CHAPTER 10

NOISE AND VIBRATION

10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

This chapter assesses the likely noise and vibration impacts associated with the proposed development at Fosterstown North, Swords, Co. Dublin. The proposed development, for which a seven year permission is sought, comprises a Strategic Housing Development consisting of 645 residential units, a community facility, a childcare facility, 5 commercial units car and cycle parking, landscaping, public and communal open space, road upgrades and vehicular access and associated internal roads, pedestrian and cycle paths and all associated site and infrastructural works. A full description of the development can be found in Chapter 2.

This assessment has been prepared by Alistair Maclaurin BSc PgDip MIOA, Senior Consultant at AWN Consulting who has over 8 years' experience as an acoustic consultant.

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 EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports Draft (August 2017) were considered and consulted for the purposes of this chapter.

10.2 STUDY METHODOLOGY

The study has been undertaken using the following methodology:

- 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, this is summarised in the following sections;
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the project at the nearest sensitive locations (NSL's) to the site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the development site;
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development, and;
- The inward impact of noise in the surrounding environment into the proposed buildings has also been assessed to determine the requirements, for additional noise mitigation to provide suitable residential amenity.

10.2.1 Construction Phase – Noise

BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2

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 Parts 1 and 2* 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. Note that, in accordance with the BS5228 guidance, this assessment criterion 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 west of the site on Boroimhe Laurels and Boroimhe Willows, respectively. The closest receptor is located approximately 20m from the development site.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 10.1 sets out the values which, when exceeded, signify a potential 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

Table10.1: Example Threshold of Potential Significant Effect at Dwellings

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

I*nterpretation of the CNT*

In order to assist with interpretation of CNTs, **Error! Reference source not found.** includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of DMRB: Noise and Vibration and adapted to include the relevant significance effects from the EPA EIAR Guidelines (EPA 2017).

Guidelines for Noise Impact Assessment Significance (DMRB)	**CNT per Period**	**EPA EIAR Significance Effects**	**Determination**
Negligible	Below or equal to baseline noise level	Not Significant	
Minor	Above baseline noise level and below or equal to CNT	Slight to Moderate	
Moderate	Above CNT and below or equal to CNT +5 dB	Moderate to Significant	
Major	Above CNT +5 to +15 dB	Significant, to Very Significant	

Table10.2: Example Threshold of Potential Significant Effect at Dwellings

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

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

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

10.2.2 Construction Phase – Vibration

Peak particle velocity (PPV) is commonly used to assess the structural response of buildings to vibration. Reference to the following documents has been made for the purposes of this assessment in order to discuss appropriate PPV limit values.

- British Standard BS7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration, and;
- British Standard BS5228-2: 2009 + A1: 2014: Code of practice for noise and vibration control on construction and open sites – Vibration.

BS5228-2 and BS7385 advise 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 12.5 mm/s PPV the risk of damage tends to zero.

The recommended vibration limits in order to avoid cosmetic damage to buildings, as set out in both documents referred to above, are reproduced in Table 10.3. The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 1.4. Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in the Table. It should be noted that these values refer to the base of the building.

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

Table10.3: Transient Vibration Guide Values for Cosmetic Damage

Human response to vibration stimuli occurs at orders of magnitudes below those associated with any form of building damage, hence vibration levels lower than those indicated in Table 1.4 can lead to concern. BS5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of PPV. Table 10.4 summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	**Effect**
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1 mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Table10.4: Guidance on Effects of Human Response to PPV Magnitudes

The standard notes that single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. Where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 might be more appropriate to determine whether time varying exposure is likely to give rise to any degree of adverse comment.

10.2.3 Operational Phase – Noise from Mechanical Plant

BS 4142:2014: Methods for rating and assessing industrial and commercial sound is the industry standard method for analysing building services plant sound emissions to residential receptors. 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 sound 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 sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS4142 advises that penalties be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal sound characteristics outlined in BS 4142 recommends the application of a 2dB penalty for a tone which is just perceptible at the receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible. In relation to intermittency, BS 4142 recommends that If the intermittency us readily is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied. The following definitions as discussed in BS 4142 as summarised below:

"ambient sound level, $L_{Aeq,T}$"	equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at any given time, usually from many sources near and far, at the assessment location over a given time interval, T.
"residual sound level, $L_{Aeq,T}$"	equivalent continuous A-weighted sound pressure level of the residual sound (i.e. ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound) at the assessment location over a given time interval, T.
"specific sound level, $L_{Aeq,T}$"	equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
"rating level, $L_{Ar,T}$"	specific sound level plus any adjustment for the characteristic features of the sound.
"background sound level, $L_{A90,T}$"	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

In order to establish an initial estimate of impact, BS 4142 states the following:

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following.

a. Typically, the greater this difference, the greater the magnitude of the impact.
b. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d. 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, depending on the context.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

The assessment methodology described above (i.e. comparison of rated sound level to background sound level) is quoted in BS4142 as representing a methodology to 'obtain an initial estimate' of impact. It is important to note that BS4142 also comments *that 'Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration'*. BS4142 provides a list of potential pertinent factors that can influence the 'initial estimate'. The plant noise assessment conducted in the following sections has been carried out with consideration of the guidance contained in BS4142 as summarised above.

10.2.4 Operational Phase – Assessment of Significance

The draft *'Guidelines for Noise Impact Assessment'* produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party have been referenced in relation to the potential impact of changes in the ambient noise levels during the construction and the operational phases of the proposed development.

The findings of the Working Party are draft at present although they are of some assistance in this assessment. The draft guidelines state that for any assessment, the noise level threshold and significance should be determined by the assessor, based upon the specific evidence and likely subjective response to noise.

The draft 'Guidelines for Noise Impact Assessment' impact scale adopted in this assessment is shown in Table 10.5 below. The corresponding significance of impact presented in the EPA Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft September 2017) is also presented.

Noise Level Change dB(A)	Subjective Response	Impact	Noise Level Change dB(A)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant/ Profound

Table10.5: Noise Impact Scale

10.2.5 Operational Phase – Inward Noise Assessment

Dublin Agglomeration Noise Action Plan 2019 - 2023

The Dublin Agglomeration NAP states the following with respect to assessing the noise impact on new residential development:

> *"In the scenario where new residential development or other noise sensitive development is proposed in an area with an existing climate of environmental noise, there is currently no clear national guidance on*

appropriate noise exposure levels. The EPA has suggested in the interim, that Action Planning Authorities should examine planning policy guidance notes, such as ProPG (2017). Such guidance notes have been produced with a view to providing practitioners with guidance on a recommended approach to the management of noise within the planning system."

