9.0 NOISE AND VIBRATION

9.1 INTRODUCTION

This chapter presents an assessment of the impacts of the proposed residential development at Flemington Lane, Balbriggan, Co. Dublin in terms of noise and vibration in the local environment. The assessment for noise and vibration is based on the most up to date applicable guidance and assessment documents available both nationally and internationally.

Noise and vibration will be considered in terms of two aspects. The first is the outward effect of the development (i.e. the potential effect of the buildings on existing sensitive receptors in the study area), and the second is the inward effect of the existing noise and vibration sources on the development itself.

9.1.1 Statement of Authority

This EIAR Chapter has been prepared by AWN Consulting Ltd. (AWN),

The chapter was prepared by Dylan Floyd (Acoustic Consultant). Dylan holds a BSc Agri-Environmental Science. Dylan has worked in the field of acoustics since 2022. He has completed noise monitoring campaigns across numerous sites and holds a certificate from the Institute of Acoustics in environmental noise monitoring and building acoustics testing.

This chapter was reviewed by Alistair Maclaurin BSc PgDip MIOA, Senior Consultant at AWN Consulting who has prepared multiple EIS and EIAR documents throughout his 13 years' experience as an environmental consultant

9.2 STUDY METHODOLOGY

The study has been undertaken using the following methodology:

- 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;
- A baseline noise survey has been undertaken in the vicinity of the proposed development to characterise the prevailing noise environment;
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the proposed development at the nearest noise sensitive locations (NSLs) to the site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most NSLs surrounding the development site;
- An assessment has been completed of potential cumulative impacts that may arise as a result of the proposed development and other existing or proposed plans and projects;
- 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 effect of noise from the surrounding environment into the proposed residential buildings has also been assessed to determine the requirements, for additional noise mitigation to ensure a suitable internal noise environment for residential amenity.

9.2.1 Construction Phase

9.2.1.1 Criteria for Assessing Construction Noise Impacts

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

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

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

This document sets out a Construction Noise Threshold (CNT) relative to the existing noise environment. **Error! Bookmark not defined.**Table 9.1 sets out the approach.

Table 9-1: Example Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 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.

For the appropriate assessment period (i.e. daytime in this instance), the ambient noise level is determined and rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. It should be noted that this assessment method is only valid for residential properties and if applied to commercial premises without consideration of other factors may result in excessively onerous thresholds being set.

Proposed Threshold Levels for Noise

The proposed general construction hours are 07:00 to 19:00 hrs, Monday to Friday and 07:00 to 14:00 hrs on Saturdays. No working will be allowed on Sundays and Public Holidays. Taking into account the document outlined above (BS 5228-1:2009+A1:2014) and making reference to the baseline noise environment monitored around the development site (see Section 9.3), the Category A threshold from the ABC methodology is applied to all noise sensitive locations surrounding the site. The following threshold therefore applies for the proposed working hours:

- Monday to Friday - 07:00 to 19:00 hrs – 65 dB LAeq,12hr.
- Saturdays – 07:00 to 14:00 hrs – 65 dB LAeq,6hr.

Interpretation of the Construction Noise Levels (CNL)

In order to assist with interpretation of CNL, Table 9.2 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is taken from Table 3.16 of DMRB: Noise and Vibration (UKHE 2020) and adapted to include the EPA EIAR Guidelines.

Table 9-2: Construction Noise Significance Ratings.

Construction Noise Level Per Period	Guidelines for Noise Impact Assessment Significance (DMRB)	EPA EIAR Significance of Effects	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration & baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate	
Above CNT and below or equal to CNT +5 dB	Moderate	Moderate to Significant	
Above CNT +5 dB	Major	Significant, to Very Significant	

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

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

Construction Vehicular Traffic

In order to assist with interpretation of construction traffic noise, Table 9.3 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This guidance is taken from Table 3.17 of *DMRB: Noise and Vibration* (UKHA 2020). For construction traffic, due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the 'short term' period in accordance with the DMRB document.

Table 9-3: Likely Effect Associated with Change in Traffic Noise Level – Construction.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant to Slight
3 – 4.9	Perceptible	Moderate	Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

The DMRB guidance outlined above will be used to assess the predicted increases in traffic levels on public roads associated with the proposed development and comment on the likely impacts during the construction stage.

9.2.1.2 Criteria for Assessing Construction Vibration Impacts

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. For the purpose of the proposed development, the range of relevant criteria used for surface construction works for both building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Peak Particle Velocity (PPV)

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

BS7385 and BS5228-2:2009+A1:2014 advise that, for soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above for transient vibration. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table B.2 of BS5228-2:2009+A1:2014 might need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges.

The documents note that minor structural damage can occur at vibration magnitudes that are greater than twice those presented in Table 9.4. 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 vibration at base of the building. Table 9.4 sets out the limits as they apply to vibration frequencies below 4 Hz, where the most conservative limits are required. At higher frequencies, the limit values for transient vibration within Table B.2 of BS5228-2:2009+A1:2014 will apply, with similar reductions applied for continuous vibration and those for protected structures.

Table 9-4: Recommended construction vibration thresholds for buildings

Structure Type	Allowable vibration (in terms of PPV) at closest part of sensitive property to source of vibration, at frequency of ≤4 Hz	
	Transient vibration	Continuous vibration
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s	25 mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15 mm/s	7.5 mm/s
Protected and Historic Buildings	6 – 15 mm/s	3 – 7.5 mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3 mm/s	

As per BS5228-2:2009+A1:2014, below a frequency of 4 Hz where a high displacement is associated with a relatively low component PPV, a maximum displacement of 0.6 mm (zero to peak) should be used.

Human Perception

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. Higher levels of vibration, however, are typically tolerated for single events or events of short duration. For example, during piling, one of the primary sources of vibration during construction, vibration levels may typically be tolerated at up to 2.5mm/s. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant to such activities during the night-time (or if they are trying to sleep during the daytime).

BS 5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of the peak particle velocity (PPV). Table 9.5 below summarises the range of vibration values and the associated potential effects on humans.

Table 9-5: Guidance on effects of human response to PPV magnitudes

Vibration Level, mm/s PPV	Description of Effect	Possible Significance Rating
≥10	Vibration is likely to be intolerable for any more than a brief exposure to a level of 10 mm/s	Very Significant
≥1 to <10	Increasing likelihood of complaints in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Significant to Very Significant
≥0.3 to <1	Increasing likelihood of perceptible vibration in residential environments	Slight to Moderate
<0.3	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction	Not significant

Further consideration of where the effect is significant is undertaken using professional judgment based on duration and frequency of the effect, as well as the time of the day.

