9 Noise and Vibration

9.1 Introduction

This chapter has been prepared by AWN Consulting Ltd.

This chapter assesses the potential noise & vibration impacts associated with the proposed residential development at Cornelscourt, Dublin.

This section of the EIAR has been prepared by AWN 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 over 6 years' experience as an environmental consultant.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the subject site and an assessment of the potential noise and vibration impacts associated with the proposed development during both the short-term construction phase and the long-term operational phase on its surrounding environment and on the development itself. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated in an environmentally sustainable manner in order to ensure minimal impact on the receiving environment.

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this chapter and included in the references section. In addition to specific noise guidance documents, the following guidelines were considered and consulted for the purposes of this chapter:

- EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002);
- 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 Assessment Reports, (Draft August 2017), and;
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

9.2 Study Methodology

The study has been undertaken using the following methodology:

- Detailed baseline noise monitoring has been undertaken across the development site to determine the range of noise levels at varying locations across the site;
- 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;
- Predictive calculations have been performed during the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operational phase of the development at the most sensitive locations surrounding the development site;
- An inward noise impact assessment has been completed to determine the potential noise impact from environmental noise on the residential amenity of the development, and;
- A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential inward and outward impacts relating to noise and vibration from the proposed development.

9.3 The Existing Receiving Environment (Baseline)

The site is located in Cornelscourt Village, Old Bray Road, Dublin. The site is bounded to the north-east by the N11 national road. Along the east and south borders are predominantly residential in nature. To the west lies a commercial building. A service station with car wash facility is situated to the south-west of the site.

Environmental Noise Survey

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. 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.

Choice of Measurement Positions

Measurement locations were selected as shown in Figure 9.1 below.

Figure 9.1 - Noise Survey Locations

The attended noise survey was conducted between the following periods:

- 10:20hrs to 12:15hrs on 16 August 2019.

The unattended noise survey was conducted between the following periods:

- 12:00hrs on 7 August 2019 to 17:00hrs on 14 August 2019.

The measurements cover a period that was selected in order to provide a typical snapshot of the existing noise climate, with the primary purpose being to ensure that the proposed noise criteria associated with the development are commensurate with the prevailing environment. The weather during the survey periods was variable with some heavy rainfall. Data for analysis has omitted these periods of adverse weather conditions and typical noise levels have been selected from a day and night of calm and dry weather.

Personnel and Instrumentation

Donogh Casey (AWN) performed the measurements during the survey periods. Attended and unattended measurements were made using a Rion NL-52 Sound Level Meter. Sample periods were 15-minutes for attended noise measurements and 5-minutes for unattended noise measurements.

Before and after the survey the measurement instruments were check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

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_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

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 maximum sound level measured during the sample period using the 'F' time weighting.

L_{day} is the average L_{Aeq} noise level measured over the course of the daytime period, defined as 07:00hrs to 19:00hrs

$L_{evening}$ is the average L_{Aeq} noise level measured over the course of the daytime period, defined as 19:00hrs to 23:00hrs

L_{night} is the average L_{Aeq} noise level measured over the course of the daytime period, defined as 23:00hrs to 07:00hrs

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.

Survey Results and Discussion

The results of the surveys at the unattended monitoring location are summarised in Table 9.1 below.

Date	Period (T)	Measured Noise Levels	
		$L_{Aeq,T}$	$L_{A90,T}$
07/08/2019	Day (07:00 – 23:00hrs)	69	52
	Night (23:00 – 07:00hrs)	65	39
08/08/2019	Day (07:00 – 23:00hrs)	70	53
	Night (23:00 – 07:00hrs)	66	47
09/08/2019	Day (07:00 – 23:00hrs)	70	54
	Night (23:00 – 07:00hrs)	63	43
10/08/2019	Day (07:00 – 23:00hrs)	68	53
	Night (23:00 – 07:00hrs)	64	44
11/08/2019	Day (07:00 – 23:00hrs)	69	52
	Night (23:00 – 07:00hrs)	65	40
12/08/2019	Day (07:00 – 23:00hrs)	69	53
	Night (23:00 – 07:00hrs)	65	40
13/08/2019	Day (07:00 – 23:00hrs)	69	53
	Night (23:00 – 07:00hrs)	66	41
14/08/2019	Day (07:00 – 23:00hrs)	70	53

Table 9.1 - Unattended Survey Results

Figure 9.2 presents the distribution of the magnitude of L_{AFmax} events during the night period at noise monitoring location U1.