In addition, the following is provided:

"In advance of any national guidance relating to noise in the planning process, the following actions relating to planning and development will be considered for implementation:

a) To integrate Noise Action Plans into the County Development Plans.
b) To develop guidelines relating to Noise and Planning for FCC [Fingal County Council]. These guidelines should outline the considerations to be taken into account when determining planning applications for both noise-sensitive developments and for those activities which will generate noise. They should introduce the concept of a risk based approach to assessment of noise exposure, and for Good Acoustic Design to be encouraged as part of all new residential developments in FCC.
c) To require developers to produce a noise impact assessment and mitigation plans, where necessary, for any new development where the Planning Authority considers that any new development will impact negatively on pre-existing environmental noise levels within their Council area.
d) To ensure that future developments are designed and constructed in such a way as to minimise noise disturbances in accordance with Department of the Environment, Community and Local Government planning guidelines such as the Urban Design Manual. e.g. the position, direction and height of new buildings, along with their function, their distance from roads, and the position of noise barriers and buffer zones with low sensitivity to noise,
e) To ensure that new housing areas and in particular brown field developments will be planned from the outset in a way that ensures that at least the central area is quiet. This could mean designating the centre of new areas as pedestrian and cycling zones with future developments to provide road design layouts to achieve low speed areas where appropriate.
f) To incorporate street design in new developments, which recognise that residential streets have multi-function uses (e.g. movement, recreation) for pedestrians, cyclists and vehicles, in that priority order. The noise maps will be used to identify and classify the priority areas and streets. In the design of streets, cognisance should be given to the Irish Manual for Roads and Streets 2013.
g) To require sound proofing for all windows, in all new residential developments, where noise maps have indicated undesirable high noise levels. This may also lead to a requirement to install ducted ventilation.
h) To advise during pre-planning meetings regarding site specific design, the orientation of sensitive rooms and balconies away from noise, designing the layout and internal arrangement in apartments to ensure that similar rooms in individual units are located above each other or adjoin each other and that halls are used as buffer zones between sensitive rooms and staircases."

In accordance with this NAP policy, the ProPG document has been referred to and an Acoustic Design Statement (ADS) has been prepared to comply with the requirements of this policy.

Fingal Development Plan Policy on Aircraft Noise

The members of Fingal County Council resolved to adopt Variation No. 1 of the Fingal Development Plan 2017-2023 at a Council meeting on 9 December 2019. Variation No. 1 outlines revised Noise Zones and policy objectives in relation to aircraft noise from Dublin Airport.

Four noise zones (Zone A to D) are now indicated representing potential site exposure to aircraft exposure. The council will actively resist residential development within Zone A, and resist in Zone B and C pending independent acoustic advice and mitigation measures. Certain specific residential developments located in Zone D may be required to demonstrate that aircraft noise intrusion has been considered in the design.

Table 10.6 below outlines the objectives to be adhered to by applicants for developments in each zone.

Zone	Indication of Potential Noise Exposure during Airport Operations	Objective
D	≥ 50 dB and < 54 dB $L_{Aeq, 16hr}$ and ≥ 40 dB and < 48 dB L_{night}	**To identify noise sensitive developments which could potentially be affected by aircraft noise and to identify any larger residential developments in the vicinity of the flight paths serving the Airport in order to promote appropriate land use and to identify encroachment.** *All noise sensitive development within this zone is likely to be acceptable from a noise perspective. An associated application would not normally be refused on noise grounds, however where the development is residential-led and comprises non residential noise sensitive uses, or comprises 50 residential units or more, it may be necessary for the applicant to demonstrate that a good acoustic design has been followed.* *Applicants are advised to seek expert advice.*
C	≥ 54 dB and < 63 dB $L_{Aeq, 16hr}$ and ≥ 48 dB and < 55 dB L_{night}	**To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development** *Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed.* *The noise assessment must demonstrate that relevant internal noise guidelines will be met. This may require noise insulation measures.* *An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.* *Applicants are strongly advised to seek expert advice.*
B	≥ 54 dB and < 63 dB $L_{Aeq, 16hr}$ And ≥ 55 dB L_{night}	**To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure noise insulation is incorporated within the development.** *Noise sensitive development in this zone is less suitable from a noise perspective than in Zone C. A noise assessment must be undertaken in order to demonstrate good acoustic design has been followed.* *Appropriate well-designed noise insulation measures must be incorporated into the development in order to meet relevant internal noise guidelines.* *An external amenity area noise assessment must be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.* *Applicants must seek expert advice.*

A	≥ 63 dB $L_{Aeq, 16hr}$ and/or ≥ 55 dB L_{night}	**To resist new provision for residential development and other noise sensitive uses.** *All noise sensitive developments within this zone may potentially be exposed to high levels of aircraft noise, which may be harmful to health or otherwise unacceptable. The provision of new noise sensitive developments will be resisted.*
Notes: • 'Good Acoustic Design' means following the principles of assessment and design as described in ProPG: Planning & Noise – New Residential Development, May 2017; • Internal and External Amenity and the design of noise insulation measures should follow the guidance provided in British Standard BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'		

Table 10.6: Aircraft Noise Zones

ProPG: Planning & Noise (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 UK or Irish government document, since it's publication 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, and;
    - Element 4 - Other Relevant Issues.

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

A. Planning consent may be granted without any need for noise conditions;
B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or,
D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

Section 3.0 of the ProPG provides a more detailed guide on decision making to aid local authority planners on how to interpret the findings of an accompanying Acoustic Design Statement (ADS).

A summary of the ProPG approach is illustrated in Figure 10.1.

