
- ISO 9613: 1996: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.