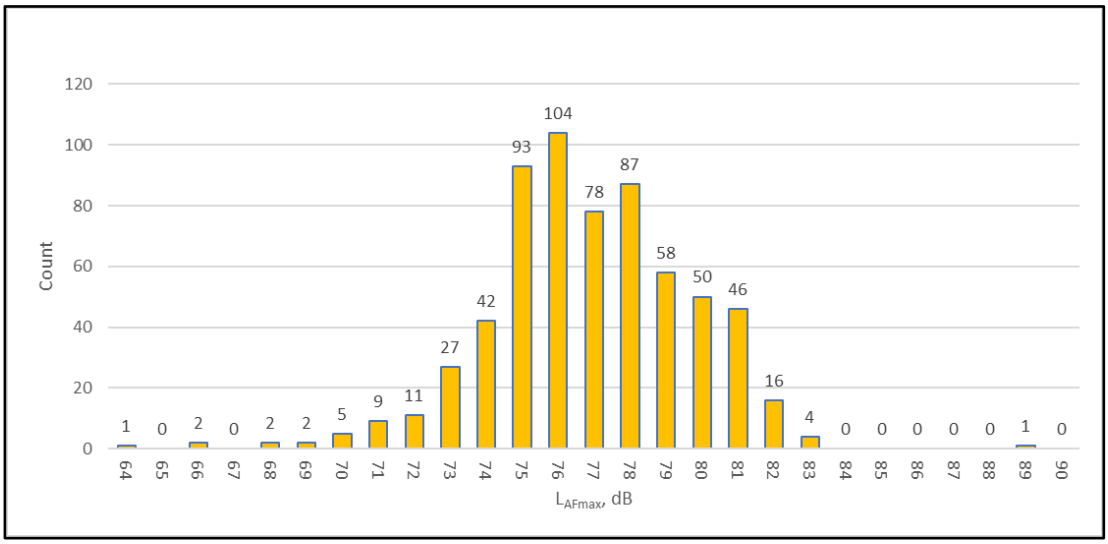

Figure 9.2 - Distribution of the Magnitude of Night Time Noise Events at Location U1

The results of the surveys at attended monitoring locations A1 and A2 are summarised in Tables 9.2 and 9.3 below.

Date/Time	Measured Noise Levels				
	L_{AFmax}	L_{AFmin}	L_{Aeq}	L_{A10}	L_{A90}
16/08/2019 10:23:28	65	47	57	60	51
16/08/2019 10:59:28	84	47	56	58	52
16/08/2019 11:56:20	99	46	62	55	49

Table 9.2 - Attended Noise Measurements at Location A1

Date/Time	Measured Noise Levels				
	L_{AFmax}	L_{AFmin}	L_{Aeq}	L_{A10}	L_{A90}
16/08/2019 10:41:34	59	45	50	52	48
16/08/2019 11:23:00	55	43	48	50	45
16/08/2019 11:38:32	57	44	49	51	46

Table 9.3 - Attended Noise Measurements at Location A2

Road traffic noise from the N11 road was the dominant source of noise at all locations, however it was noted during the attended survey that noise emissions from the service station car wash facility, which includes a jet wash, contributed towards the overall noise levels, in particular at location A1.

9.4 Characteristics of the Proposed Development

The current proposal provides for a Build to Rent development consisting:

- 468 residential units (452 apartments and 16 houses) as follow:
    - 41 no. studio apartment units,
    - 257 no. 1 bed apartment units,
    - 136 no. 2 bed apartment units;
    - 18 no. 3 bed apartment units;
    - 10 no. 3 bed semi-detached house units; and
    - 6 no. 1 bed bungalow units.
- A café / restaurant of c. 140 sq m; office space of 149 sq m; concierge of c. 149 sq m; and a residential tenant amenity space of c. 458 sq m is also proposed.
- 274 Car Parking Spaces (273 at basement level and 1 at surface level)
- 12 Motor Cycle Spaces
- 616 Bicycle Parking Spaces
- Public Open Space
- Vehicular Access
- Basement Areas
- Sub Stations and 3 Switch Rooms
- All Associated Site Development Works

When considering a development of this nature, the potential noise and vibration impacts on the surroundings must be considered for each of two distinct stages, the short-term construction phase and the permanent operational phase.

During the construction phase the main site activities will include, site clearance, building construction, road works, and landscaping. This phase has the greatest potential for noise and vibration impacts on the surrounding environment, however this phase will be of short-term impact.

