12 AIR (NOISE AND VIBRATION)

12.1 Introduction

This chapter assesses the likely Noise and Vibration impacts associated with the proposed residential development at Dunshaughlin, Co. Meath. The proposed development is in two distinct sites and comprise a total area of 14.8 Ha. The proposed development will involve construction of a residential development, a childcare facility and all associated ancillary and infrastructural works. A full description of the development is available in Chapter 3 - Description of the Proposed Development.

This section of the EIAR has been prepared by AWN Consulting in the context of current relevant standards and guidance. This assessment has been prepared by Alistair Maclaurin BSc PgDip MIOA, Senior Consultant at AWN Consulting who has prepared multiple EIS and EIAR documents throughout his over 7 years' experience as an environmental consultant.

12.2 Assessment Methodology

The following methodology has been prepared based on the requirements of the EPA document Guidelines on the information to be contained in Environmental Impact Assessment Reports Draft August 2017 and on our experience of preparing the noise & vibration chapters for similar developments. The assessment will be undertaken using the following methodology: -

- Baseline noise monitoring has been undertaken in the vicinity of the proposed development site in order to characterise the existing noise environment.
- A review of the most applicable standards and guidelines has been reviewed in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development.
- Predictive calculations relating to construction phase impacts have been undertaken at the nearest sensitive locations to the development site.
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the proposed development.
- A schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.
- The inward impact of noise and vibration in the surrounding environment into the proposed buildings has also been assessed to determine the requirements, for additional noise mitigation, where required, to provide suitable residential amenity.

12.2.1 Construction Noise

There is no published statutory Irish guidance relating to the maximum permissible noise and vibration levels that may be generated during the construction phase of a project. It is common practice to use BS 5228:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites* with respect to the controlling noise and vibration impacts. In this instance, appropriate criteria relating to permissible construction noise levels are taken from Part One of the standard *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 significant noise impact is associated with the construction activities.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.1 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors.

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value in Decibels, dB		
	Category A[A]	Category B[B]	Category C[C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and Weekends	55	60	65
Night-Time (23:00 to 07:00)	45	50	55

Table 12.1: Example Threshold of Significant Effect at Dwellings.

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

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined and rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur.

School

It is also noted that there is a school located on the eastern boundary of the site. The limit for construction noise at the school, when in use, is 65 dB L_{Aeq}.

12.2.2 Construction Vibration

In terms of vibration, British Standard BS 5228-2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration* recommends that, for soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. The standard also notes that below 12.5 mm/s peak particle velocity (PPV) the risk of damage tends to zero. It is therefore common, on a cautionary basis to use this lower value. Taking the above into consideration the vibration criteria in Table 12.2 are recommended for nearby properties.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15 Hz	15 to 40 Hz	40 Hz and above
12 mm/s	20 mm/s	50 mm/s

Table 12.2: Transient vibration guidance values for avoidance of cosmetic building damage.

12.2.3 Operational Phase – Additional Traffic on Public Roads

In order to consider the potential noise impact associated with the proposed development introducing additional traffic onto the existing road networks, and given that vehicle movements on public roads are assessed using a different parameter (the ten percentile noise level; L_{A10}), it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development in terms of the L_{A10} parameter.

In order to assist with the interpretation of the noise impact associated with vehicular traffic on public roads, Table 12.3 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2019).

Long Term Magnitude	**DMRB Magnitude of Impact Long Term Noise Change (dB $L_{A10,18hr}$ of L_{night})**
Greater than or equal to 10.0	Major
5.0 to 9.9	Moderate
3.0 to 4.9	Minor
Less than 3.0	Negligible

Table 12.3: Likely Impact Associated with Change in Traffic Noise Level.

12.2.4 Operational Phase – Mechanical Plant and Services

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.

British Standard BS 4142:2014+A1:2019 *Methods for Rating and Assessing Industrial and Commercial Sound* 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, 4dB 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.

12.2.5 Operational Phase – Residential Inward Noise Impact

The Professional Guidance on Planning & Noise (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since it's adoption it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

The ProPG outlines a systematic risk based 2-stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows: -

- Stage 1 – Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels.
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include: -
    - Element 1 – Good Acoustic Design Process.
    - Element 2 – Noise Level Guidelines.
    - Element 3 – External Amenity Area Noise Assessment.
    - Element 4 – Other Relevant Issues.

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 12.1 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

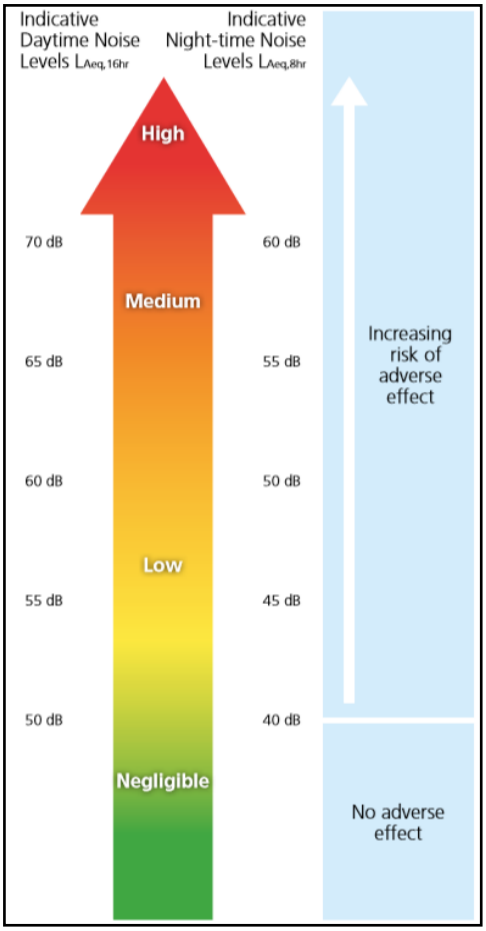

Figure 12.1: ProPG Stage 1 - Initial Noise Risk Assessment.

It should be noted that a site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and the site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times a night.

Element 2 of the ProPG document sets out recommended internal noise targets derived from *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings*. The recommended indoor ambient noise levels are set out in Table 12.4 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

Activity	Location	(07:00 to 23:00 hr)	(23:00 to 07:00 hr)
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 $L_{Aeq, 8hr}$ 45 dB L_{AFmax}*

Table 12.4: ProPG Internal Noise Levels.

*Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded no more than 10 times per night without a significant impact occurring.

In addition to these absolute internal noise levels, ProPG provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

ProPG provides the following advice with regards to external noise levels for amenity areas in the development: -

> *"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."*

12.2.6 Operational Phase – Creche Inward Noise Impact

BS8233 also sets out recommended internal noise levels for several different non-domestic building types from external noise sources such as road and air traffic. The guidance is primarily for use by designers, hence this standard may be used as the basis for the development of an appropriate schedule of noise control measures.

The recommended indoor ambient noise levels in non-domestic buildings are as follows:-

Objective	Typical Situations	Design range dB LAeq,T
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 – 55
	Open plan office	45 – 50
	Night club, public house	40 – 45
	Ballroom, banqueting hall	35 – 40
	Living room	35 – 40

Table 12.5: Indoor ambient noise levels in spaces when they are unoccupied, and privacy is important

Objective	Typical Situations	Design range dB LAeq,T
Speech or telephone communications	Department Store Cafeteria, canteen, kitchen	50 – 55
	Concourse Corridor, circulation space	45 – 55
Study and work requiring concentration	Library, gallery, museum	40 – 50
	Staff/meeting room, training room	35 – 45
	Executive office	35 – 40
Listening	Place of worship, counselling, meditation, relaxation	30 – 35

Table 12.6: Indoor ambient noise levels in spaces when they are unoccupied, and privacy is important

Based on a review of the BS 8233 standard and considering the proposed usage of the proposed development a criterion for internal noise levels for the crèche and community uses has been identified for each of the following rooms:

The recommended indoor ambient noise levels in non-domestic buildings are as follows: -

Room	Activity	Design Criterion dB $L_{Aeq,T}$
Quiet Room	Daytime Resting & Sleeping	35
Preschool Room	Study and Work requiring concentration	40
Office		40

Table 12.7: Recommended design criteria for Rooms

12.2.7 Operational Phase – Vibration Criteria

There are no expected sources of vibration associated with the operational phase, therefore, vibration criteria are not specified for this phase.