9.2.2 Operational Phase

9.2.2.1 Criteria for Assessing Operational Noise Impacts

The main potential source of outward noise from the proposed development will relate to traffic flows to and from the development site onto the public roads. There will also be a variety of electrical and mechanical plant required to service the development. The relevant guidance documents used to assess potential operational noise and vibration impacts are summarised in the following sections.

Change in Traffic Noise Levels

In the absence of any Irish guidelines or standards describing the effects associated with changes in road traffic noise levels, reference has been made to the DMRB Noise and Vibration (UKHE 2020). This document provides magnitude rating tables relating to changes in road traffic noise. The document suggests that, during the year of opening, the magnitude of impacts between the Do Minimum and the Do Something scenarios are likely to be greater compared to the longer-term period (fifteen years post-opening), when people become more habituated to the noise level change. It shows that small changes in noise levels are not normally noticeable, whereas an increase of 10 dB would be described as a doubling of loudness. In summary, the assessment looks at the impact with and without development at the nearest noise sensitive locations.

Table 9-6: Likely impact associated with short-term change in traffic noise level (DMRB 2020)

Change in Noise Level (dB LA10)	Short to medium-term magnitude	EPA Classification of Impact
<1.0	Negligible	Imperceptible
1.0 to 2.9	Minor	Not Significant
3 – 4.9	Moderate	Slight, Moderate
>5.0	Major	Significant

Table 9-7: Likely impact associated with long-term change in traffic noise level (DMRB 2020)

Change in Noise Level(dB LA10)	Subjective Reaction	Long-Term Term Magnitude	EPA Classification of Impact
< 3.0	Barely Perceptible	Negligible	Not Significant
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Significant
10+	More than a doubling of loudness	Major	–Very Significant

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

Plant Noise

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 effect. Plant contained within plant rooms has the least potential for impact, once consideration is given to appropriate design of the space.

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

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

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

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

BS 4142 (2014+A1:2019) 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 (2014+A1:2019) assessment, it is necessary to compare the measured external background noise level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

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

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

"residual noise level, $L_{Aeq,T}$" is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].

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

"rating level, $L_{Ar,T}$" is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);

"background noise level, $L_{A90,T}$" is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

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

It is important to note that cumulative plant noise levels from the proposed development site must be designed to meet the relevant noise criteria set at a given sensitive receptor location.

Internal Noise at Receivers within the Development

To ensure there is no adverse impact on the future inhabitants of the proposed development itself, it is appropriate to refer to internal noise targets derived from BS 8233: 2014: *Guidance on Sound Insulation and Noise Reduction for Buildings.* The recommended indoor ambient noise levels are set out in Table 9-8 and are based on annual average data; that is to say, they omit occasional events where higher intermittent noisy events may occur.

Table 9-8: Professional practice guidance on planning and noise (ProPG) internal noise levels (BS 8233:2014)

Activity	Location	Day (07:00 to 23:00hrs) dB LAeq,16hr	Night (23:00 to 07:00hrs) dB LAeq,8hr
Resting	Living room	35 dB LAeq,16hr	-
Dining	Dining room/ area	40 dB LAeq,16hr	-

Sleeping	Bedroom	35 dB LAeq,16hr	30 dB LAeq,8hr 45 dB LAmax,T Note A

Note A: 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.

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

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

- Daytime (07:00 to 23:00 hrs): 55 dB LAeq,16hrs day
- Night-time (23:00 to 07:00 hrs): 45 dB LAeq,8hrs night

Residential Inward Noise Impact Assessment

The *Professional Practice Guidance on Planning & Noise* (ProPG) (2017) is the most commonly used guidance document for assessment of the inward noise impacts within new residential developments.

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

- **Stage 1**: Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels.
- **Stage 2**: Involves a full detailed appraisal of the Proposed Development covering four “key elements” that include: -

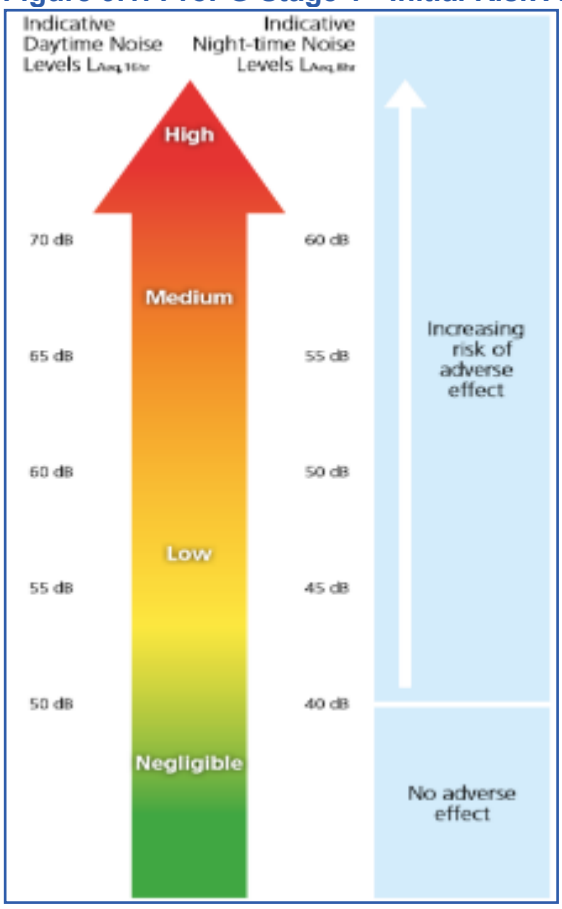
- Element 1 – Good Acoustic Design Process
- Element 2 – Noise Level Guidelines
- Element 3 – External Amenity Area Noise Assessment
- Element 4 – Other Relevant Issues

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk, based on the pre-existing noise environment. Error! Reference source not found. 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 no. L_{AFMax} events exceed 60 dB during the night period, and the site should be considered a high risk if the L_{AFMax} events exceed 80 dB more than 20 times a night.

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings. The recommended indoor ambient noise levels are set out in Table 9.8 above and are based on annual average data.

Figure 9.1: ProPG Stage 1 - Initial Risk Assessment



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 $L_{Aeq,16hr}$."

9.2.2.2 Criteria for Assessing Operational Vibration Impacts

There are no noteworthy sources of vibration associated with the operational stage; therefore vibration criteria have not been specified.