During the operational phase of the development, no significant sources of outward noise or vibration are expected with the development. The primary source of outward noise in the operational context relates to any changes in traffic flows along the local road network and any operational plant noise. There is the potential for an inward noise impact on the development from road traffic noise generated by traffic on the N11 national road.

9.5 Potential Impact of the Proposed Development

Noise Criteria

Construction Phase

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.

Residential Receptors

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. Note that, in accordance with the BS5228 guidance, this assessment criteria is only applicable to residential receptors.

The closest neighbouring noise sensitive properties to the proposed development are the residential dwellings that bound the south and east of the site, these are located approximately 10m from the development site at their closest point.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 9.4 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 D	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

Table 9.4 - Example Threshold Of Significant Effect at Dwellings

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

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

Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) 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. Baseline monitoring carried out as part of this assessment would indicate that noise sensitive receptors surrounding the site will range from Category A at the southern boundary of the site to category C where receptors are close to the N11. Figure 9.3 presents a map indicating properties that fall into the various categories where green,

orange and red are categories A, B and C respectively. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur.

Commercial Receptors

BS5228-1:2009+A1 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedence of fixed noise limits. For example paragraph E.2 states:

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."

Paragraph E.2 goes on to state:

"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;

75 decibels (dBA) in urban areas near main roads in heavy industrial areas".

For non-residential locations it is considered appropriate to adopt the 75dB(A) criterion during the day. The non-residential properties are only considered to be noise sensitive during office hours.