12.3 Receiving Environment

12.3.1 Proposed Development and Surrounding Environment

The proposed development consists of two sites bounded by the R125. The M3 is also audible at both sites, and particularly at the western boundary of the northern site. Figure 12.2 indicates the boundaries and layout of the proposed development site and its context within the local environment.

Various noise sensitive receptors surround the sites and are identified as below:

R1 – The Meadows Residential Estate (permitted)

R2 – Residential Estate (under construction)

R3 – Dunshaughlin Community College

R4 – Manor Court Residences

R5 – Residential Receptor

R6 – Dwelling

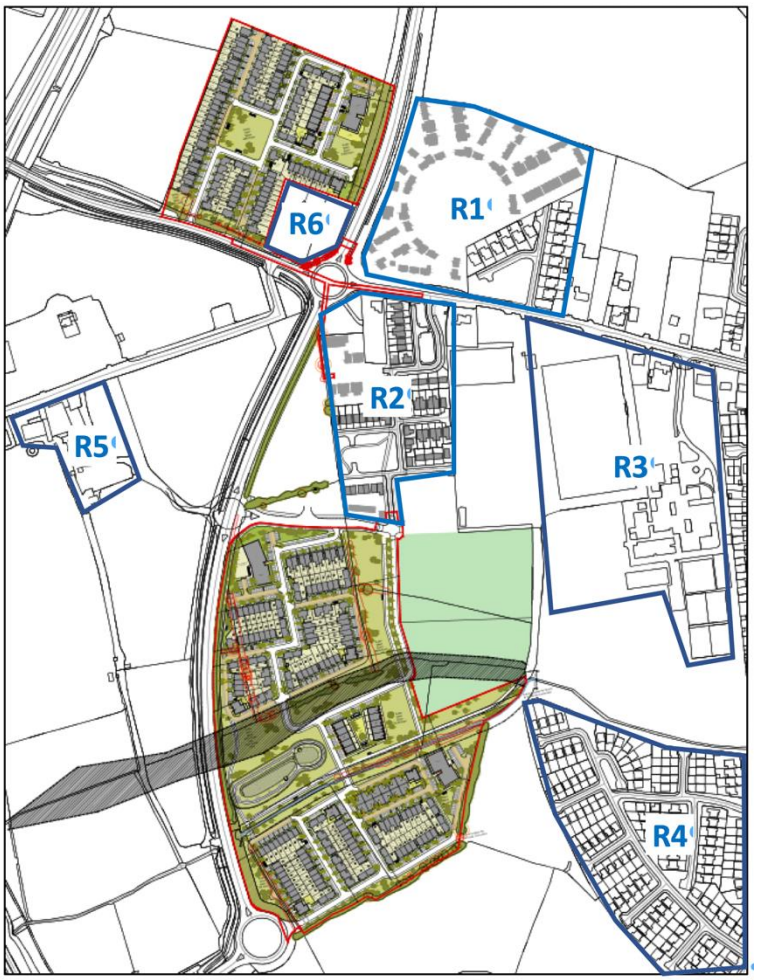

Figure 12.2: Proposed Development Site and Surrounding Noise Sensitive Receptors.

12.3.2 Survey Methodology

An environmental noise survey has been conducted at the site in order to quantify the prevailing noise environment. The survey was conducted in general accordance with *ISO 1996-2:2017 Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Environmental Noise Levels*. Specific details are set out as follows.

12.3.3 Survey Locations

Two unattended survey locations were selected to determine noise levels within and around the development sites, one for each site. The location on the north site (U1) was situated at the boundary closest to the M3. The location on the south site (U2) was located on the boundary closest to the R125. The locations were selected to characterise the traffic noise that is incident on the site.

In addition to the unattended locations, three attended locations were selected to characterise the noise environment at sensitive receptors surrounding the site. Figure 12.3 presents the monitoring locations.

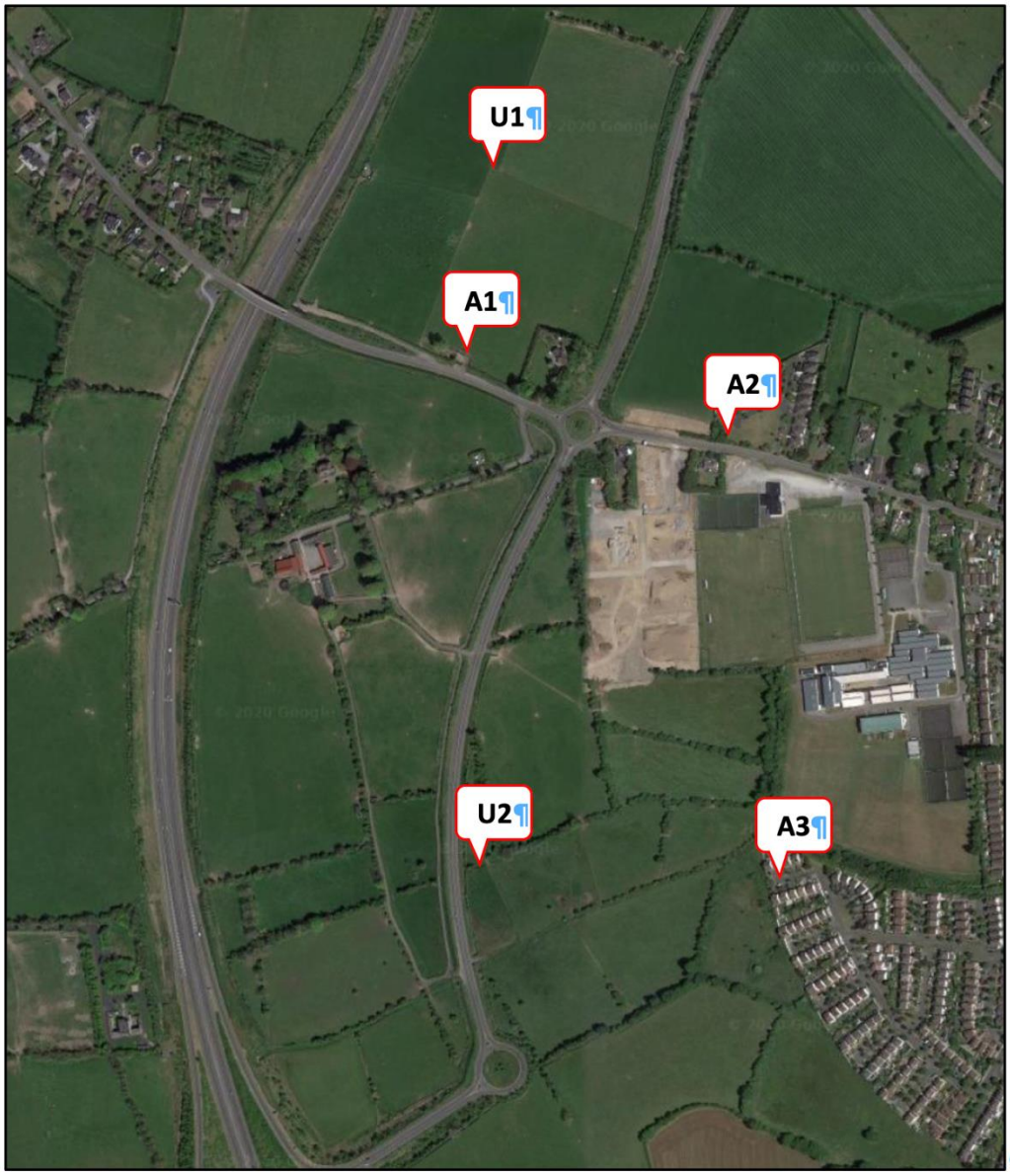

Figure 12.3: Monitoring Locations.