9.2.3 Dublin Agglomeration Noise Action Plan 2024 – 2028

The Dublin Agglomeration Noise Action Plan 2024 – 2028, addresses the requirements of the European Noise Directive 2002/49/EC for local authorities for managing environmental noise. The Noise Action Plan (NAP) states the following regarding planning guidance: *"The appropriate use of the planning system can be used to help avoid, or minimise, the adverse impacts of noise without placing unreasonable restrictions on development".*

The action plan outlines guidance to minimise the impact in relation to noise on new developments. ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise, and BS 8233: Guidance on Sound Insulation and Noise Reduction for Buildings, are recommended as guidance to be employed in areas where people are being brought to noise in the form of existing road and rail noise.

9.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SCENARIO)

9.3.1 Site Area Description

The proposed development currently comprises of greenfield lands. A full description of the development is provided in Chapter 2: Description of the Proposed Development. The site is to be located in the western part of the town of Balbriggan, County Dublin.

9.3.2 Receptors

The site is bordered by a series of individual houses to the north on Flemington Lane, numerous residential estates to the east and south east and agricultural lands to the south west and west.

9.3.3 Environmental Noise Survey

An environmental noise survey has been conducted to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise -- Determination of Environmental Noise Levels*. Specific details are set out in the following sections.

9.3.4 Choice of Measurement Positions

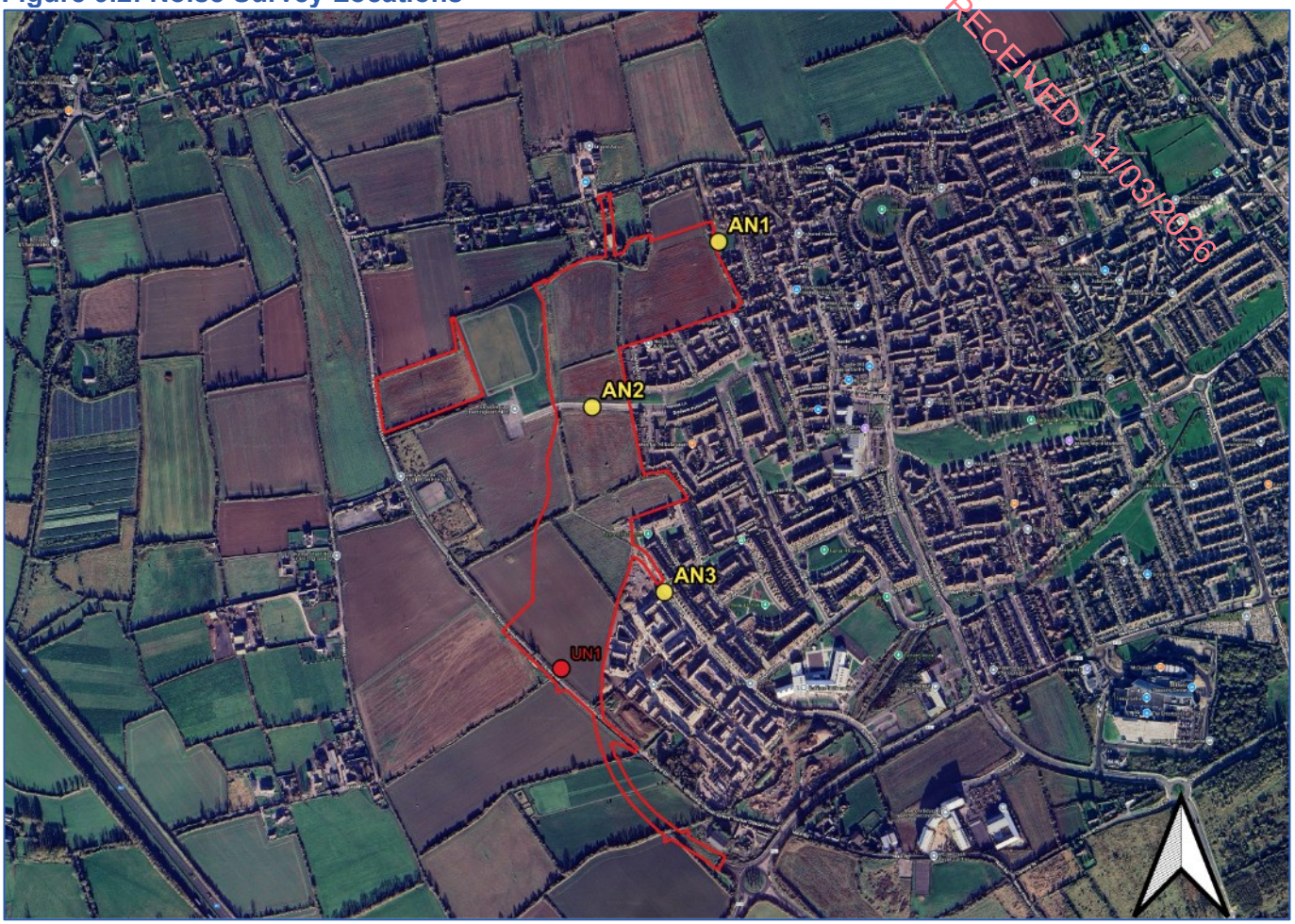
An environmental noise survey was carried out at the site by AWN Consulting between 17 October and 21 October 2025 to assess the existing noise environment. Measurement locations were selected as shown in Figure 9.2. These locations were chosen to representatively characterise the baseline noise conditions in the surrounding area.

Three attended monitoring locations, designated AN1 to AN3, were selected:

- **AN1** was positioned to capture the baseline noise environment of the adjacent residential area, Flemington Park.
- **AN2** was located to assess the baseline noise levels near the residential estates of Hastings Lawn and Bremore Pastures Park.
- **AN3** was situated to monitor noise levels near the residential estates of Tayler Hill Gardens and Folkstown Park Avenue.

In addition, one unattended monitoring location, **UN1**, was installed on the development site itself, overlooking Clonard Road (Local Road) —the primary noise source in the area. The purpose of UN1 was to measure the noise levels directly affecting the proposed development.

Figure 9.2: Noise Survey Locations



9.3.5 Survey Period

The attended noise survey was conducted between the following periods:

- AN1 to AN3 between 09:47 hrs to 13:16 hrs on 17 October 2025.

The unattended noise survey was conducted between the following periods:

- UN1 between 14:30 hrs on 17 October to 14:30 hrs on 21 October 2025.

The measurements cover a period that was selected 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.

9.3.6 Instrumentation

The measurements were performed using the equipment listed in Table 9.9 below.