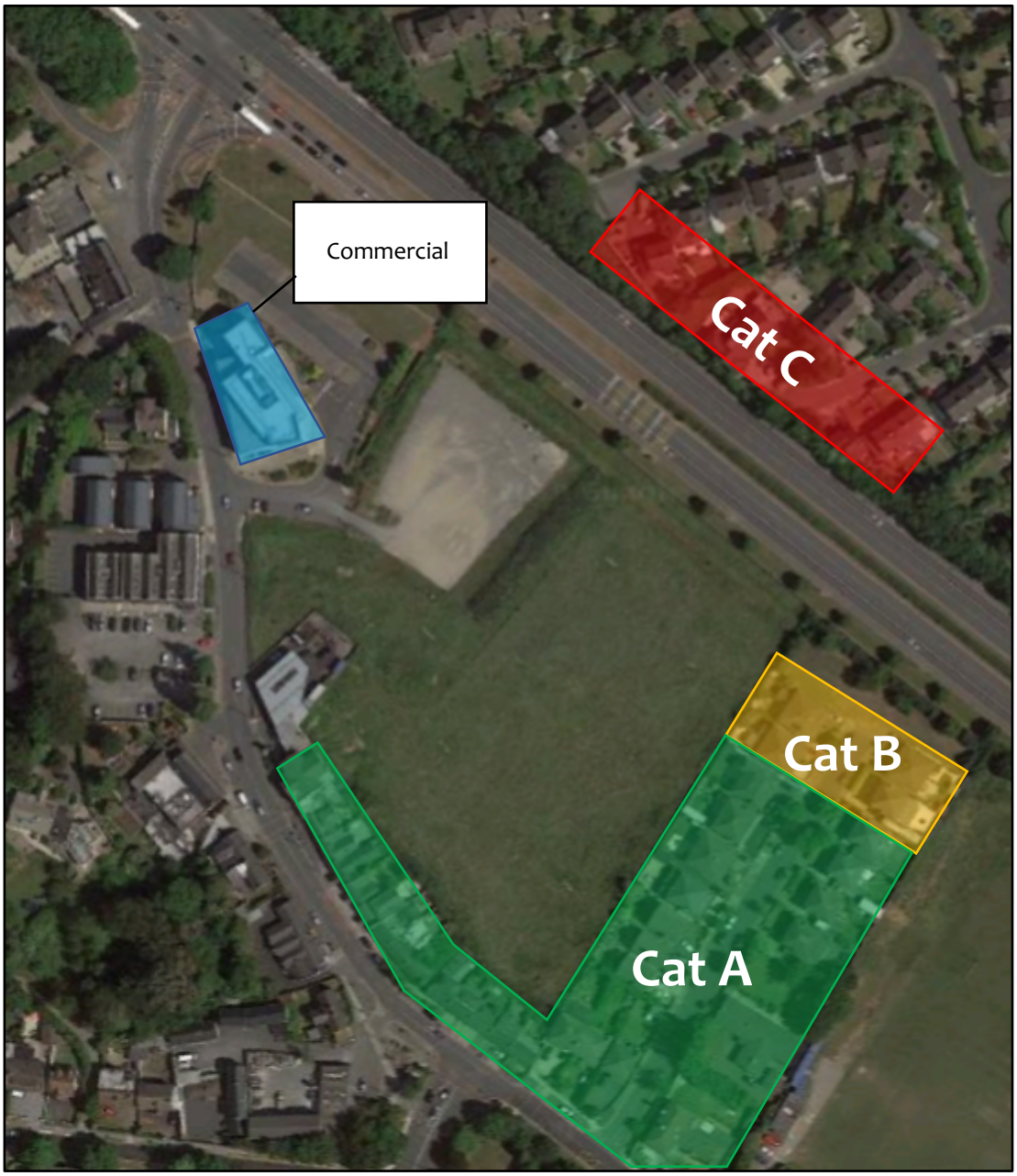

Figure 9.3 - Noise Sensitive Receptor Construction Categories

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 associated with vehicular traffic on public roads, Table 9.5 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2011).

Change in Sound Level (dB LA10)	Subjective Reaction	DMRB Magnitude of Impact	EPA Classification Magnitude of Impact
0	Inaudible	No Change	Neutral
0.1 – 2.9	Barely Perceptible	Negligible	Imperceptible
3 – 4.9	Perceptible	Minor	Slight
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate
10+	Doubling of loudness and above	Major	Significant

Table 9.5 - Likely Impact Associated with Change in Traffic Noise Level

Operational Phase – 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; and,
- 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 9.4 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.

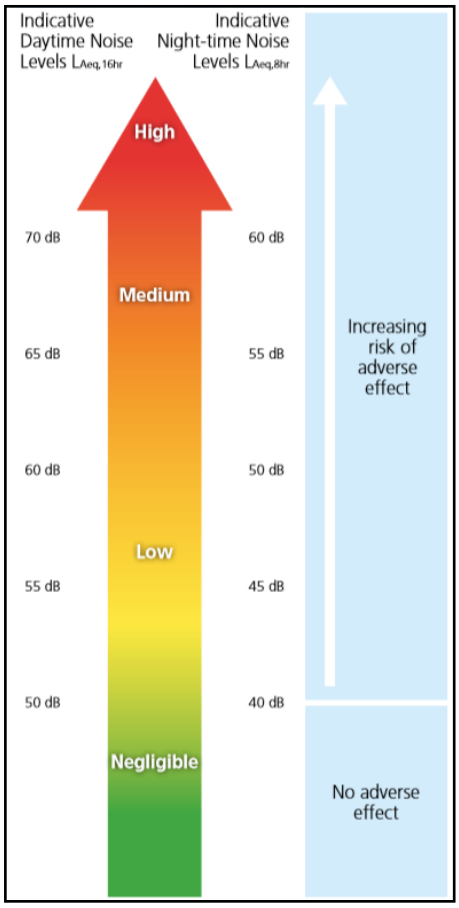

Figure 9.4 - ProPG Stage 1 - Initial Noise Risk Assessment

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). The recommended indoor ambient noise levels are set out in Table 9.6 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 23:00hrs)	(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 $L_{Aeq,\ 8hr}$ 45 dB L_{AFmax}

Table 9.6 - 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 $L_{Aeq,16hr}$."*

Operational Phase – Outward Noise Impact

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.

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 2dB penalty for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB 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 +10dB 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 +5dB 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.

Vibration Criteria

Construction Phase

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 property 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 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this lower value. Taking the above into consideration the vibration criteria in Table 9.7 are recommended.

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 15Hz	15 to 40Hz	40Hz and above
12 mm/s	20 mm/s	50 mm/s

Table 9.7 - Instrumentation Details

Operational Phase

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

9.6 Potential Cumulative Impacts

There are no known potential cumulative impacts.

9.7 Do Nothing Scenario

In the event of a Do Nothing Scenario the noise environment is not expected to change.

9.8 Risks to Human Health

In terms of the noise exposure of construction workers and potential hearing damage that may be caused due to exposure to high levels of noise, the Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) provides guidance in terms of allowable workplace noise exposure levels for employees. The Regulations specify two noise Action Levels at which the employer is legally obliged to reduce the risk of exposure to noise. The appointed contractor will be required to comply with the Regulations and provide appropriate noise exposure mitigation measures where necessary. The noise exposure level to off-site receptors during the construction phase will be below the lower Action Level and therefore the risk of noise exposure resulting in potential hearing damage to off-site receptors is minimal.

9.9 Predicted Impacts of the Proposed Development

Construction Phase - Noise

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 18:00hrs, 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 and lorry movements on uneven road surfaces. Due to the nature of the construction works on site there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings as a result of vibration.