12.3.4 Procedure

Survey equipment was installed at measurements Locations U1 and U2 between the following periods: -

- U1: 13:05hrs on Friday 31st January to 14:50hrs on Thursday 6th February 2020
- U2: 12:43hrs on Friday 31st January to 15:13hrs on Thursday 6th February 2020

Sample periods for the noise measurements were 15 minutes.

Attended measurements at locations A1 – A3 were undertaken on 6th February 2020.

12.3.5 Instrumentation

Noise measurements were conducted using a Rion Type NL-42 Sound Level Meter for unattended survey locations and a Brüel & Kjær 2250L was used during the attended surveys. The measurement apparatus was check calibrated both before and after each survey using a Brüel & Kjær Type 4231 Sound Level Meter Calibrator.

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

L_{AFmax} is the instantaneous fast time weighted maximum sound level measured during the sample period.

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 $2x^{10-5}$ Pa.

12.3.7 Measurement Results

12.3.7.1 Location U1

The results of the baseline noise survey at location U1 is presented in Table 12.8.

Date	Period	Measured Ambient Noise Levels, dB[1]	
		$L_{Aeq,T}$	$L_{A90,T}$
31/01/2020	Day (07:00 – 23:00)	59	55
	Night (07:00 – 23:00)	55	47
01/02/2020	Day (07:00 – 23:00)	59	55
	Night (07:00 – 23:00)	46	37
02/02/2020	Day (07:00 – 23:00)	58	54
	Night (07:00 – 23:00)	56	43
03/02/2020	Day (07:00 – 23:00)	61	57
	Night (07:00 – 23:00)	58	45

04/02/2020	Day (07:00 – 23:00)	62	58
	Night (07:00 – 23:00)	56	42
05/02/2020	Day (07:00 – 23:00)	59	55
	Night (07:00 – 23:00)	54	40
06/02/2020	Day (07:00 – 23:00)	57	53

Table 12.8: Measurement Results at Location U1.

[1] Note that the L_{Aeq} levels are the logarithmic average and the L_{A90} levels are the arithmetic average of the relevant measurement periods.

Figure 12.4 presents the distribution of the magnitude of L_{AFmax} events during the night period at noise monitoring location U1.

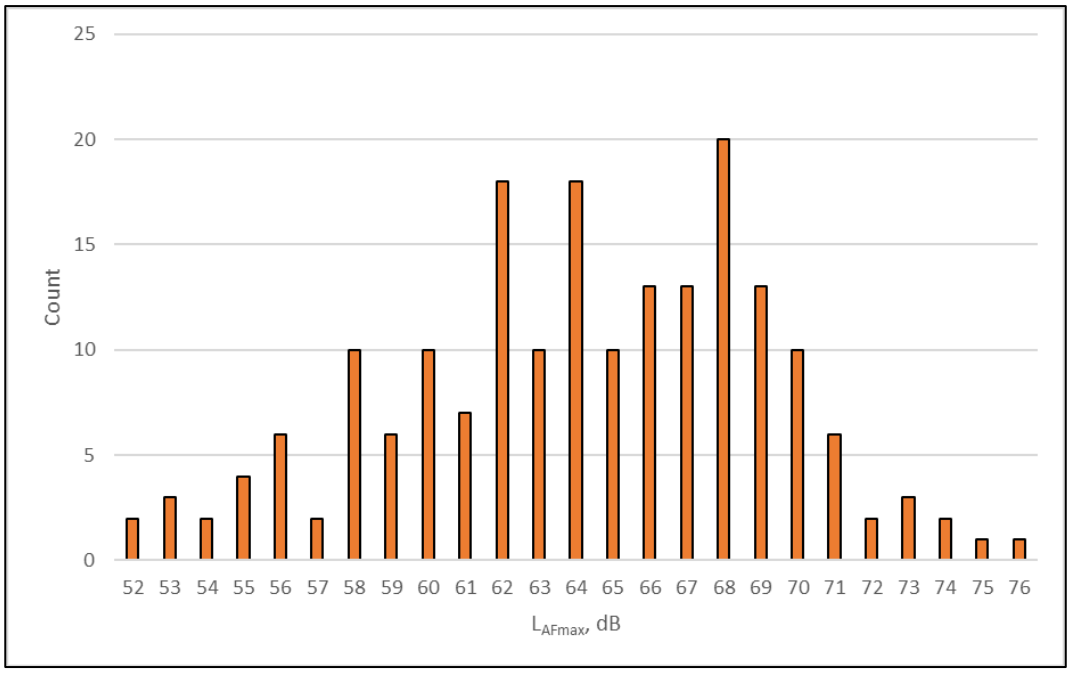

Figure 12.4: Distribution of the Magnitude of Night Time Noise Events at Location U1.

12.3.7.2 Location U2

The results of the baseline noise survey at location U2 is presented in Table 12.9.

Date	Period	Measured Ambient Noise Levels, dB[1]	
		$L_{Aeq,T}$	$L_{A90,T}$
31/01/2020	Day (07:00 – 23:00)	64	54
	Night (07:00 – 23:00)	55	46
01/02/2020	Day (07:00 – 23:00)	63	52
	Night (07:00 – 23:00)	53	37
02/02/2020	Day (07:00 – 23:00)	62	51
	Night (07:00 – 23:00)	57	42
03/02/2020	Day (07:00 – 23:00)	65	53
	Night (07:00 – 23:00)	58	43

04/02/2020	Day (07:00 – 23:00)	65	54
	Night (07:00 – 23:00)	57	39
05/02/2020	Day (07:00 – 23:00)	64	54
	Night (07:00 – 23:00)	58	40
06/02/2020	Day (07:00 – 23:00)	64	53

Table 12.9: Measurement Results at Location U2.

[1] Note that the L_{Aeq} levels are the logarithmic average and the L_{A90} levels are the arithmetic average of the relevant measurement periods.

Figure 12.5 presents the distribution of the magnitude of L_{AFmax} events during the night period at noise monitoring location U2.