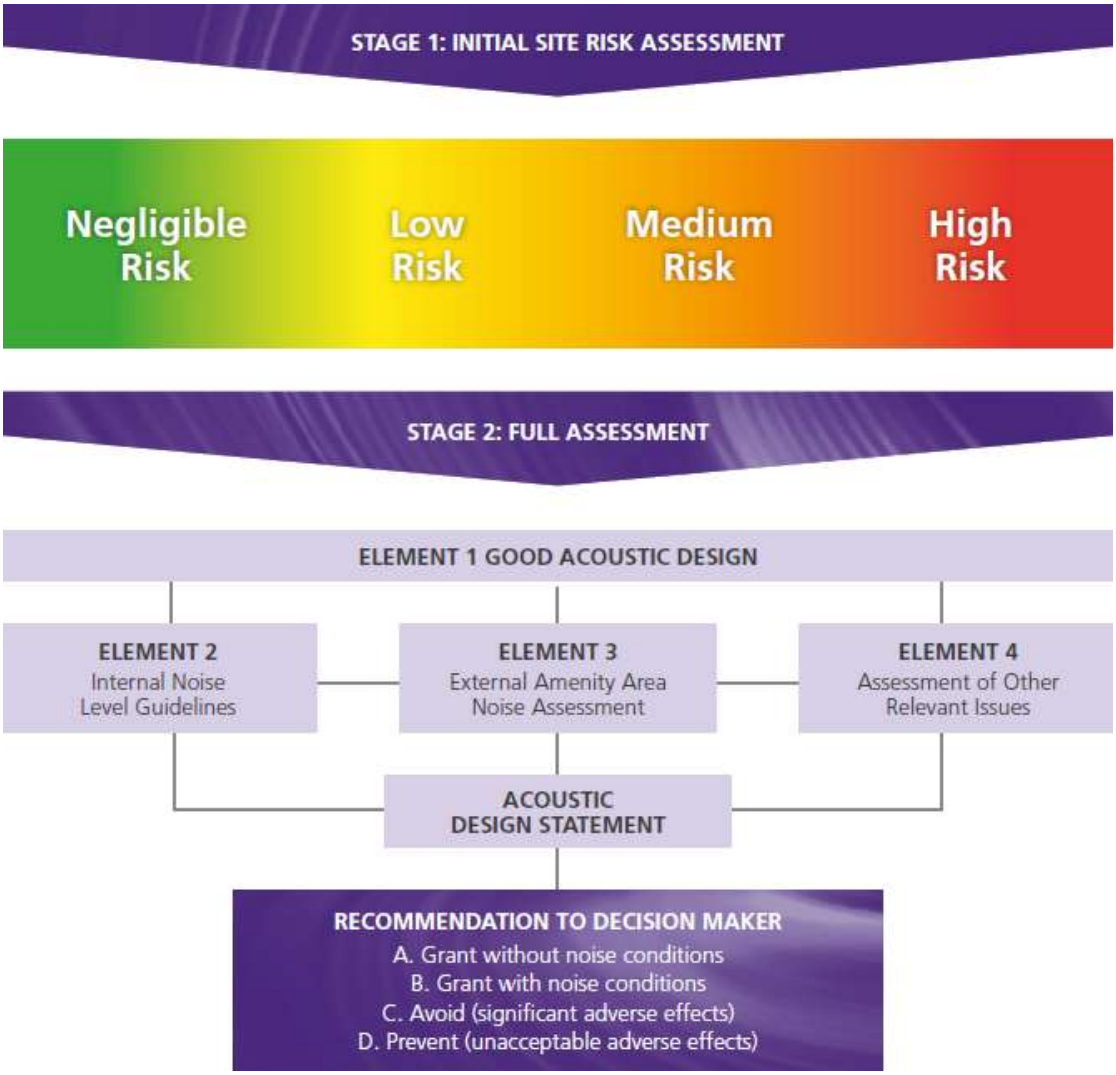

Figure 10.1: ProPG Approach (Source: ProPG)

10.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

Baseline noise monitoring has been undertaken across the development site to determine the range of noise levels at varying locations across the site and to establish the existing noise climate the nearest noise sensitive locations and across the development site itself.

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.

10.3.1 Choice of Measurement Locations

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.

Measurement locations were selected as shown in Figure 10.2.

Figure 10.2: Measurement Locations

Location A1 – Attended measurements undertaken adjacent to dwellings on Dublin Rd
Location A2 – Attended measurements undertaken adjacent to dwellings on Boroimhe Willows
Location A3 – Attended measurements undertaken adjacent to dwellings on Boroimhe Laurels
Location U1 – Unattended measurements undertaken on site.

10.3.2 Survey Periods

The attended noise survey (Locations A1 to A3) was conducted between the following periods:

- 12:30hrs to 15:30hrs on 3 July 2019.

The unattended noise survey (Location U1) was conducted between the following periods:

- 12:15hrs on 3 July 2019 to 16:15hrs on 4 July 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.

10.3.3 Instrumentation

Attended measurements were made using a Brüel and Kjær Type 2250 Sound Level Meter serial number 2818091. Unattended measurements were made using a RION NL-52 serial number 1076328. Sample periods were 15

minutes. Before and after the survey the measurement instruments were check calibrated using a B&K Sound Level Calibrator.

10.3.4 Measurement Parameters

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

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

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

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

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

10.3.5 Survey Results

The results of the surveys at the unattended monitoring location are graphed in Figure 10.3 and summarised in Table 10.7 below.

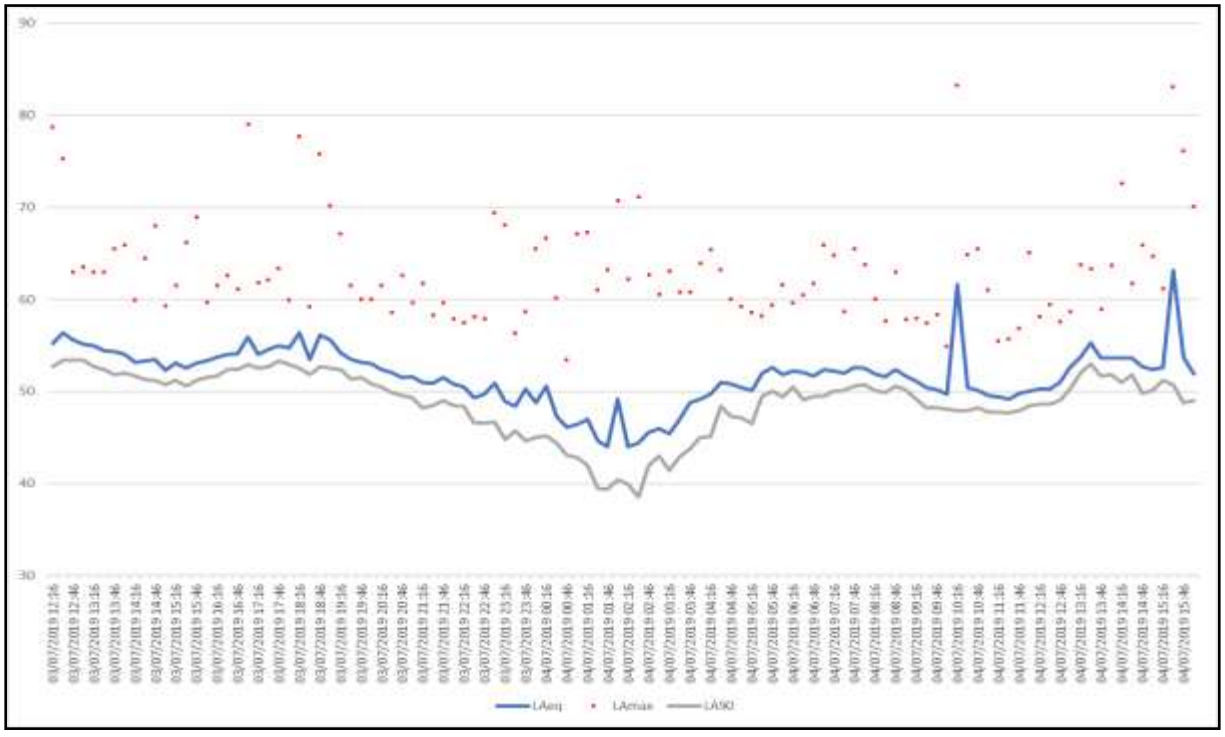

Figure 10.3: Measured Noise Levels at Location U1

Date / Time	Period	Measured Noise Levels, dB		
		$L_{Aeq,T}$	L_{Amax}	$L_{A90,T}$
03/07/2019	Day (12:16 – 23:01hrs)	54	79	51
03/07/2019	Night (23:01 – 07:01hrs)	49	71	45
04/07/2019	Day (07:01 – 16:16hrs)	54	83	50