Due to the fact that 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. Table 9.8 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.)	Construction Noise Level at 10m Distance (dB L_{Aeq})
Site Preparation	Wheeled Loader Lorry (D3 1)	75
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Demolition	Pulveriser on Tracked Excavator (C1.5)	72
	Tracked Crusher (C1.14)	82
	Breaker Mounted on Backhoe (C1.2)	92
	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 9.8 - Typical Noise Levels Associated with Construction Plant Items

For the purposes of the assessment we have assumed that standard good practice measures for the control of noise from construction sites will be implemented. These issues are commented upon in further detail in the mitigation section of this chapter.

Table 9.9 presents the predicted daytime noise levels from an indicative construction period on site at the nearest off-site receptor. Note construction noise sources for site are assumed to be running 50% of the time over soft ground. The predictions have been prepared at various distances to provide an overview of how construction works will effect noise sensitive at various locations across the site. The distance of 10m is representative of the worst-case situation when construction work is ongoing on the site boundaries closest to existing residential dwellings in categories A and B.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level (dB $L_{Aeq,T}$) at Distance:		
		10m	35m	50m
Site Preparation	Wheeled Loader Lorry (D3 1)	65	54	51
	Track Excavator (C2 22)	62	51	48
	Dozer (C2.13)	68	57	54
	Dump Truck (C4.2)	68	57	54
Site Preparation Total		**72**	**62**	**58**
Foundations	Tracked Excavator (C3.24)	64	53	50
	Concrete Pump (C3.25)	68	57	54
	Compressor (D7 6)	67	56	53
	Poker Vibrator (C4 33)	68	57	54
	Large Rotary Bored Piling Rig (C3.14)	(no piling expected at this distance)	62	59
Foundations Total		**73**	**65**	**62**
General Construction	Hand tools	71	60	57
	Tower Crane (C4.48)	66	55	52
	Pneumatic Circular Saw (D7.79)	65	54	51
	Internal fit – out	60	49	46
General Construction Total		**73**	**62**	**59**
Landscaping	Dozer (C2.13)	68	57	54
	Dump Truck (C4.2)	68	57	54
	Surfacing (D8.25)	58	47	44
Landscaping Total		**71**	**60**	**57**

Table 9.9 - Construction Noise Predictions

Construction predictions indicate that a significant impact may temporarily occur when works are on-going at the boundaries to the closest sensitive residential receptors at the east and south of the site (A and B in Figure 9.3), this is when works will be at 10m distance to the noise sensitive receptors. However, the vast majority of the construction works will take place at distances from the receptors where no significant impacts are predicted, for instance at distances of 35m and greater there are no significant impacts predicted.

It should be noted that where significant impacts are predicted, these are worst case scenarios that assume all plant for an activity will operate along the boundary line opposite a sensitive receptor, under real world conditions this is unlikely to occur. Construction noise levels will be lower than these levels for the majority of the time at the majority of properties in the vicinity of the proposed development.

No significant impacts are predicted at the commercial receptors.

Construction Phase - Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given that rock breaking is not expected. In terms of piling, this activity is not expected to occur within 35m distance to the nearest noise sensitive property. 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 orders of magnitude below the limits set out in Table 9.7 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants. The impacts are predicted to be short-term, negative and not significant.

Operational Phase – Additional Road Traffic on Public Roads

A traffic impact assessment relating to the proposed development has been prepared by DBFL Consulting Engineers as part of this EIAR. Information from this report 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 and the calculated change in noise levels during these two periods are summarised in Table 9.10.

Junction	Year 2021			Year 2036		
	Do Nothing	Do Something	Change in Noise Level (dB)	Do Nothing	Do Something	Change in Noise Level (dB)
A	9035	10185	+0.5	10419	11569	+0.5
B	558	558	0.0	643	643	0.0
C	9078	10228	+0.5	10469	11618	+0.5
D	8913	9570	+0.3	10279	10935	+0.3
E	2359	2403	+0.1	2720	2764	+0.1
F	9042	9742	+0.3	10428	11128	+0.3
G	9268	10450	+0.5	10688	11870	+0.5
H	9367	9936	+0.3	10803	11371	+0.2
I	9299	9874	+0.3	10724	11299	+0.2
J	9714	9802	0.0	11202	11291	0.0
K	9407	9893	+0.2	10848	11334	+0.2

Table 9.10 - Change in Traffic Noise Levels with Proposed Development

The predicted increase in traffic noise levels associated with the development is less than 1dB for both the opening and design years. Reference to Table 9.5 confirms that this increase is barely perceptible and the resultant impact is imperceptible.