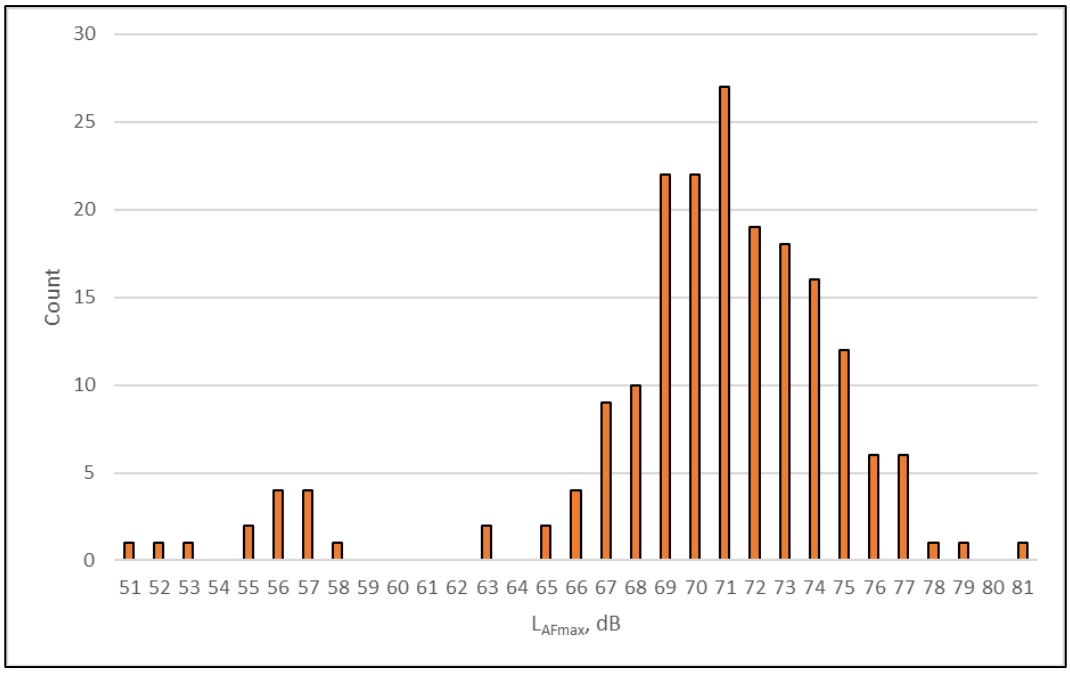

Figure 12.5: Distribution of the Magnitude of Night Time Noise Events at Location U2.

12.3.7.3 Location A1

The results of the baseline noise survey at location A1 is presented in Table 12.10.

Date	Time	Measured Ambient Noise Levels, dB		
		$L_{Aeq,T}$	L_{AFmax}	$L_{A90,T}$
06/02/2020	11:35	66	83	47
	12:40	67	85	50
	13:41	69	87	48

Table 12.10: Measurement Results at Location A1.

The noise environment at this location was noted to be dominated by traffic noise with highest levels attributed to localised traffic passing and noise from the M3 noted in lulls of local traffic. Some construction noise was also present during the survey.

12.3.7.4 Location A2

The results of the baseline noise survey at location A2 is presented in Table 12.11.

Date	Time	Measured Ambient Noise Levels, dB		
		$L_{Aeq,T}$	L_{AFmax}	$L_{A90,T}$
06/02/2020	11:53	59	76	48
	12:58	62	77	48
	13:58	62	77	50

Table 12.11: Measurement Results at Location A2.

The noise environment at this location was noted to be dominated by local traffic noise. Aircraft movements were audible. Construction noise and generators were also present during the survey.

12.3.7.5 Location A3

The results of the baseline noise survey at location A3 is presented in Table 12.12.

Date	Time	Measured Ambient Noise Levels, dB		
		$L_{Aeq,T}$	L_{AFmax}	$L_{A90,T}$
06/02/2020	12:18	47	65	43
	13:20	46	60	43
	14:20	45	69	39

Table 12.12: Measurement Results at Location A3.

The noise environment at this location was noted to be dominated distant road traffic noise. Aircraft movements were audible. Some distant construction noise was also present during the survey.

12.4 Characteristics of the Proposed Development

12.4.1 Proposed Development

When considering a development of this nature, the potential noise and vibration impact on the surroundings and on the development itself must be considered for each of two distinct stages: -

- Construction phase.
- Operational phase.

12.4.1.1 Construction Stage

During the construction stage the main focus in relation to noise and vibration impacts will be from demolition and piling activities. These activities have the potential to emit the highest levels of noise or vibration at receptor locations. The construction phase impacts will be short-term in duration.

12.4.1.2 Operational Stage

The primary potential sources of noise and vibration during the operational phase of the proposed development are as a result of traffic related noise increases which are deemed long-term to permanent; plant noise which are deemed long-term to permanent; and, the inward noise impact of road traffic on to the development itself which is deemed long-term to permanent.

12.4.2 Cumulative

The potential impacts identified for the proposed development for both the construction and operational phases are the same for the cumulative assessment.

12.5 Potential Impact of the Proposed Development

It's noted that there are two layout options for the proposed development, one with a road link between Character Area 3 and Character Area 4 and one without. In terms of this noise impact assessment there will be no significant differences between either layout, hence both options are considered to be assessed within this Chapter.

12.5.1 Proposed Development

12.5.1.1 Construction Stage

Construction Noise

Taking into account the baseline noise levels shown in 12.3 Receiving Environment, Table 12.13 presents the construction noise thresholds for each sensitive receptor as assessed per the ABC criteria discussed in Section 12.2.1. The thresholds are used to determine whether construction noise impacts have the potential to cause an significant impact.

Receptor Ref	Measurement Location Ref	Baseline Noise Level, dB	Category	Daytime Construction Noise Threshold, dB
R1	A2	62	A	65
R2	A2	62	A	65
R3	A3	62	A	65
R4	A3	46	A	65
R5	U1	59	A	65
R6	A1	67	B	70

Table 12.13: Designated Receptor Construction Categories.

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators.

The proposed general construction hours are 07:00 to 18:30hrs, Monday to Friday and 08:00 to 14:00 on Saturdays.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, piling and lorry movements on uneven road surfaces. Due to the distance of the construction works on site to nearby receptors there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings as a result of vibration.

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 BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. Table 12.14 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme at a standard reference distance of 10 metres from the various plant items.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	A-weighted Sound Pressure Level, $L_{Aeq,T}$, at 10 m
Site Preparation	Wheeled Loader Lorry (D3 1)	75
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Foundations	Tracked Excavator (C3.24)	74
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77
	Poker Vibrator (C4 33)	78
General Construction	Hand tools	81
	Tower Crane (C4.48)	76
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68

Table 12.14: Typical Noise Levels for Construction Plant BS5228.

Table 12.15 presents the predicted daytime noise levels from an indicative construction period on site at the nearest off-site receptor. Note that construction noise sources for the site are assumed to be running 66% of the time and mitigation measures are not in place for this prediction.

The predictions have been prepared for a distance of 15m and 40m for existing and permitted residential receptors. These distances are representative of the worst-case situation when construction work is ongoing on the site boundaries closest to the receptors.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Predicted at Nearest Receiver at 15 m distance dB L_{Aeq}	Predicted at Nearest Receiver at 40 m distance dB L_{Aeq}
Site Preparation	Wheeled Loader Lorry (D3 1)	70	61
	Track Excavator (C2 22)	67	58
	Dozer (C2.13)	73	64
	Dump Truck (C4.2)	73	64
Total		**77**	**69**
Foundations	Tracked Excavator (C3.24)	69	60
	Concrete Pump (C3.25)	73	64
	Compressor (D7 6)	72	63
	Poker Vibrator (C4 33)	73	64
Total		**78**	**69**
General Construction	Hand tools	76	67
	Tower Crane (C4.48)	71	62
	Pneumatic Circular Saw (D7.79)	70	61
	Internal fit – out	65	56
Total		**78**	**69**

Landscaping	Dozer (C2.13)	73	64
	Dump Truck (C4.2)	73	64
	Surfacing (D8.25)	63	54
Total		**76**	**67**

Table 12.15: Predicted Construction Noise Levels

It is predicted that, when unmitigated, the construction activities will give rise to noise emissions high enough such that a short-term, potentially significant impact will occur at the nearest noise sensitive locations.