Table 9-9: Noise Monitoring Equipment Details

Measurement	Manufacturer	Equipment Model	Serial Number	Calibration date
Sound Level Meter	Larson Davis	LxTI	0006122	30/06/2025
Calibrator	Brüel & Kjær	Type 4231	2205805	28/11/2024

The microphone was protected using a proprietary windshield. The sound level meter was check calibrated using a Brüel & Kjær Type 4231 Sound Level before and after the survey. Calibration certificates available on request.

9.3.7 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 2 × 10-5 Pa.

9.3.8 Procedure

The unattended monitoring equipment was configured to log data over 15-minute periods, saved to the instrument memory for subsequent analysis. Survey personnel noted all primary noise sources contributing to noise build-up when the instrumentation was being set up and collected.

The attended noise monitoring equipment was configured to measure data over a 15-minute period at each location. Three measurements were taken at each location.

9.3.9 Results

The weather during the survey periods was generally dry and calm and was not considered to have had a detrimental effect on the noise measurements.

9.3.9.1 Unattended Survey Results UN1

Table 9.10 summarises the measured day, evening and night-time noise levels for the entire survey period.

Table 9-10: Summary of Measured Noise Levels (dB re. 2x10-5 Pa) at UN1

Date	Sound Pressure Level (dB re. 2x10^{-5} Pa)					
	Daytime (07:00 to 19:00 hrs)		Evening (19:00 to 23:00 hrs)		Night (23:00 to 07:00 hrs)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
Friday 17 October 2025	61	50	57	48	51	44
Saturday 18 October 2025	61	54	62	54	62	53
Sunday 19 October 2025	61	54	57	53	53	45
Monday 20 October	60	50	57	51	55	48
Tuesday 21 October 2025	61	55	-	-	-	-
Average	61[1]	50[2]	59[1]	51[2]	57[1]	47[2]

Note 1: Logarithmically averaged
Note 2: Arithmetically averaged

Daytime noise levels were found to range between 60 to 61 dB $L_{Aeq,12hour}$, evening noise levels were in the range between 57 to 62 dB $L_{Aeq,4hour}$, while night-time noise levels were in the range of 51 to 62 dB $L_{Aeq,8hour}$.

Dominant noise sources noted during the survey were road traffic on the Clonard road with distant construction activity clearly audible form nearby construction site to the west and south west. Distant road traffic was also barely audible during Clonard road traffic and construction lulls.

Saturday, 18th October recorded higher evening and nighttime noise levels compared to the other survey days.

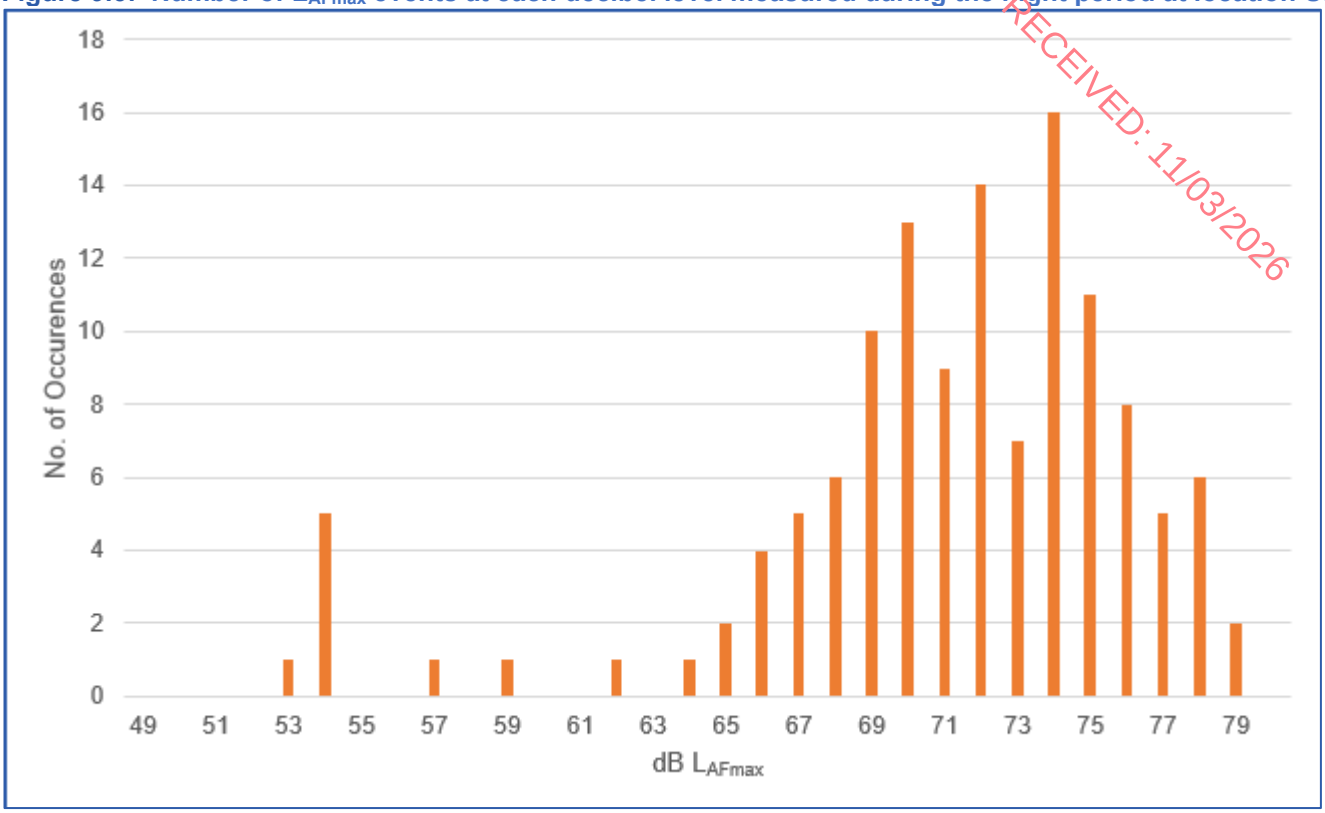
During the evening period on the 18th, the L_{Aeq} was 62 dB, compared to an average of 59 dB, and the L_{A90} was 54 dB, compared to the average of 51 dB.

During the nighttime period, the L_{Aeq} on the 18th was 62 dB, compared to the average of 57 dB, and the L_{A90} was 53 dB, compared to the average of 47 dB.

After reviewing the collected data, there was isolated period of elevated noise that could have skewed the results over a short time frame. A review of weather data for the day indicated that it began to rain and there were elevated wind speeds during the evening and nighttime periods, with over 1 mm of rainfall occurring between the survey intervals, which may have caused the elevated results. This weather affected data has been omitted from the chapters assessment and appropriate data was used to complete the assessments in this chapter.