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, neutral and imperceptible impact.

Operational Phase – Inward Noise Impact

The development lands in question are in proximity to the N11 National Road which lies to the north-east of the site. Noise from the road has the potential to impact the residential developments proposed for the site itself.

Existing Noise Climate

The existing noise and vibration climate within the development lands was surveyed and the results summarised in Section 9.3 of this chapter. The results of the survey have indicated that the N11 contributes significant noise levels at the measurement locations on the north-east boundary of the site. In addition to this it was noted that noise emissions from the service station and car wash on the south-west boundary contributed to overall noise levels during the day period.

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 Section 9.5 (Table 9.6).

It is possible to calculate internal noise levels within the residential properties 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 in order 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;
- Topographical survey of the development site, and;
- OS mapping of surrounding environment.

Calibration of Noise Model

Noise levels recorded during the unattended survey location U1 were used to calibrate the noise model. Noise levels are calculated at the same location using the developed noise model. The results are presented in Table 9.11 below for daytime periods, i.e. 07:00 to 19:00hrs, evening periods (19:00 to 23:00hrs) and night-time periods, 23:00 to 07:00hrs and compared against those measured on site.

Location	Time Period	Measured Noise Level, dB	Predicted Noise Level, dB
U1	Day	70	70
	Night	66	66

Table 9.11 - Predicted & Measured Noise Levels at Development Site

The model results are considered an accurate representation of noise levels across the site.

Noise Risk Classification of the Site

Following the methodology outlined in ProPG, as discussed in Section 9.5.1, the noise model has been used to predict noise levels across the site. The results of this exercise are presented in Figures 9.5 and 9.6 for day and night periods respectively.