Construction Vibration

Potential for vibration impacts during the demolition and construction phase programme are likely to be limited given the distances to the receptor locations. With respect to the potential vibration impact, the only significant source of vibration is expected to be due to excavations and foundation activities. However, the distance between the areas where these activities are to occur and the nearest noise sensitive locations are such that all vibration transmission would be below recommended guideline criteria. Vibration levels are also expected to be below a level that would cause disturbance to building occupants

None the less, it is required that vibration from construction activities to off-site residences be limited to the values set out in Table 12.2. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Consequently, the impacts may be described as locally negative, not significant and short-term.

12.5.1.2 Operational Stage

Additional Traffic on Public Roads

A Traffic & Transport Assessment has been undertaken as part of this EIAR. Information from the chapter has been used to determine the predicted change in noise levels in the vicinity of a number of roads in the area surrounding the proposed development, for the opening and design years.

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. Traffic flow data in terms of the AADT figures has been assessed for the opening year, the opening year + 5 and the opening year + 15. The calculated changes in noise levels during these periods are summarised in Table 12.16. The predictions indicate that the additional traffic on public roads will be imperceptible and negligible.

Junction	Change in Noise Level, dB			Magnitude	Description
	2024	2029	2039		
1A	+0.2	+0.4	+0.4	Imperceptible	Negligible
1B	+0.1	+0.2	+0.2	Imperceptible	Negligible
1C	+0.4	+0.8	+0.7	Imperceptible	Negligible
1D	0.0	0.0	-0.3	Imperceptible	Negligible
2A	+0.2	+0.3	+0.3	Imperceptible	Negligible
2B	0.0	0.0	0.0	Imperceptible	Negligible
2C	+0.1	+0.3	+0.3	Imperceptible	Negligible
2D	0.0	0.0	0.0	Imperceptible	Negligible
3A	+0.4	+0.6	+0.6	Imperceptible	Negligible
3B	+0.4	+0.6	+0.6	Imperceptible	Negligible
3C	+0.7	+0.9	+0.9	Imperceptible	Negligible
3D	+1.7	+1.7	+1.6	Imperceptible	Negligible
4A	+0.5	+1.0	+0.9	Imperceptible	Negligible
4B	+0.4	+0.6	+0.6	Imperceptible	Negligible
4D	0.0	0.0	0.0	Imperceptible	Negligible
5A	+0.7	+0.9	+0.8	Imperceptible	Negligible
5B	+1.0	+1.8	+1.7	Imperceptible	Negligible
6A	+1.7	+1.7	+1.6	Imperceptible	Negligible
6B	0.0	+0.2	+0.2	Imperceptible	Negligible
7A	+1.3	+1.9	+1.8	Imperceptible	Negligible
7B	+1.0	+1.8	+1.7	Imperceptible	Negligible

Table 12.16: Predicted Change in Noise Emissions (Comparison of Do Nothing and Do Something) (dB)

Outward Noise Impact – Mechanical Plant and Services

Once operational, if building services plant items are required to serve the commercial and residential aspect of the development, the cumulative operational noise level at the nearest noise external sensitive location will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods. The criteria has been selected so that the noise from items of plant does not exceed background noise levels, and hence, as per BS4142 *"this is an indication of the specific sound source having a low impact"*.

Given the baseline noise levels measured in Section 12.3 appropriate criteria for plant noise levels at the nearest sensitive noise receptors is presented in Table 12.17.

Receptor Ref	Adopted Measurement Location Ref	Daytime Plant Noise Threshold, $L_{Aeq,1hr}$ dB	Night-time Plant Noise Threshold, $L_{Aeq,15min}$ dB
R1	A2 / U2	48	37
R2	A2 / U2	48	37
R3	A3 / U2	39	37
R4	A3 / U2	39	37
R5	U1	54	37
R6	A1 / U1	47	37

Table 12.17: Adopted Criteria for Mechanical Plant and Services Noise and Sensitive Receptors.

Inward Noise Impact

The existing noise climate within the development lands was surveyed and the results summarised in Section 12.3 of this chapter. The results of the survey have indicated that noise levels on site are dominated by road traffic noise from the surrounding roads, in particular from the R125 and also the M3.

In order to determine the inward noise impact for noise sensitive properties proposed as part of the development, it is necessary to determine the internal noise levels within the proposed buildings. These can then be compared against appropriate internal noise criteria from BS 8233, as summarised in Table 12.4.

It is possible to calculate internal noise levels within the residential properties and living spaces proposed within the site, taking account of the existing and future potential noise environment, proposed constructions and the relevant sound insulation provided by the building elements (i.e. walls, roof, glazing etc.).

Noise Model of Site

In order to calculate noise levels across the site, an acoustic model was developed to initially calibrate against noise survey data recorded on site. Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels on the proposed site. The selected software, Brüel & Kjær Type 7810 Predictor, calculates noise levels in accordance with the selected source.

The following information was included in the model: -

- Site layout drawings of proposed development.
- OS mapping of surrounding environment.

Calibration of Noise Model

Noise levels recorded during the unattended and attended surveys were used to calibrate the noise model. The model predictions at the unattended locations were calibrated to within 1 dB of the measured values. This is regarded as a strong correlation in respect of predicted noise levels. Locations A1 and A2 are calibrated to within 2 dB of the measured noise levels, again this is considered a strong correlation. It is noted that predicted noise levels at location A3 are 4 dB higher than those that were measured, this is a due to the greater uncertainty due to the distance from noise sources affecting this location (approximately 350 m distance between source and receiver). It is not expected that this will have an adverse effect on the assessment. Noise levels are calculated over daytime periods, i.e. 07:00 to 23:00hrs and night-time periods, 23:00 to 07:00 hrs.

Location	Time	Measured Noise Level, dB	Calculated Noise Level, dB
U1	Daytime	62	63
	Night-time	58	58
U2	Daytime	65	65
	Night-time	58	58
A1	Daytime	66 - 69	64
A2	Daytime	59 - 62	63
A3	Daytime	45 - 47	51

Table 12.18: Predicted & Measured Noise Levels at Development Site.

Figure 12.6 and Figure 12.7 display the calculated noise contours across the site for day and night-time periods at a height of 4m above ground.

The results of the modelling exercise demonstrate that highest noise levels are experienced along the boundaries to the R125.