The L_{AFmax} values were measured at 15-minute intervals over the duration of the unattended monitoring survey. Figure 9.3 presents the distribution of the magnitude of L_{AFmax} events during the night period.

Figure 9.3: Number of L_{AFmax} events at each decibel level measured during the night period at location UN1



120 events measured above 60 dB L_{AFmax}. No events were measured at or above 80dB L_{AFmax}. The most commonly occurring L_{AFMax} values are between 69 and 75 dB L_{AFmax}.

9.3.9.2 Survey Position AN1

The survey results for Location AN1 are presented in Table 9.11. During the survey, distant road traffic noise and birdsong was the dominant noise sources at this location. Distant construction noises, distant road traffic noise, dog barks and occasional helicopter fly byes were also audible at this measurement position.

Table 9-11: Measured noise levels at Location AN1

Date	Measurement Period	Measured Noise Levels, dB re 2x10-5 Pa		
		L_{Aeq}	L_{AFMax}	L_{AF90}
17 October 2025	09:47 - 10:02	49	68	36
	10:59 – 11:14	44	66	34
	12:27 – 12:42	49	69	37

Daytime noise levels were in the range of 44 to 49 dB $L_{Aeq,15min}$ and in the range of 36 to 37 dB $L_{A90,15min}$ during the measurement periods.

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

9.3.9.3 Survey Position AN2

The survey results for Location AN2 are presented in Table 9.12. During the survey, the dominant noise sources at this location were distant road traffic and construction activities. Additional audible sounds included landscaping equipment, dog barking, and pedestrian footfall. The measurement taken at 11:41 recorded elevated noise levels, attributed to landscaping work in a nearby residential estate.

Table 9-12: Measured noise levels at Location AN2

Date	Measurement Period	Measured Noise Levels, dB re 2x10-5 Pa		
		L_{Aeq}	L_{AFMax}	L_{AF90}
17 October 2025	10:10 - 10:25	47	65	37
	11:41 – 11:56	53	70	40
	12:51 – 13:06	44	63	39

Daytime noise levels were in the range of 44 to 53 dB $L_{Aeq,15min}$ and in the range of 37 to 40 dB $L_{A90,15min}$ during the measurement periods.

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

9.3.9.4 Survey Position AN3

The survey results for Location AN3 are presented in Table 9.13. During the survey, the dominant noise sources at this location were nearby construction activities including HGV passing the monitoring location. Additional audible sounds included dog barking and distant road traffic noise. The measurement taken at 12:03 recorded elevated noise levels, attributed to a HGV parking and letting his engine run idle for approximately 5 minutes of the measurement.

Table 9-13: Measured noise levels at Location AN3

Date	Measurement Period	Measured Noise Levels, dB re 2x10-5 Pa		
		L_{Aeq}	L_{AFMax}	L_{AF90}
17 October 2025	10:35 – 10:50	68	89	48
	12:03 – 12:18	68	92	57
	13:11 – 13:26	63	82	43

Daytime noise levels were in the range of 63 to 68 dB $L_{Aeq,15min}$ and in the range of 43 to 57 dB $L_{A90,15min}$ during the measurement periods.

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

9.3.9.5 Vibration

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

9.4 DO NOTHING SCENARIO

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations and within the development site will remain largely unchanged resulting in a neutral and local impact in the long-term.

Moreover, if the current proposal were not developed, then it is likely that one similar in nature would be proposed, in line with the national policy of promoting compact growth on brownfield sites and the sites zoning designations that support development of the site for residential and mixed uses.

9.5 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

A description of the proposed development/project is contained in chapter 2 of the EIAR. The following provides a description of the main characteristics of the project as they relating to noise and vibration during the demolition, construction and operational phases.

9.5.1 Construction Phase

During the construction phase, a variety of items of plant will be in use for the purposes of demolition, site clearance and construction. The type and number of equipment will vary between the varying construction phases and 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.

9.5.2 Operational Phase

During the operational phase, the potential sources of noise are those associated with additional vehicular traffic on public roads, operational plant and building services, and vehicular movements.

Noise and vibration emissions from the proposed development will vary both in terms of duration and magnitude. The following sections analyse the expected construction and operational phase noise and vibration impacts, both in terms of the proposed assessment criteria and the expected impacts in terms of the significance of effects.

9.6 POTENTIAL IMPACTS/EFFECTS OF THE PROPOSED DEVELOPMENT

9.6.1 Construction Phase

A variety of items of plant will be in use for the purpose of site clearance and construction works. There will also 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 in the vicinity of existing noise sensitive properties.

The proposed general construction hours are 07:00 to 19:00 hrs, Monday to Friday and 07:00 to 14:00 hrs on Saturdays. No working will be allowed on Sundays and Public Holidays. Subject to the agreement of the local authority, out of hours working may be required for watermain connections, foul drainage connections etc.

The construction phase will be controlled using construction noise threshold values which the contractor will be required to work within as much as is practicable. In this regard, the choice of plant, scheduling of works on site, provision of localised screening and other best practice control measures will be employed.

9.6.1.1 Sensitive Receptors

Noise and vibration impacts have been assessed to the nearest sensitive locations to the site boundaries, i.e. a worst-case assessment of the closest sensitive locations during any of the construction stages. These closest locations are identified in Figure 9.4 and described below.

Figure 9.4: Indicating closest noise sensitive locations

- **NSL1:** Cluster of residential houses along Flemington Lane, approx. 40 m to the north of the northern site boundary and approximately 40 m from the closest construction activities.
- **NSL2:** Cluster of residential houses along Flemington Lane, approx. 75 m to the north of the northern site boundary and approximately 75 m from the closest construction activities.
- **NSL3:** Flemington Park residential development approx. 10 m to the north and northeast of the eastern site boundary and approximately 25 m from the closest construction activities.
- **NSL4:** The Hastings residential development approx. 10 m to the east of the eastern site boundary and approximately 25 m from the closest construction activities.
- **NSL5:** Bremore Pastures residential development approx. 10 m to the east of the eastern site boundary and approximately 25 m from the closest construction activities.
- **NSL6:** Taylor Hills residential development approx. 5 m to the east of the eastern site boundary and approximately 10 m from the closet construction activities.
- **NSL7**: Folkstown Park Ave residential development approx. 15 m to the east and southeast of the eastern site boundary and approximately 30 m from the closet construction activity.

The construction stage will be undertaken over a number of phases from site preparation through to building construction and internal fit out. In terms of the potential noise and vibration impacts, the key stages and activities are expected to involve:

- Site clearance and demolition of existing structures;
- Ground works (excavation and piling);
- Superstructure Construction; and
- Internal fit out.