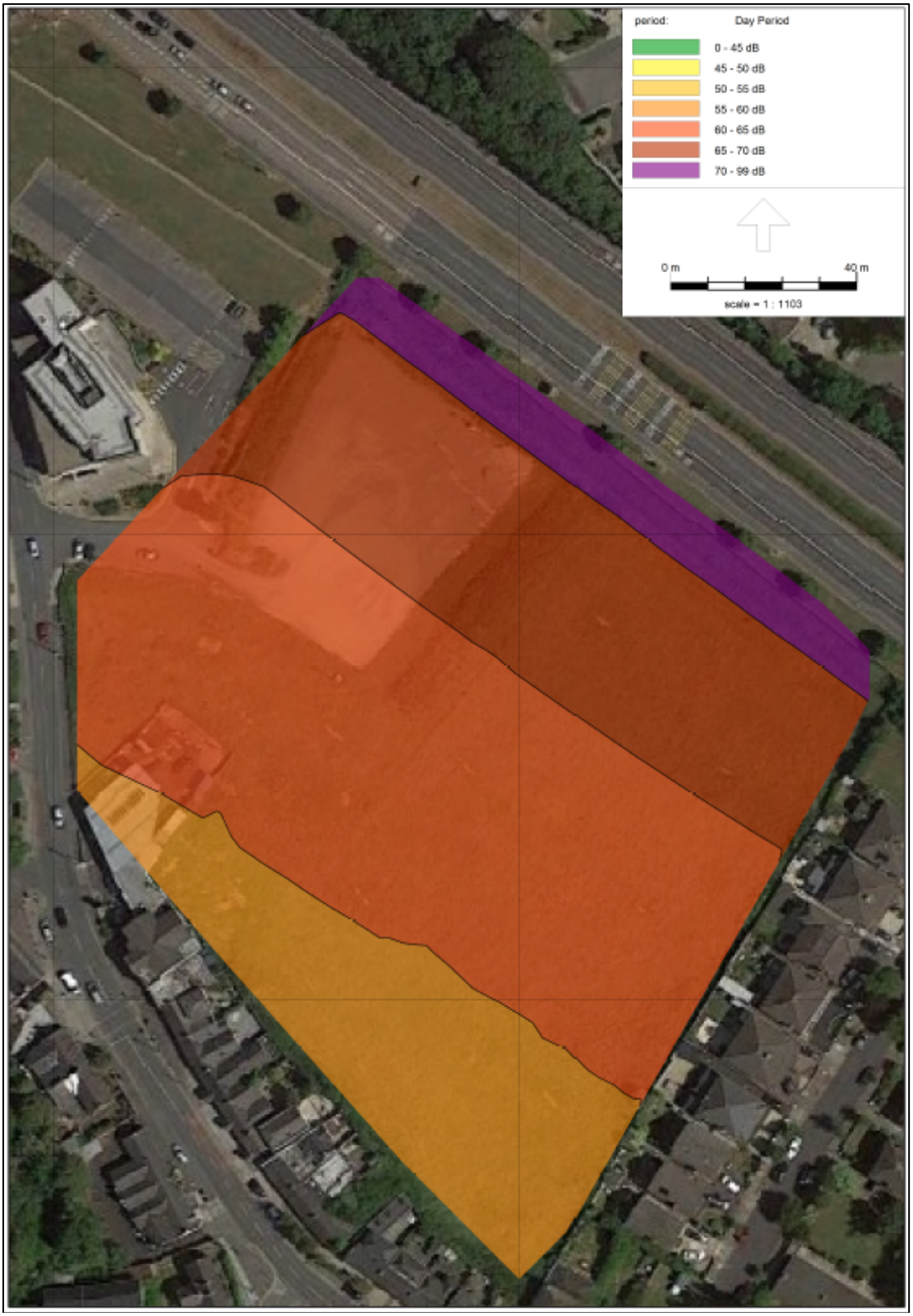

Figure 9.5 - Predicted Existing Noise Contour Across the Cleared Development Site – Day

Figure 9.6 - Predicted Existing Noise Contour Across the Cleared Development Site – Night

Road traffic noise levels calculated across the majority of the site during daytime periods are between 55 and 70 dB $L_{Aeq,16hr}$. Night time noise levels are the order of 45 to 65 dB $L_{Aeq,8hr}$ across the site in this situation. The area of the site closest to the N11 experience noise levels up to 71 dB $L_{Aeq,16hr}$ during the day and 66 dB $L_{Aeq,8hr}$ at night.

Giving consideration to the measured and predicted noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site varies from medium to high noise risk.

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the L_{AFmax} noise levels. In the case of the AWN survey the L_{AFmax} noise levels typically measured less than 80dB during the night with sporadic events also recorded above this level. ProPG guidance considers 20 night events over 80dB to be a high risk, therefore this site would be considered a medium risk in terms of maxima events.

ProPG states the following with respect to medium and high risks:

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 Medium 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.

Façade Noise Levels

Noise levels have been predicted across the development site during day and night-time periods using the noise model developed to include the development 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 above these levels 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.

Figure 9.7 identifies 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 9.10.