Table 10.7: Measured Noise Levels at Location U1

The results of the surveys at attended monitoring locations A1, A2 and A3 are summarised in Tables 10.8 to 10.10 below.

Time	Measured Noise Levels, dB		
	L_{Aeq}	L_{Amax}	L_{A90}
12:50	67	81	58
13:51	68	81	58
14:51	68	78	57

Table 10.8: Measured Noise Levels at Location A1

The noise environment at location A1 was dominated by passing road traffic on the R836 and the R132.

Time	Measured Noise Levels, dB		
	L_{Aeq}	L_{Amax}	L_{A90}
13:09	50	65	47
14:10	49	67	46
15:10	50	69	44

Table 10.9: Measured Noise Levels at Location A2

The noise environment at location A2 was dominated by local road traffic and distant road traffic the R132.

Time	Measured Noise Levels, dB		
	L_{Aeq}	L_{Amax}	L_{A90}
12:29	62	78	50
13:29	61	80	48
14:30	61	78	49

Table 10.10: Measured Noise Levels at Location A3

The noise environment at location A3 was dominated by local road traffic on the Forest Road.

10.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development comprises a Strategic Housing Development of 645 no. residential units (comprising 208 no. 1 bedroom units, 410 no. 2 bedroom units, and 27 no. 3 bedroom units), in 10 no. apartment buildings, with heights ranging from 4 no. storeys to 10 no. storeys, including undercroft / basement levels (for 6 no. of the buildings). The proposals include 1 no. community facility in Block 1, 1 no. childcare facility in Block 3, and 5 no. commercial units (for Class 1-Shop, or Class 2- Office / Professional Services or Class 11- Gym or Restaurant / Café use, including ancillary takeaway use) in Blocks 4 and 8.

The development includes a total of 363 no. car parking spaces (63 at surface level and 300 at undercroft / basement level). 1,519 no. bicycle parking spaces are provided at surface level, undercroft / basement level, and at ground floor level within the blocks. Bin stores and plant rooms are located at ground floor level of the blocks and at undercroft / basement level. The proposal includes private amenity space in the form of balconies / terraces for all apartments. The proposal includes hard and soft landscaping, lighting, boundary treatments, the provision of public and communal open space including 2 no. playing pitches, children's play areas, and an ancillary play area for the childcare facility.

The proposed development includes road upgrades, alterations and improvements to the Dublin Road / R132, including construction of a new temporary vehicular access, with provision of a new left in, left out junction to the Dublin Road / R132, and construction of a new signalised pedestrian crossing point, and associated works to facilitate same. The temporary vehicular access will be closed when vehicular access to the lands is made available

from the lands to the north. The proposal includes internal roads, cycle paths, footpaths, vehicular access to the undercroft / basement car park, with proposed infrastructure provided up to the application site boundary to facilitate potential future connections to adjoining lands.

The development includes foul and surface water drainage, green roofs and PV panels at roof level, 5 no. ESB Substations and control rooms (1 no. at basement level and 4 no. at ground floor level within Blocks 2, 4, 7, and 8), services and all associated and ancillary site works and development.

A full description of the proposed development can be found in Chapter 2 of this EIAR.

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

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

During the operational phase of the development, the primary source of outward noise in the operational context relates to any changes in traffic flows along the local road network and building services noise.

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

10.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

10.5.1 Construction Noise

A variety of items of plant will be in use for the purposes site clearance and construction. The type and number of equipment will vary between the varying construction phases depending on the phasing of the works. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

The closest noise sensitive locations to the main building works will be the residential units to the east of the site which are at a distance of approximately 20m from the potential construction works. This distance relates to the closest boundary to the nearest residential noise sensitive locations. The remainder of works will take place across the site at varying distances of up to 250m. Reference to the noise baseline survey results (Section 1.3.5) and guidance contained in BS 5228 Part 1 for construction noise levels presented in Table 1.1, the threshold for significance from constriction activities is set as follows for the closest residential noise sensitive locations:
Significance Category - A: ,

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

An appropriate construction noise limit at the nearest commercial buildings is considered to be **75 dB $L_{Aeq,1hr}$.**

For site clearance, building construction works and landscaping works (excavators, loaders, dozers, concreting works, mobile cranes, generators), noise source levels are quoted in the range of 70 to 80dB L_{Aeq} at distances of 10m within BS 5228-1. For the purposes of this assessment, a combined sound power value of 115dB $L_{w(A)}$ has been used for construction noise calculations. This would include, for example, 5 no. items of construction plant with a sound pressure level of 80dB L_{Aeq} at 10m operating simultaneously along the closest works boundary.

Given the type and number of construction equipment will vary over the course of the construction phase, noise levels have been calculated at the closest noise sensitive locations assuming the construction noise levels and

distances noted above. For the purpose of the assessment, a standard site hoarding of 2.4m high has been included in the calculations for noise sensitive boundaries. The calculations also assume that the equipment will operate for 66% of the working time. Table 10.11 summarises the result of this assessment.

Activity	Sound Power at construction works, dB Lw(A)	Calculated noise levels at varying distances, dB $L_{Aeq,T}$					
		20m	30m	50m	60m	100m	200m
Site Clearance General Construction Landscaping	115	74	71	66	65	60	54

Table 10.11:Construction Noise Predictions at Various Distances

The predicted noise levels detailed in the Table 10.11 indicate that during the main construction phase including site clearance, building construction works etc. assuming up to 5 items of plant are operating simultaneously at the closest noise sensitive boundaries, there is potential for the residential significance threshold to be exceeded at distances of up to 50m. Considering the closest residential noise sensitive locations to the development lands are at 20m distance, and based on the predicted noise levels above, the associated construction noise impact has the potential to be moderate to significant when construction works are undertaken at locations of the site closest to the nearby noise sensitive receptors. However, it should be noted that at distances of 50m or greater from the receptors the construction works are not predicted to cause a significant impact. Given that the majority of construction works will take place at distances greater than 50m it is expected that for the majority of the construction period the nearest receptors will experience a moderate effect.