The construction programme will create typical construction activity related noise onsite. Indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in British Standard Institute (BSI) *BS 5228-1:2009 +A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise* (BSI, 2014) . This standard sets out sound power / sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels.

The following section discusses typical noise levels associated with the proposed development demolition/construction phase and comments on potential noise impacts at distances to the nearest Noise Sensitive Locations (NSLs) during the key stages and types of activities that will occur on site.

9.6.1.2 Demolition Works

The existing buildings and associated structures within the site will be demolished. There will be periods when breakers will be required to break out foundations and solid structures. For this specific activity a total construction noise level of 92 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations.

9.6.1.3 Excavation and Piling

For construction works associated with activities such as excavation and structural works including excavators, loaders, dozers, cranes, generators, concreting works and continuous flight augured piling etc. noise levels are typically in the range of 70 to 82 dB L_{Aeq} at 10m.

9.6.1.4 Construction of Proposed Structure

For construction work areas with lower noise levels such as those associated with superstructure works including site compounds (for storage, offices and material handling, generators etc.), smaller items of mobile plant (excavators, cranes, dozers), landscaping and concreting works with lower noise emissions, a total construction noise level of 80 dB LAeq at 10m has been used for the purposes of indicative calculations. This would include, for example two items of plant at 75 dB L_{Aeq} and three items of plant at 70 dB L_{Aeq} operating simultaneously within a work area.

9.6.1.5 Indicative Construction Noise Levels

Indicative noise calculations have been undertaken which assume that plant items are operating for 66% of the time. Screening from a standard site hoarding of 2.4m is assumed around all site boundaries. It must be stated that for most of the time, plant and equipment will be a greater distance from the nearest NSLs than those used within the calculations and the “on-time” of plant and equipment will be less than those assumed over a normal working day (i.e. the use of piling rigs or breakers for demolition will be in use for shorter periods than those assumed over a normal working day) and consequently will have lower noise levels. The assessment presented is therefore representative of a best estimate conservative scenario representing construction activities. Table 9.14 presents the calculated noise levels at varying distances.

Table 9-14: Calculated Construction Noise Levels at Varying Distances

Activity	Predicted Construction Noise Level L_{aeq}(1hour) (dB)					
	10m	20m	30m	40m	50m	100m
Demolition works	85	79	75	73	71	65
Excavations and Piling Works	75	69	65	63	61	56
General Site Work including Superstructure and Fit out	73	67	63	61	59	53

Reference to the construction noise levels in Table 9.14 indicate that the CNT of 65 dB $L_{Aeq,T}$ will be exceeded at the closest NSLs when activities are occurring along the closest site boundaries. However, a range of noise levels will occur as works take place across the site.

During the demolition phase, which comprise the demolition of a single storey house and an agricultural shed, in a small part of the project site at Flemington Lane, the CNT is likely to be briefly exceeded at NSLs 1 and 2, situated to the north of the site. NSL 1 is approximately 40 meters from the demolition works, while NSL 2 is approximately 80 meters away. However, it's noted that the exceedance will likely be brief. Reference to the temporal criteria outlined in Section 9.2.1 indicates that although the noise threshold will likely be exceeded at NSLs 1 and 2, the overall effect is determined to be n**egative, slight to moderate and brief**. At all other identified NSLs, noise levels will remain below the CNT. Having regard to the nature of the demolition works relating to the demolition of a house and dismantling of an agricultural shed, it should be noted that this will be the shortest phase of works, anticipated to be less than a week, and the use of breakers will only occur for a portion of this phase.

The distance between NSL 7 and the piling works is approximately 30 meters, which would produce a noise level that is below the CNT and results in a **negative, slight to moderate and temporary** impact. All other NSLs are located more than 30 meters from the piling activity and therefore will not exceed the CNT

During general site construction works, which involve building structures, lower noise levels will typically be generated. There is potential for the CNT to be exceeded by a small margin at distances of 20 meters or less, particularly when works occur along immediate site boundaries. When activities take place at 25 meters or more from NSLs, noise levels are expected to remain within the CNT. NSL 6 is the only location where the approximate distance to construction activity falls within 20 meters, meaning the CNT is likely to be exceeded. This would result in **a negative, moderate to significant and temporary** impact assessed. For all other NSLs, the CNT is not predicted to be exceeded during this phase.

Noise mitigation measures will therefore be required on site to reduce construction noise levels along these boundaries to reduce any potential significant effects. Recommended mitigation measures are presented in Section 9.8.

9.6.1.6 Construction Vibration

During rock breaking, there is potential for vibration to be generated through the ground. Empirical data for this activity is not provided in the BS 5228-2:2009+A1:2014 (BSI 2014b) standard, however the likely level of vibration from this activity is expected to be significantly below the vibration criteria for building damage on experience from other sites. AWN Consulting Ltd have previously conducted vibration measurements under controlled conditions, during trial construction works, where breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- 3 tonne hydraulic breaker on small CAT tracked excavator; and
- 6 tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 PPV (mm/s) to 0.25 PPV (mm/s) at distances of 10m to 50m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.4 PPV (mm/s) to 0.24 PPV (mm/s) at distances of 10m to 50m respectively.

Whilst these measurements relate to a breaking of concrete, the range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity. The vibration levels experienced at surrounding receptors will be well below the criteria of cosmetic building damage, however, it will likely be perceptible when work is taking place at the closest locations to the receptors. Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in table 9.5.

There is potential for piling to be used for building and basement foundations for apartment buildings. For the purposes of this assessment, the 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 600 mm pile diameter for bored piling into soft ground over rock:

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

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the nearest buildings are not expected to pose any significance in terms of cosmetic or structural damage. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of nearby buildings.

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 9.4 and therefore will 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 9.5. The predicted vibration impact during the construction phase is **negative, not significant and short-term.**

9.6.1.7 Construction Traffic

During the construction phase, traffic associated with the proposed development would consist of a mix of Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) travelling to and from the site.

It is noted that in order to increase traffic noise levels by 1 dB, traffic volumes would need to increase by the order of 25%. It is forecast that additional traffic introduced onto the local road network due to the construction stage of the development will not introduce a level of traffic that would result in a volume change in excess of 25% on the surrounding road network and the expected impact is therefore **negative**, **not significant and short-term.**

9.6.2 Operational Phase

Once the proposed development is operational, the potential noise impacts to the surrounding environment are predicted to be minimal. The residential aspect of the development is not expected to generate any significant noise sources over and above those which form part of the existing environment at neighbouring residential areas (road traffic noise, estate vehicle movements, children playing, etc.).