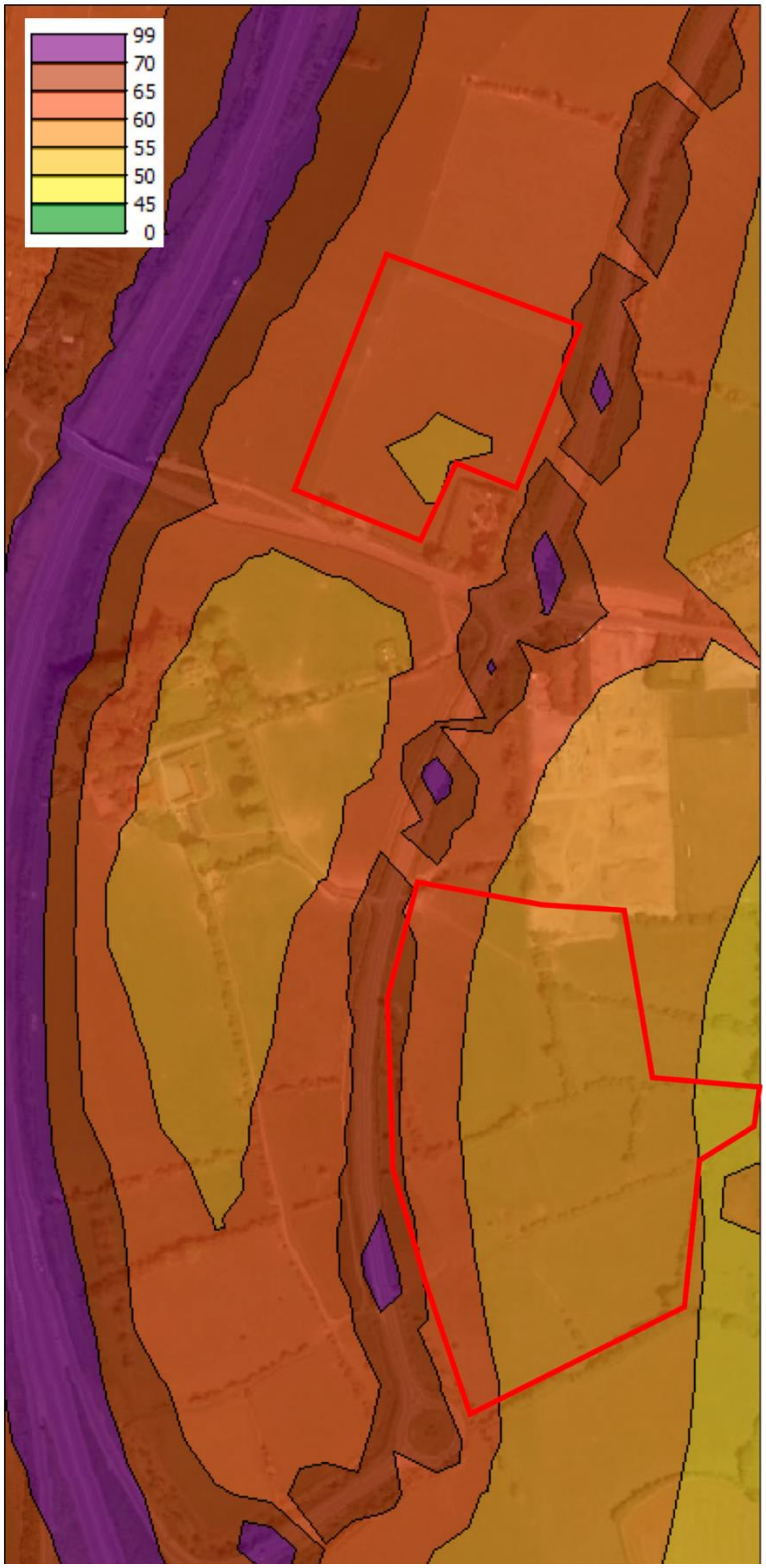

Figure 12.6: ProPG Stage 1 - Initial Noise Risk Assessment – Day Time (Approximate Site Location Highlighted in Red).

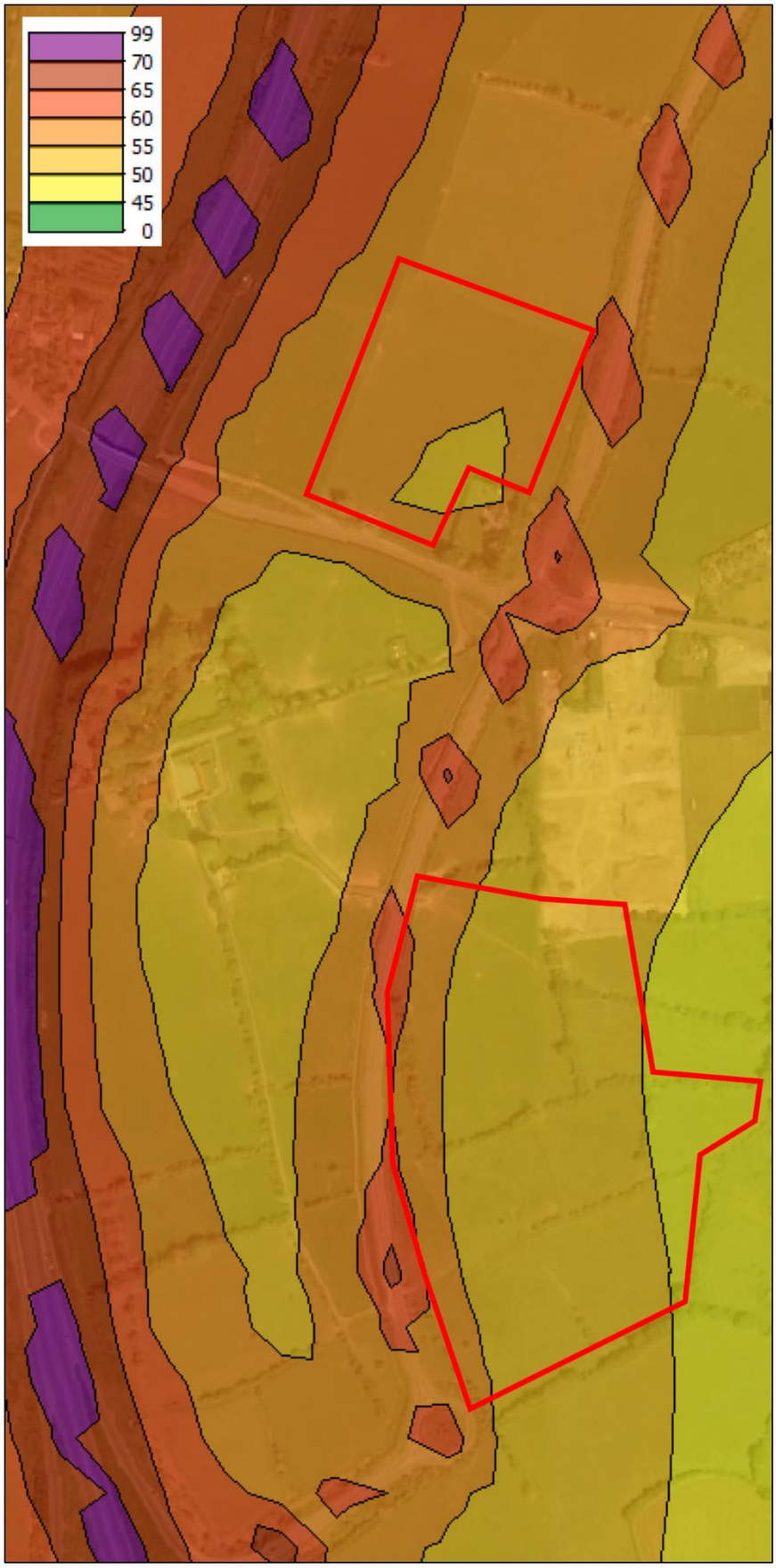

Figure 12.7: ProPG Stage 1 - Initial Noise Risk Assessment – Night Time (Approximate Site Location Highlighted in Red).

Giving consideration to the noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site lies ranges from low to high noise risk categories.

ProPG states the following with respect to low to high risks areas: -

Low Risk At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.

Medium Risk As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.

High Risk High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Given the above it can be concluded that the development site may be categorised as Low to High Risk and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development. It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used:

> *"2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."*

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or high-risk noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitable designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

Acoustic Design Statement – Part 1

Noise levels have been predicted across the development site during day and night-time periods using the noise model developed to include the proposed buildings. Where façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night, it is possible to achieve reasonable internal noise levels while also ventilating the dwellings with open windows. Therefore, for those properties where the façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night, no further mitigation is required.

Where façade levels are greater, the sound insulation performance of the building façade becomes important and a minimum sound insulation performance specification is required for windows and vents to ensure the internal noise criteria are achieved. Note the model takes into account a 1.5m high barrier along southern site boundary to the R125.

Figure 12.8 and Figure 12.9 identify those facades where the noise levels are higher and where mitigation in the form of enhanced glazing and ventilation will be required. The specification of this enhanced façade is discussed in Section 12.6.1.2. Without mitigation the impact on internal living space for the facades indicated in red and yellow are defined as negative, significant and permanent.