A schedule of best practice noise mitigation measures is included in Section 1.5.1.

In terms of noise associated with these construction activities the associated effect is stated to be:

Quality	*Significance*	*Duration*
Negative	Moderate - Significant	Short Term

10.5.2 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.

In this instance, taking account of the distance to the nearest sensitive off-site buildings, vibration levels at the closest neighbouring buildings are expected to be orders of magnitude below the limits set out in Table 10.3 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants, as set out in Table 10.4. The potential vibration impact during the construction phase if of short-term, neutral and imperceptible impact.

Quality	Significance	Duration
Neutral	Imperceptible	Short Term

10.5.3 Operational Phase – Additional Vehicular Traffic on Surrounding Roads

A Traffic Impact Assessment relating to the proposed development has been prepared 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 traffic flow figures has been assessed for the opening year and the opening year +15. The calculated change in noise levels during these two periods are summarised in Table 10.12. The assessed roads/routes are indicated in Figure 10.4.

The results of the predictions indicate that only routes 4, 17, 18 and 21 will have an impact greater than Negligible. However, it is predicted that the impact along these routes will be negative, long term and not significant.

The impact for all other routes is considered to be neutral, negligible and long term.

Reference	Change in Noise Level (dB)	Impact
Year 2024		
1	-0.2	Negligible
2	+0.1	Negligible
3	-0.2	Negligible
4	+1.7	Not Significant
5	+0.1	Negligible
6	+0.1	Negligible
7	-0.2	Negligible
8	-1.0	Negligible
9	-0.2	Negligible
10	+0.1	Negligible
11	0.0	Negligible
12	+0.1	Negligible
13	+0.7	Negligible
14	-0.6	Negligible
15	+0.1	Negligible
16	+0.6	Negligible
17	+1.2	Not Significant
18	+1.9	Not Significant
19	+0.1	Negligible
20	-0.8	Negligible
21	+1.2	Not Significant
Year 2039		
1	-0.4	Negligible
2	-0.1	Negligible
3	-0.3	Negligible
4	+1.5	Not Significant
5	0.0	Negligible
6	0.0	Negligible
7	-0.3	Negligible
8	-1.2	Negligible
9	-0.3	Negligible
10	-0.1	Negligible
11	-0.1	Negligible
12	0.0	Negligible
13	+0.5	Negligible

14	-0.8	Negligible
15	0.0	Negligible
16	+0.4	Negligible
17	+1.1	Not Significant
18	+1.7	Not Significant
19	-0.1	Negligible
20	-0.9	Negligible
21	+1.0	Not Significant

Table 10.12: Noise Level Changes Due To Increased Traffic on Public Roads

Figure 10.4: Assessed Road Links

10.5.4 Operational Phase – Building Services Plant

Once operational, there will be building services plant items required to serve 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. In this instance, is it best practice to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for the development.

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 as set out in this assessment. Based on the baseline noise data collected for this assessment it is considered an appropriate design criterion is the order of 40 dB $L_{Aeq,15min}$. This limit is set in order to achieve acceptable internal noise levels within residential spaces based on prevailing noise levels in the area.

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

In terms of noise associated with day to day activities the associated effect is stated to be as follows:

Quality	Significance	Duration
Neutral	Imperceptible	Long Term

10.5.3 Operational Phase – Vibration

There are no sources of vibration associated with the day to day operation of the development that will give rise to impacts at nearby noise sensitive locations. In terms of these the operational phase of the development the associated effect is stated to be:

Quality	Significance	Duration
Neutral	Imperceptible	Long Term

10.5.4 Operational Phase – Inward Noise Impact

10.5.4.1 Stage 1 – Noise Risk Assessment

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 10.5 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. 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.

Paragraph 2.9 of ProPG states that:

"The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."

ProPG states the following with respect to the initial risk assessment:

"The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application. In other words, the risk assessment should include the acoustic effect of any existing site features that will remain (e.g. retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain (e.g. buildings to be demolished, fences and barriers to be removed) if development proceeds."

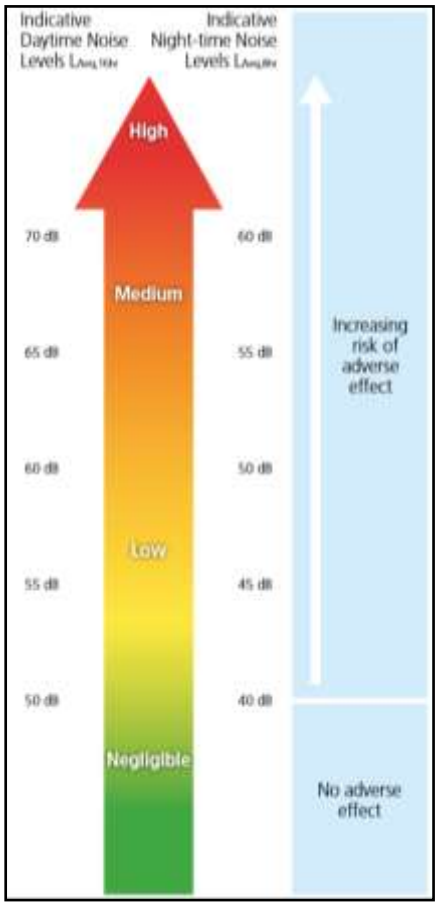

Figure 10.5: ProPG Approach (Source: ProPG)

Consideration also needs to be given to the fact that the noise environment across the site may change in future years. The major change to the local infrastructure that is likely to alter the noise environment is the development of the North Runway at Dublin Airport. To address this Fingal have produced noise zone maps for the area surrounding the airport.

These maps present noise contours as follows:

- Zone A – ≥ 63 dB $L_{Aeq,16hr}$ and/or ≥ 55 dB L_{night};
- Zone B – ≥ 54 dB $L_{Aeq,16hr}$ and < 63 dB $L_{Aeq,16hr}$ and ≥ 55 dB L_{night};
- Zone C – ≥ 54 dB $L_{Aeq,16hr}$ and < 63 dB $L_{Aeq,16hr}$ and ≥ 48dB L_{night} and < 55 dB L_{night}; and,
- Zone D – ≥ 50 dB $L_{Aeq,16hr}$ and < 54dB $L_{Aeq,16hr}$ and ≥ 40dB Lnight and < 48dB L_{night}

Figure 10.6 presents the current development site in the context of these zones. Note that road traffic noise is not expected to change significantly into the future.