The main potential noise impact associated with the proposed development is considered, therefore, to relate to the generation of additional traffic to and from the site as a result of the new residential buildings. Potential noise impacts also relate to operational plant serving the apartment buildings, where relevant. Once operational, there are no noteworthy sources of vibration associated with the development site.

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

- Additional vehicular traffic on surrounding roads;
- Building services plant;
- Crèche playground area;

9.6.2.1 Additional Vehicular Traffic on Surrounding Roads

For the purposes of assessing the 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 proposed development, given that traffic from the development will make use of the existing road network.

A traffic impact assessment relating to the proposed development has been prepared by the Traffic Insights as part of this EIAR (refer to Chapter 11 – Traffic & Transportation). The results of this assessment in terms of overall Annual Average Daily Traffic (AADT) and the percentage of HGVs have been reviewed to predict any impact of the proposed development on traffic flows in the area. The calculated change in noise levels during Opening Year (2027) and Future Design Years (2032) and (2042) are summarised in Table 9.15, Table 9.16 and Table 9.17.

Table 9-15: Summary of change in noise level (Opening Year 2027)

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J1	Arm A - R122(NNE)	15,739	2%	15,631	2%	0.0
	Arm B -L1360	6,389	6%	6,434	6%	0.0
	Arm C - R122 (SSW)	17,712	3%	21,176	3%	0.8
	Arm D - C Ring Road	-	-	5,730	2%	-
J2	Arm A - R122(NNE)	14,160	1%	10,990	1%	-1.1
	Arm B - Naul Road	336	4%	246	5%	-1.3
	Arm C - R122 (SSW)	15,711	1%	11,193	1%	-1.5
	Arm D - L1130	3,374	4%	0		-
J3	Arm A - R122(NE)	13,064	2%	13,864	2%	0.3
	Arm B - R122 (SE)	14,161	2%	11,958	2%	-0.7
	Arm C - Boulevard Rd	6,043	1%	4,641	2%	-1.1

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J4	Arm A - R122(NE)	8,461	2%	8,948	2%	0.2
	Arm B - Retail Park	5,944	2%	5,944	2%	0.0
	Arm C - R122 (SW)	13,025	2%	13,421	2%	0.1
	Arm D - Castlemill Link Road	9,151	2%	9,243	2%	0.0
J5	Arm A - R122(NE)	9,235	2%	9,594	2%	0.2
	Arm B - Millfield	5,367	2%	5,449	2%	0.1
	Arm C - R122 (SW)	8,405	2%	8,868	2%	0.2
	Arm D - Westbrook Park	1,072	2%	1,095	2%	0.1
J6	Arm A - R122(E)	5,507	1%	5,687	1%	0.1
	Arm B - Harry Reynolds Road (S)	4,476	3%	4,511	3%	0.0
	Arm C - R122 (W)	9,242	2%	9,601	2%	0.2
	Arm D - Harry Reynolds Road (N)	7,858	2%	8,002	2%	0.1
J7	Arm A - R132 (SE)	11,075	3%	11,252	3%	0.1
	Arm B - R122 Chapel Street	4,677	2%	4,856	1%	0.2
	Arm C - R132 (NW)	10,986	3%	11,120	3%	0.1
J8	Arm A - R122(NNE)	10,661	3%	10,747	3%	0.0
	Arm B - Harry Reynolds Road	5,348	3%	5,391	3%	0.0
	Arm C - R122 (SSW)	9,989	3%	10,077	3%	0.0
J9	Arm A - Cardy Rock Crescent	1,651	2%	1,669	2%	0.0
	Arm B - R132 (SE)	9,925	3%	10,028	3%	0.0
	Arm C - Hamlet Lane	3,873	2%	4,041	2%	0.2

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
	Arm D - R132 (NW)	7,697	4%	7,743	4%	0.0
J10	Arm A - R132 (SE)	7,769	4%	7,866	3%	0.1
	Arm B - Bremore Cottages	2,029	1%	2,097	1%	0.1
	Arm C - R132 (NW)	6,272	4%	6,318	4%	0.0
J11	Arm A - Flemington Lane North (L1130)	3,310	2%	3,343	2%	0.0
	Arm B - Flemington Lane	1,739	1%	1,807	1%	0.2
	Arm C - Flemington Lane South (L1130)	3,364	2%	3,399	2%	0.0
J12	Arm A - Trimleston	390	1%	392	1%	0.0
	Arm B - The Rise	5,430	2%	5,597	2%	0.1
	Arm C - Barons Hall Rise	4,627	3%	4,737	3%	0.1
	Arm D - Hamlet Lane	4,090	3%	4,369	3%	0.3
J13	Arm A - The Park	6,718	3%	6,830	2%	0.1
	Arm B - Moylaragh Road	2,741	2%	2,757	2%	0.0
	Arm C - Castlemill Road	7,511	2%	7,607	2%	0.1
J14	Arm A - Hampton Gardens Drive	710	2%	710	2%	0.0
	Arm B - Castlemill Link road (SSE)	9,177	2%	9,269	2%	0.0
	Arm C - Taylor Hill Walk	608	1%	608	1%	0.0
	Arm D - Castlemill Link Road (NW)	8,418	2%	8,510	2%	0.0
J15.1	Arm A - R122 (E)	18,901	3%	19,382	3%	0.1

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
	Arm B - M1 On Slip	6,035	4%	6,170	4%	0.1
	Arm C - R122 (W)	12,882	4%	13,176	4%	0.1
	Arm D - M1 Off Slip	2,462	6%	2,514	6%	0.1
J15.2	Arm A - R122 (ENE)	12,864	4%	13,158	4%	0.1
	Arm B - M1 Off Slip	6,328	4%	6,457	3%	0.1
	Arm C - R122 (WSW)	6,566	5%	6,676	5%	0.1
	Arm D - M1 On Slip	2,657	5%	2,712	5%	0.1

Table 9-16: Summary of change in noise level (Future Design Year 2032)