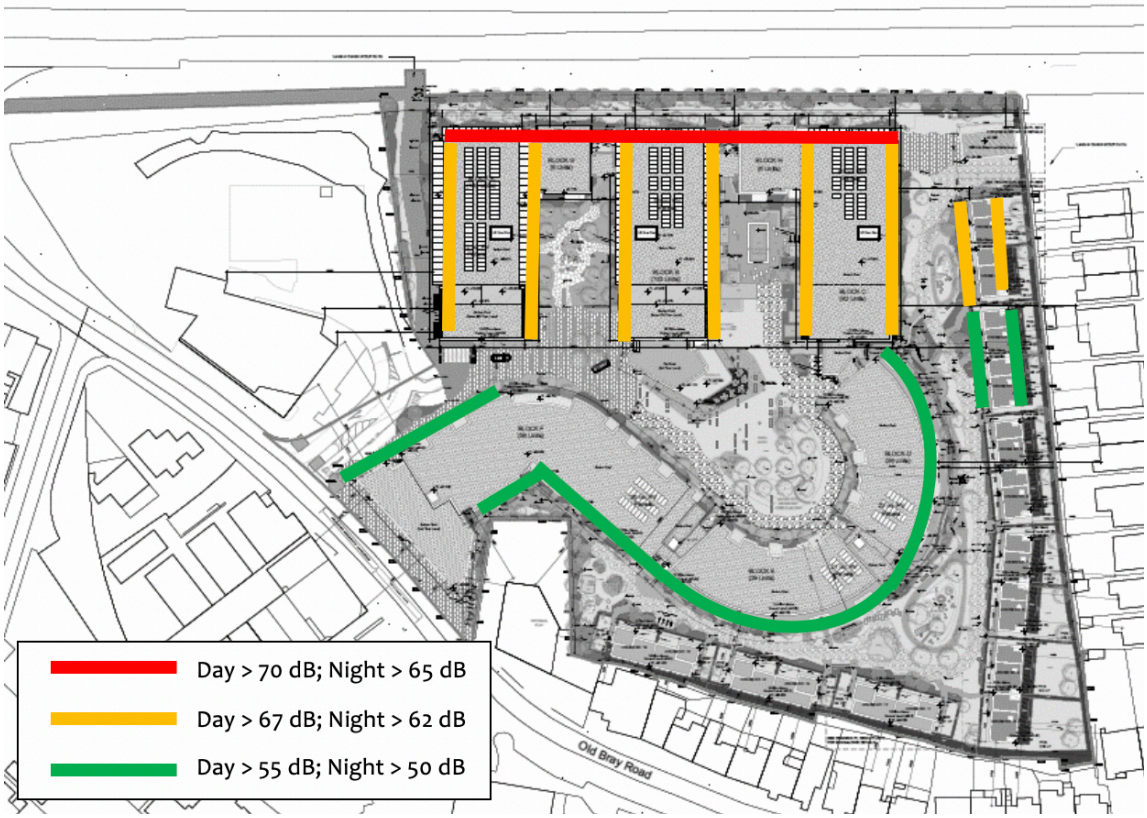

Figure 9.7 - Locations for Enhanced Acoustic Façade Specification

External Noise Levels

External noise levels within the vast majority of public open spaces and private gardens across the development site are generally within the recommended range of noise levels from ProPG of between 50 – 55 dB $L_{Aeq,16hr}$ as illustrated in Figure 9.8. It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site, therefore no further mitigation is required to control external noise levels across amenity areas.

Figure 9.8 - Predicted Noise Levels Across External Areas (1.5m above ground)

Operational Phase - Outward Noise Impact

Once operational, there will be building services plant items required to serve the commercial and residential aspect of the development. These will typically be limited to heating and cooling plant and extract units, depending on the building design and user requirements. Given the use of these

buildings, the majority of plant items are likely to be required during daytime hours only, however, there may be requirement for night-time operational plant, depending on specific requirements.

The location or type of building services plant has not yet been established, therefore it is not possible to calculate noise levels to the surrounding environment. These items will be selected at a later stage, however, 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 noise sensitive location within the development (e.g. apartments, etc.) will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods

9.10 Mitigation Measures

Construction Phase

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Predictions indicate that significant construction noise impacts are expected to occur when work is ongoing at boundary locations adjacent to noise sensitive locations, hence the contractor will ensure that all best practice noise and vibration control methods will be used. In this regard, various mitigation measures can be considered and applied during the construction of the proposed development, such as:

- limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- all site access roads will be kept even so as to mitigate the potential for vibration from lorries.

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

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- erection of barriers as necessary around noisy processes and items such as generators heavy mechanical plant or high duty compressors;
- placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.

Operational Phase – Inward Noise Impact

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 9.7 will be provided with glazing and ventilation that achieves the minimum sound insulation performance as set out in Table 9.12 and Table 9.13. Other facades in the development have no minimum requirement for sound insulation.

Façade	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
RED	30	30	39	44	48	51	42
ORANGE	30	29	32	41	46	49	39
GREEN	27	26	33	39	39	47	37

Table 9.12 - Sound Insulation Performance Requirements for Glazing, SRI (dB)

Façade	Octave Band Centre Frequency (Hz)						$D_{ne,w}$
	125	250	500	1k	2k	4k	
RED	31	33	42	43	39	44	42
ORANGE	35	34	33	38	49	49	39
GREEN	33	34	33	42	29	32	34

Table 9.13 - Sound Insulation Performance Requirements for Ventilation, SRI (dB)

The overall R_w and $D_{ne,w}$ outlined above are provided for information purposes only. The over-riding requirement is the 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 Tables 9.12 and 9.13 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.

9.11 Monitoring

Construction Phase

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.

Operational Phase

Noise or vibration monitoring is not required once the development is operational.

9.12 Reinstatement

Not applicable.

9.13 Interactions

In compiling this impact assessment, reference has been made to the project description provided by the project co-ordinators, project drawings provided by the project architects and traffic flow projections associated with the development provided by the traffic consultants.

9.14 Difficulties Encountered

No difficulties were encountered during the formation of this chapter.

9.15 References

Dublin Agglomeration Noise Action Plan 2018 – 2023 (NAP).

BS 8233: 2014: Guidance on sound insulation and noise reduction for buildings.

British Standard BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound

Design Manual for Roads & Bridges – Volume 11 Section 3.

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.

ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

ISO 9613 (1996): Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.

EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002).

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 Assessment Reports, (Draft August 2017).

EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

Professional Guidance on Planning & Noise (ProPG), (IoA, 2017).