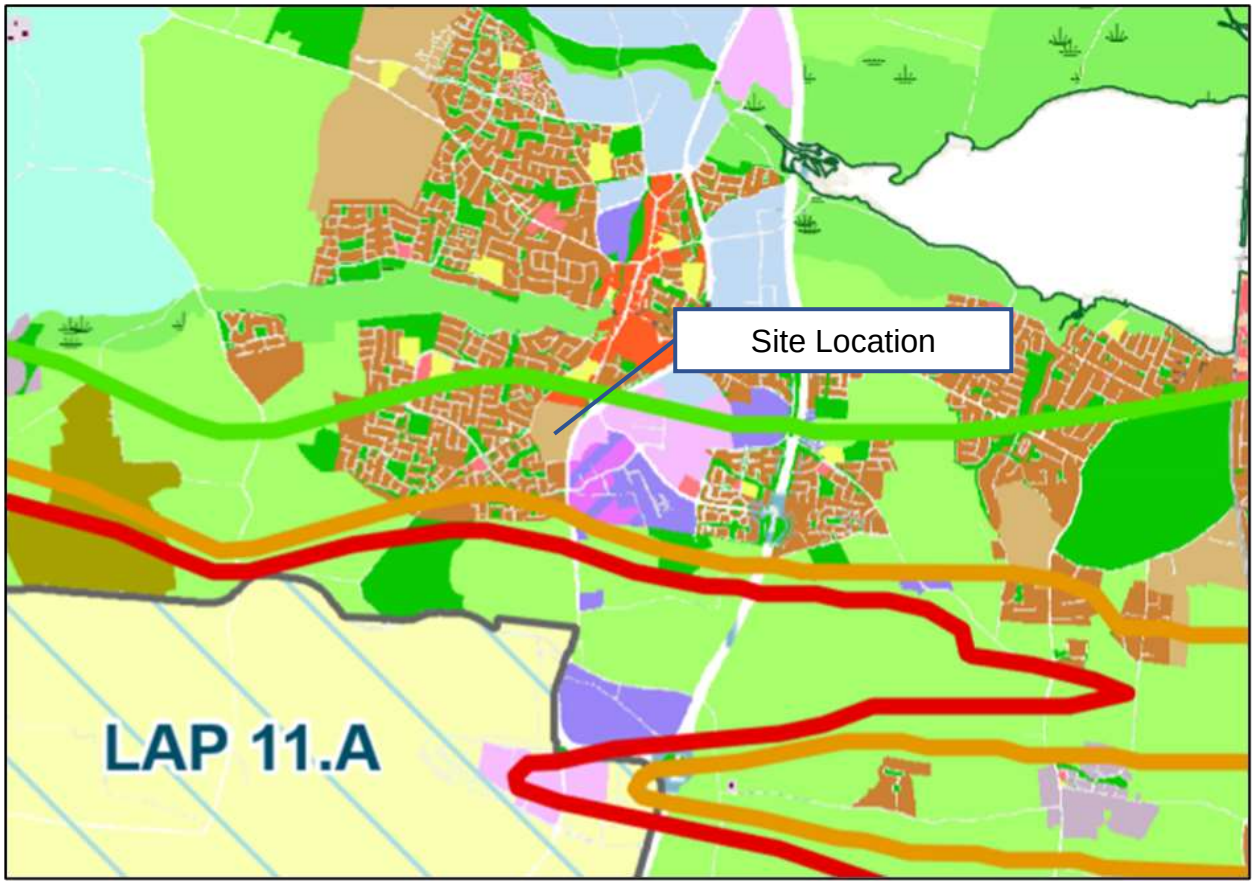

Figure 10.6: Fingal County Dublin Airport Noise Zones

It is noted that while the proposed development site is located in Zone C. Based on the noise Zones, the worst case noise levels incident to dwellings and external amenity areas falling within these zones can be summarised as Zone C – 63 dB $L_{Aeq,16hr}$ and 55 dB L_{night}.

Noise Model of 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 ISO 9613: Acoustics – Attenuation of sound during propagation outdoors.

The following information was included in the model:

- Site layout drawings of the proposed development;
- OS mapping of the surrounding environment, and
- 3D topographical survey data for the development

Noise levels recorded during the attended and unattended surveys were used to calibrate the noise model. This is done by comparing the predicted levels from the noise model against the levels measured at the site over daytime periods (07:00 to 23:00hrs) and night-time periods (23:00 to 07:00 hrs). The noise model has assumed a reduction in noise level of 5 dB during the night period for locations adjacent to the Forest Road. In this instance the model calibrated to within 1dB of the calculated values which is regarded as a strong correlation in respect of predicted noise levels.

Location	Time Period	Measured Noise Level, dB	Predicted Noise Level, dB
U1	Day	54	53
	Night	49	49
A1	Day	67 - 68	67
A2	Day	49 - 50	49
A3	Day	61 - 62	62

Table 10.13: Predicted & Measured Noise Levels at Development Site

Noise Risk Classification of the Site

Following the methodology outlined in ProPG, as discussed in Section 10.2.2, the noise model has been used to predict noise levels across the site. The results of this exercise are presented in Figures 10.7 and 10.8 for day and night periods respectively.

Figure 10.7: Predicted Existing Noise Contour Across the Cleared Development Site – Day

Figure 10.8: Predicted Existing Noise Contour Across the Cleared Development Site – Night

The models indicate that noise levels vary across site from 45 to 70 dB $L_{Aeq,16hr}$ during the day and 40 to 65 dB $L_{Aeq,16hr}$ during the night.

Future Noise Levels

Note that the noise model represents road traffic noise only as the measurements taken on site were dominated by road traffic. Comparison of the noise model results with the Dublin Airport Zone C contours of 63 dB $L_{Aeq,16hrs}$ and 55 dB $L_{Aeq,8hrs}$ indicates that future aircraft noise has the potential to increase noise levels and be dominate on areas of the site that are located further from the R132.

For assessment purposes the noise model results have been logarithmically summed with the upper noise levels of the Dublin Airport Zone C to take into account the potential future noise levels generated by the airport. An appropriate frequency spectrum has been applied to the airport noise contour to take account of the low frequency content in aircraft noise. The results indicate that noise levels across the development will range from 63 to 71 dB $L_{Aeq,16hrs}$ during the day and 55 to 65 dB $L_{Aeq,8hrs}$ during the night period.

Noise Risk Assessment Conclusion

Given the above it can be concluded that the development site may be categorised as Medium to High Risk. ProPG states the following with respect to High risk:

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.*

Consequently, 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 it does not preclude residential development on sites that are identified as having medium 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.