For the remaining facades the impact without mitigation is defined as neutral, imperceptible and permanent.

Figure 12.8: Facades Requiring Enhanced Acoustic Façade Specification (north site).

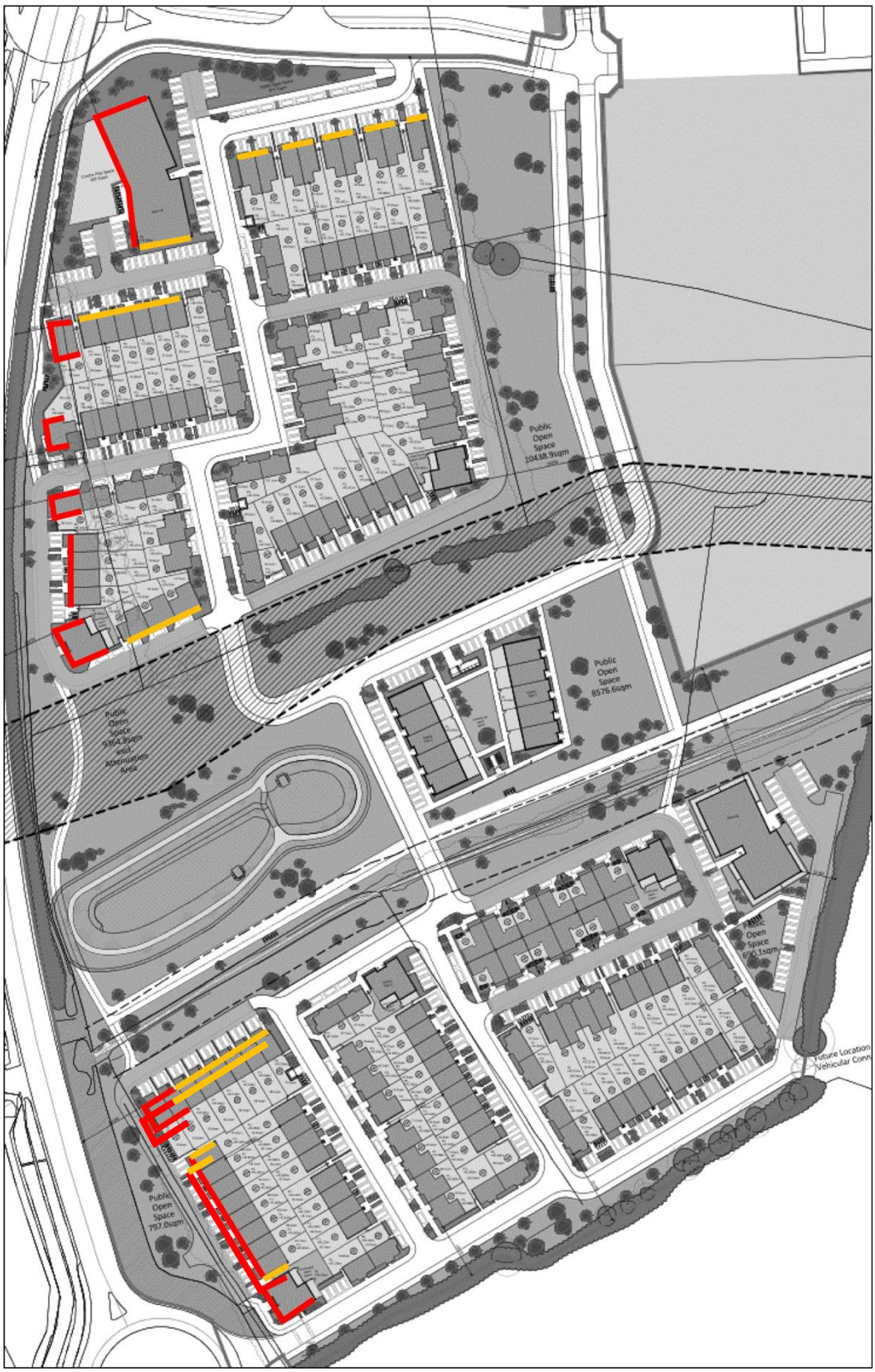

Figure 12.9: Facades Requiring Enhanced Acoustic Façade Specification (south site)

External Noise Levels

As mentioned above in Section 12.2.5 the range of noise levels for external amenity spaces from ProPG should not exceed 50 to 55 dB $L_{Aeq,16hr}$.

External noise levels at residential units with private garden spaces in the vast majority of the north and south sites are predicted to fall within the recommended criteria.

Noise levels in the private gardens on the western most boundary of the north site are predicted to exceed the recommended range. However, occupants of these units will have access to a public amenity space located directly behind the dwellings where the external noise levels will meet the recommendations in ProPG. This will offset the impact on private amenity space in line with the guidance provided in ProPG, which states: -

> *"3(v) Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
>
> - *a relatively quiet, protected, publically accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations."*

Considerable portions of the public external amenity space will also meet the recommendations in ProPG as illustrated in Figure 12.10 and Figure 12.11. The south site will be further protected from traffic noise by a 1.5m barrier along the boundary of the R125. It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site. The noise impact on external amenity space is therefore rated as neutral, not significant and permanent.

Figure 12.10: Predicted Noise Levels Across External Areas, dB $L_{Aeq,16hr}$ (1.5m above ground)

Figure 12.11: Predicted Noise Levels Across External Areas, dB $L_{Aeq,16hr}$ (1.5m above ground)

12.5.1.3 Do-Nothing Impact

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations 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.

12.5.2 Cumulative

The proposed development combined with other permitted developments in the area have the potential to result in cumulative noise or vibration impacts at surrounding noise sensitive locations during the construction and operational phases of the development.

The baseline scenario, as measured, takes into account existing road traffic and other noise sources in the area.

12.5.2.1 Construction Stage

The closest permitted development with the potential to contribute to a cumulative effect is the development Ref 190815 at Roestown, Cookstown and Readsland in Meath. Should the construction phase of this proposed development coincide with the construction of the permitted development, there is potential for cumulative construction noise levels at noise sensitive locations identified as R3, R4 and R6 (see Figure 12.2). The potential cumulative impacts are greatest at the noise sensitive location R6 which adjoins the proposed development site. In the event that construction works are occurring simultaneously at both sites the construction noise levels presented in Table 12.15 have the potential to increase by up to 3 dB. However, this would only be during the worst case and would be temporary in nature.

12.5.2.2 Operational Stage

Potential operational cumulative impacts relate to increased traffic flows resulting from other developments and any building services plant from other sources. Given the minor increase in noise levels for this development, and that a 100% increase in traffic flow is required for a minor impact to be indicated, it is not expected that any significant impacts will occur with additional operational traffic from surrounding developments. The noise impacts are determined to be long-term, imperceptible.

There are no expected cumulative noise impacts associated with building services plant from the proposed development and other development in the vicinity at external noise sensitive locations. The operation of any mechanical or electrical services associated with the proposed development will be designed to ensure the overall impact is deemed to be long-term and not significant.

12.5.2.3 Do-Nothing Impact

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations 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.

12.6 Mitigation Measures (Ameliorative, Remedial or Reductive Measures)

12.6.1 Proposed Development

12.6.1.1 Construction Stage

With regard to construction activities, best practice control measures from construction sites within *BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2* will be used to control noise and vibration impacts. The contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to the closest residential noise sensitive locations are not significant. This will be particularly important during demolition, foundation construction including piling works which are likely to be the activities to have the highest potential noise and vibration impact.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include: -

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.

- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- During construction, the contractor will manage the works to comply with noise limits outlined in BS 5228-1:2009+A1 2014. Part 1 – Noise.
- All items of plant will 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.
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted.
- Monitoring levels of noise and vibration during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include: -

- Selection of plant with low inherent potential for generation of noise and/ or vibration.
- Erection of good quality site hoarding to the site perimeters which will act as a noise barrier to general construction activity at ground level.
- Erection of barriers as necessary around items such as generators or high duty compressors, and.
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.

Table 12.19 presents the predicted daytime noise levels from an indicative construction period on site at the nearest off-site receptors assuming standard mitigation measures. Note construction noise sources for the site are assumed to be running 66% of the time. The predictions have been prepared at a distance of 15m & 40m to consider the impact on the closest receptors and take account of the 5 dB screening effect of a 2.4m site hoarding.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Predicted at Nearest Receiver at 15 m distance dB L_{Aeq}	Predicted at Nearest Receiver at 40 m distance dB L_{Aeq}
Site Preparation	Wheeled Loader Lorry (D3 1)	65	56
	Track Excavator (C2 22)	62	53
	Dozer (C2.13)	68	59
	Dump Truck (C4.2)	68	59
Total		**72**	**64**
Foundations	Tracked Excavator (C3.24)	64	55
	Concrete Pump (C3.25)	68	59
	Compressor (D7 6)	67	58
	Poker Vibrator (C4 33)	68	59
Total		**73**	**64**
General Construction	Hand tools	71	62
	Tower Crane (C4.48)	66	57

	Pneumatic Circular Saw (D7.79)	65	56
	Internal fit – out	60	51
Total		**73**	**64**
Landscaping	Dozer (C2.13)	68	59
	Dump Truck (C4.2)	68	59
	Surfacing (D8.25)	58	49
Total		**71**	**62**

Table 12.19: Construction Noise Predictions.

It is predicted that construction activities may cause a negative, short-term, potentially significant impact at receptor R6 which is located on the boundary of the northern site.

At all other receptors the construction works are not predicted to cause a significant impact.

Note that the predicted noise levels referred to in this section are indicative only and are intended to demonstrate that it will be possible for the contractor to comply with current best practice guidance.

The noise impacts due to demolition and construction works with mitigation in place may be described as negative, significant and short-term at location R6. For R1 and R2 the impact is negative, significant and temporary during the foundations phase. All other phases and all other receptors are predicted to have a negative, moderate and short-term impact.

12.6.1.2 Operational Stage

Outward Noise

As part of the detailed design of the development, plant items and, where necessary, appropriately selected remedial measures will be specified in order that the adopted plant noise criteria is achieved at the façades of noise sensitive properties, including those within the development itself.

Residential Inward Noise (Acoustic Design Statement Part 2)

As is the case in most buildings, the glazed elements and ventilation paths of the building envelope are typically the weakest element from a sound insulation perspective. In general, all wall constructions (i.e. block work or concrete and spandrel elements) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal.

In this instance the facades highlighted in Figure 12.8 and Figure 12.9 will be provided with glazing and ventilation that achieves the minimum sound insulation performance as set out in Table 12.20 and Table 12.21. Other facades in the development have no specific requirement for sound insulation. The calculations assume that one vent is required per room.

Facade	**Octave Band Centre Frequency (Hz)**						**dB R_w**
	125	**250**	**500**	**1k**	**2k**	**4k**	
Orange	Standard Double Glazing						33
Red	26	27	34	40	38	46	38

Table 12.20: Sound Insulation Performance Requirements for Glazing, SRI (dB)

Facade	Octave Band Centre Frequency (Hz)						dB $D_{ne,w}$
	125	250	500	1k	2k	4k	
Orange	30	33	38	37	36	36	38
Red	31	33	42	43	39	39	42

Table 12.21: Sound Insulation Performance Requirements for Ventilation, $D_{,n,e}$ (dB)

The overall R_w and $D_{ne,w}$ outlined above are provided for information purposes only. The over-riding requirement is the minimum octave-band sound insulation performance values which may also be achieved using alternative glazing and ventilation configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 12.20 and Table 12.21 or greater.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing and ventilation systems. In the context of the acoustic performance specification the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

The assessment has demonstrated that the recommended internal noise criteria can be achieved through consideration of the proposed façade elements at the design stage. The calculated glazing and ventilation specifications are preliminary and are intended to form the basis for noise mitigation at the detailed design stage. Consequently, these may be subject to change as the project progresses.

Following the provision of these measures the impacts will be considered neutral, not significant and permanent.

Creche Inward Noise (Acoustic Design Statement Part 2)

Consideration of the sound insulation of the following building element has been considered in the calculations: -

- External wall construction.
- Background ventilation.
- Glazed elements.

Typically, external wall constructions offer a high degree of sound insulation, much greater than that offered by the glazing systems and vents. Therefore, noise intrusion via the wall and roof constructions will be minimal. For the assessment of the building envelope sound insulation we have assumed the external wall as providing a minimum overall sound insulation performance of 50 dB R_w.

In order to meet the criterion for internal ambient noise levels the required performance specification for glazing and ventilation systems are provided below: -

Building	Octave Band Centre Frequency (Hz)						dB R_w
	125	250	500	1k	2k	4k	
Creche	26	27	34	40	38	46	38

Table 12.22: Sound Insulation Performance Requirements for Glazing, SRI (dB).

Building	Octave Band Centre Frequency (Hz)						dB R_w
	125	250	500	1k	2k	4k	
Creche	31	33	42	43	39	39	42

Table 12.23: Sound Insulation Performance Requirements for Ventilation, $D_{,n,e}$ (dB).

12.7 Residual Impact of the Proposed Development

12.7.1 Proposed Development

12.7.1.1 Construction Stage

At location R6 the construction noise impact can be assessed as below: -

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

For all other receptors the impact can be described as:

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

12.7.1.2 Operational Stage

Outward Noise Impact – Mechanical Plant

In terms of outward noise impact a set of criteria has been established using relevant guidance. Plant items will be selected at a later stage and will be designed and located so that the criteria is met, and that there is no negative impact on sensitive receivers within the development itself or on nearby sensitive receptors. With measures in place to ensure that noise emissions meet the above thresholds it is expected that any impacts will be: -

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

Outward Noise Impact – Additional Traffic on Public Roads

In terms of outward noise impact from additional traffic on public roads the impact can be described as: -

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Permanent

Residential Inward Noise Impact

This assessment identifies facades where mitigation in the form of enhanced glazing and ventilation will be required. The specification of this enhanced façade is discussed in Section 12.6.1.2. Following the provision of these measures the impacts will are considered to be: -

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

12.7.1.3 Worst Case Impact

12.7.2 Cumulative

12.7.2.1 Construction Stage

Construction noise impacts have the potential to increase by up to 3 dB if all surrounding developments progress through each phase simultaneously. However, this would only be during the worst case and would be temporary in nature.

12.7.2.2 Operational Stage

Given the minor increase in noise levels for this development, and that a 100% increase in traffic flow is required for a minor impact to be indicated, it's not expected that any significant impacts will occur with additional operational traffic from surrounding developments. Other outward noise impacts will be controlled through mitigation so that no additional impact will occur.

12.8 Monitoring

12.8.1 Proposed Development

12.8.1.1 Construction Stage

The contractor will be required to ensure construction activities operate within the noise limits set out within this assessment. The contractor will be required to undertake regular noise monitoring at locations representative of the closest sensitive locations to ensure the relevant criteria are not exceeded.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise. There is no monitoring recommended for the operational phase of the development as impacts due to noise and vibration are predicted to be not significant.

12.9 Reinstatement

Not applicable.

12.10 Difficulties Encountered

No difficulties encountered.