10.5.4.2 Stage 2 – Acoustic Design Strategy

Element 1 – Good Acoustic Design Process

In practice, good acoustic design should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life or occupants or compromising other sustainable design objectives. Section 2.23 of the ProPG outlines the following checklist for Good Acoustic Design:

- Check the feasibility of relocating, or reducing noise levels from relevant sources;
- Consider options for planning the site or building layout;
- Consider the orientation of proposed building(s);
- Select construction types and methods for meeting building performance requirements;
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
- Assess the viability of alternative solutions; and,
- Assess external amenity area noise.

In the context of the proposed development, each of the considerations listed above have been addressed in the following subsections.

Relocation of Reduction of Noise from Source

Aircraft and road noise sources are located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

Due to major noise source of concern in relation to the site being aircraft noise, planning, layout and orientation changes will not have any material impact on aircraft noise levels incident on the proposed buildings.

Select Construction Types for meeting Building Regulations

The design of all buildings are required to meet with all relevant parts of the Building Regulations. The specific detail of which will be completed at detailed design stage. In terms of the building sound insulation, the glazed elements and any required ventilation paths to achieve compliance with Part F of the Building Regulations will be the weakest elements in the façade.

Consideration will therefore be given to the provision of sound insulation performance for glazing and ventilation, where required, to achieve suitable internal noise levels within the development. Achievement of acceptable internal ambient noise levels does not form part of building regulation requirements, however, this will be incorporated into the building design in line with best practice and compliance with the guidance set out in ProPG.

Impact of noise control measures on fire, health and safety etc.

The good acoustic design measures that have been implemented on site, e.g. glazing and ventilation specifications are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

The site lies within Dublin Airport Noise Zone C. Due to the height at which aircraft noise would be incident to the dwellings and external amenity areas, an acoustic barrier or similar would be ineffective and is not proposed anywhere on the site.

Assess External Amenity Area Noise

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 $L_{Aeq,16hr}$."

External noise levels across the majority of the site during the daytime, with the North Runway in operation, are expected fall in the region of 63 dB $L_{Aeq,16hr}$.

It is noted that whilst the public external amenity areas would be above the desirable level of 55 dB $L_{Aeq,16hr}$ it is not possible to reduce the noise level across external spaces due to aircraft noise being the dominant noise source.

Summary

Considering the constraints of the site, insofar as possible and without limiting the extent of the development area, the principles of Good Acoustic Design have been applied to the development.

Element 2 – Internal Noise Levels

Element 1 – Good Acoustic Design Process

Internal Noise Criteria

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 10.14 and are based on annual average data.

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 $L_{Aeq,8h}$

Table 10.14: ProPG Internal Noise Levels

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 WHO guidelines, then a relaxation of the internal L_{Aeq} values by up to 5dB can still provide reasonable internal conditions.

Discussion on Open / Closed Windows

In the first instance, it is important to note the typical level of sound reduction offered by a partially open window falls in the region of 10 to 15 dB .

Considering the design goals outlined in Table 10.14 and a sound reduction across an open window of 15 dB, the free-field noise levels that would be required to ensure that internal noise levels do not exceed good (i.e. at or below the internal noise levels) or reasonable internal noise levels (i.e. 5 dB above the internal noise levels) have been summarised in Table 10.15.

Level Desired	Day07:00 to 23:00hrs	Night 23:00 to 07:00hrs
Good (i.e. at or below the internal noise levels)	50 – 55dB $L_{Aeq,16hour}$	45dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels)	55 – 60dB $L_{Aeq,16hour}$	50dB $L_{Aeq,8hour}$

Table10.15: External Noise Levels Required to Achieve Internal Noise Levels

In this instance the external noise levels are such that it will not be possible to achieve the desired good internal noise levels with windows open for properties located within Zone C and therefore appropriate acoustic specifications to windows and passive vents will be provided to ensure the rooms are adequately ventilated and achieve the good internal noise levels detailed here.

Façade Noise Levels

Based on the reviews and noise measurements presented previously for the site, noise levels have been predicted across the development. The expected levels are cumulative, taking account of aircraft and road sources, where relevant, at specific buildings. Table 10.16 summarises the calculated noise level at the most exposed buildings.

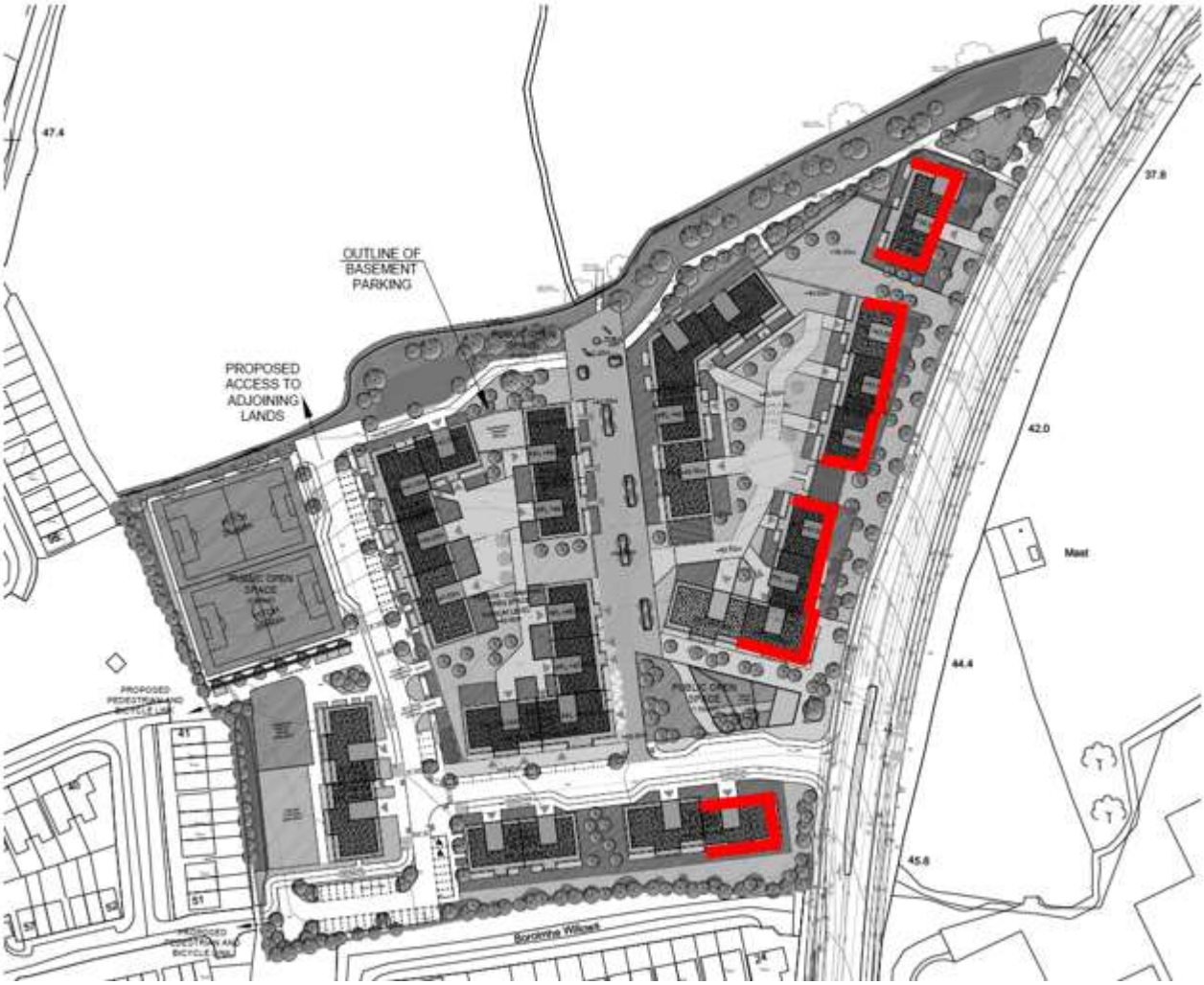

Figure 10.9 – Facades Noise Level Reference

Location	Daytime, $L_{Aeq, 16hr}$	Night-time, $L_{Aeq, 8hr}$
RED	68	64
All other facades	63	55

Table 10.16: Assigned Façade Noise Levels (Refer to Figure 10.9)

Recommend Façade Treatment

The British Standard BS EN 12354-3: 2000: Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound provides a calculation methodology for determining the sound insulation performance of the external envelope of a building. The method is based on an elemental analysis of the building envelope and can take into account both the direct and flanking transmission paths.

The Standard allows the acoustic performance of the building to be assessed taking into account the following:

- Construction type of each element (i.e. windows, walls, etc.);
- Area of each element;
- Shape of the façade, and;
- Characteristics of the receiving room.

The principles outlined in BS EN 12354-3 are also referred to in BS8233 and Annex G of BS8233 provide a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS8233 has been adopted here to determine the required performance of the building facades. This approach corrects the noise levels to account for the frequency content of the source in question. In this instance, rail and road traffic noise, depending on the buildings in question. For properties with cumulative impacts from both rail and road, the frequency content of the dominant source has been used for calculations.

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. In this instance the facades will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 10.17. For the purposes of this assessment it is understood that the building will be ventilated by heat recovery units therefore removing the need to open windows to ventilate living spaces.

Location	Octave Band Centre Frequency (Hz)						dB R_w
	125	250	500	1k	2k	4k	
RED	26	28	36	42	43	43	40
All Other Facades	26	26	33	39	39	47	37

Table 10.17:Sound Insulation Performance Requirements for Glazing, SRI (dB)

10.6 POTENTIAL CUMULATIVE IMPACTS

A review of recent planning permissions for the area was conducted and it was found that there were 2 no. relevant sites for which cumulative impacts may occur should their construction phase and that of the proposed development overlap. These include a strategic housing development at Phase 1 lands, Townlands of Fosterstown North and Cremona (planning ref. ABP-308366-20) and a residential development at Fosterstown North, Boroimhe Link Road (planning ref. F18A/0306). The other permissions referenced in Appendix 2.1 are not considered to be of relevance to this chapter.

In terms of construction, given the layout of the nearby receptors in comparison with the proposed construction sites, it is expected that the proposed development will dominate the noise levels at the local residential receptors to the west and south of the site and there is unlikely to be any significant cumulative effect given the distance to the other identified developments.

The results of the predictions indicate that only routes 4, 17, 18 and 21 will have an impact greater than Negligible. However, it is predicted that the impact along these routes will be not significant.

10.7 '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.

10.8 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

10.8.1 Construction Phase - Noise

N&V CONST 1: Noise and Vibration Control Measures

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 implementation of all best practice noise and vibration control methods will ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during excavation and foundation construction 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 and vibration control measures will be employed. These will 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.
- Where practicable, localised screening should be used during breaking activities to obscure line of site to the closest sensitive receptors.

10.8.2 Operational Phase – Mechanical and Electrical Plant

N&V OPER 1: Mechanical and Electrical Plant

As part of the detailed design of the development, plant items with appropriate noise ratings and, where necessary, appropriately selected remedial measures (e.g. enclosures, silencers etc.) 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.

10.8.3 Operational Phase – Inward Noise

N&V OPER 2: Inward Noise

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. blockwork 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. It's also noted that the ventilation strategy will be for Mechanical Ventilation Heat Recovery units which are expected to provide strong sound insulation to external noise, hence ingress of noise through the ventilation systems is considered to be negligible for this assessment.

In this instance the facades will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 10.17.

Location	Octave Band Centre Frequency (Hz)						dB R_w
	125	250	500	1k	2k	4k	
RED	26	28	36	42	43	43	40
All Other Facades	26	26	33	39	39	47	37

Table 10.17: Sound Insulation Performance Requirements for Glazing, SRI (dB)

The overall R_w outlined above are provided for information purposes only. The over-riding requirements are the octave band sound insulation performance values which may also be achieved using alternative glazing configurations. Any selected system will be required to provide the same or greater level of sound insulation performance as that set out in Tables 10.17.

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.

10.9 RESIDUAL IMPACTS

10.8.1 Construction Noise

It is predicted that when works take place at less than 50m distance to the receptors a moderate to significant impact will occur, hence the impacts are predicted to be:

Quality	Significance	Duration
Negative	Moderate - Significant	Short-Term

It should be noted that the assessment can be considered "worst case" and it is unlikely that all items of plant assessed will be in operational simultaneously.

For the majority of the construction period works are expected to take place at greater than 50m distance to the closest receptors for which the impacts are predicted to be:

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

10.8.2 Construction Vibration

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Short Term

10.8.3 Additional Traffic on Roads

The impacts are predicted to be:

Quality	*Significance*	*Duration*
Negative	Negligible to Not Significant	Long Term

10.8.4 Operational Outward Noise Impact

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Long Term

10.8.5 Operational Inward Noise Impact

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

10.10 MONITORING

The contractor will be required to ensure construction activities operate within the noise and vibration limits set out within this assessment. The contractor will be required to undertake regular noise and vibration 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.

Vibration monitoring should be conducted in accordance with BS 6472 for human disturbance and BS ISO 4866:2010 for building damage.

10.11 REINSTATEMENT

Not applicable to noise and vibration.

10.12 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. There is also an interaction with Human Health, which has informed Chapter 3- Population and Human Health of this EIAR.

10.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered when compiling this assessment.

10.14 REFERENCES

British Standard BS 4142: 2014+A1:2019: 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).