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J1	Arm A - R122(NNE)	16,681	2%	16,647	2%	0.0
	Arm B -L1360	6,829	7%	6,874	7%	0.0
	Arm C - R122 (SSW)	18,818	3%	22,445	3%	0.8
	Arm D - C Ring Road	-	-	5,968	2%	-
J2	Arm A - R122(NNE)	14,981	1%	11,743	1%	-1.1
	Arm B - Naul Road	359	4%	264	5%	-1.3
	Arm C - R122 (SSW)	16,642	1%	11,960	1%	-1.4
	Arm D - L1130	3,612	4%	0	-	-
J3	Arm A - R122(NE)	13,862	2%	14,663	2%	0.2
	Arm B - R122 (SE)	14,993	2%	12,790	3%	-0.7
	Arm C - Boulevard Rd	6,203	1%	4,801	2%	-1.1
J4	Arm A - R122(NE)	8,917	2%	9,404	2%	0.2
	Arm B - Retail Park	6,356	2%	6,356	2%	0.0
	Arm C - R122 (SW)	13,821	2%	14,217	2%	0.1
	Arm D - Castlemill Link Road	9,760	2%	9,852	2%	0.0

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J5	Arm A - R122(NE)	9,780	2%	10,139	2%	0.2
	Arm B - Millfield	5,717	2%	5,799	2%	0.1
	Arm C - R122 (SW)	8,864	2%	9,327	2%	0.2
	Arm D - Westbrook Park	1,141	2%	1,163	2%	0.1
J6	Arm A - R122(E)	5,839	1%	6,018	1%	0.1
	Arm B - Harry Reynolds Road (S)	4,778	3%	4,814	3%	0.0
	Arm C - R122 (W)	9,787	2%	10,146	2%	0.2
	Arm D - Harry Reynolds Road (N)	8,365	2%	8,509	2%	0.1
J7	Arm A - R132 (SE)	11,813	3%	11,990	3%	0.1
	Arm B - R122 Chapel Street	4,951	2%	5,131	2%	0.2
	Arm C - R132 (NW)	11,729	3%	11,863	3%	0.0
J8	Arm A - R122(NNE)	11,387	4%	11,473	4%	0.0
	Arm B - Harry Reynolds Road	5,711	3%	5,754	3%	0.0
	Arm C - R122 (SSW)	10,666	3%	10,754	3%	0.0
J9	Arm A - Cardy Rock Crescent	1,760	2%	1,779	2%	0.0
	Arm B - R132 (SE)	10,594	3%	10,696	3%	0.0
	Arm C - Hamlet Lane	4,098	3%	4,265	3%	0.2
	Arm D - R132 (NW)	8,225	4%	8,272	4%	0.0
J10	Arm A - R132 (SE)	8,289	4%	8,386	4%	0.1
	Arm B - Bremore Cottages	2,150	1%	2,219	1%	0.1
	Arm C - R132 (NW)	6,703	5%	6,749	4%	0.0

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J11	Arm A - Flemington Lane North (L1130)	3,532	3%	3,565	3%	0.0
	Arm B - Flemington Lane	1,840	1%	1,908	1%	0.2
	Arm C - Flemington Lane South (L1130)	3,588	2%	3,623	2%	0.0
J12	Arm A - Trimleston	417	1%	418	1%	0.0
	Arm B - The Rise	5,762	2%	5,930	2%	0.1
	Arm C - Barons Hall Rise	4,920	3%	5,029	3%	0.1
	Arm D - Hamlet Lane	4,302	3%	4,581	3%	0.3
J13	Arm A - The Park	7,157	3%	7,268	3%	0.1
	Arm B - Moylaragh Road	2,928	2%	2,944	2%	0.0
	Arm C - Castlemill Road	8,007	2%	8,102	2%	0.1
J14	Arm A - Hampton Gardens Drive	759	2%	759	2%	0.0
	Arm B - Castlemill Link road (SSE)	9,788	2%	9,879	2%	0.0
	Arm C - Taylor Hill Walk	649	1%	649	1%	0.0
	Arm D - Castlemill Link Road (NW)	8,976	2%	9,067	2%	0.0
J15.1	Arm A - R122 (E)	20,099	4%	20,580	4%	0.1
	Arm B - M1 On Slip	6,424	4%	6,558	4%	0.1
	Arm C - R122 (W)	13,709	4%	14,003	4%	0.1
	Arm D - M1 Off Slip	2,624	6%	2,677	6%	0.1
J15.2	Arm A - R122 (ENE)	13,690	4%	13,984	4%	0.1

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
	Arm B - M1 Off Slip	6,738	4%	6,867	4%	0.1
	Arm C - R122 (WSW)	7,003	5%	7,114	5%	0.1
	Arm D - M1 On Slip	2,832	5%	2,887	5%	0.1

Table 9-17: Summary of change in noise level (Future Design Year 2042)

Junction	Road / Arm link	AADT Do Minimum	(HGV%)	AADT Do Something	(HGV%)	Change in noise level (all vehicles)
J1	Arm A - R122(NNE)	17,600	2%	17,638	3%	0.0
	Arm B -L1360	7,271	7%	7,315	7%	0.0
	Arm C - R122 (SSW)	19,904	3%	23,693	3%	0.8
	Arm D - C Ring Road	-	-	6,202	3%	-
J2	Arm A - R122(NNE)	15,774	1%	12,469	1%	-1.0
	Arm B - Naul Road	383	4%	281	6%	-1.3
	Arm C - R122 (SSW)	17,544	1%	12,701	1%	-1.4
	Arm D - L1130	3,847	4%	0	-	-
J3	Arm A - R122(NE)	14,641	2%	15,442	2%	0.2
	Arm B - R122 (SE)	15,806	2%	13,603	3%	-0.7
	Arm C - Boulevard Rd	6,361	2%	4,958	2%	-1.1
J4	Arm A - R122(NE)	9,363	2%	9,850	2%	0.2
	Arm B - Retail Park	6,757	2%	6,757	2%	0.0
	Arm C - R122 (SW)	14,597	2%	14,993	2%	0.1
	Arm D - Castlemill Link Road	10,353	2%	10,444	2%	0.0
J5	Arm A - R122(NE)	10,312	3%	10,671	2%	0.1
	Arm B - Millfield	6,057	2%	6,139	2%	0.1
	Arm C - R122 (SW)	9,313	2%	9,776	2%	0.2
	Arm D - Westbrook Park	1,207	2%	1,229	2%	0.1

J6	Arm A - R122(E)	6,160	1%	6,339	1%	0.1
	Arm B - Harry Reynolds Road (S)	5,074	3%	5,110	3%	0.0
	Arm C - R122 (W)	10,320	3%	10,679	2%	0.1
	Arm D - Harry Reynolds Road (N)	8,860	2%	9,004	2%	0.1
J7	Arm A - R132 (SE)	12,539	4%	12,715	4%	0.1
	Arm B - R122 Chapel Street	5,219	2%	5,398	2%	0.1
	Arm C - R132 (NW)	12,459	4%	12,593	4%	0.0
J8	Arm A - R122(NNE)	12,102	4%	12,187	4%	0.0
	Arm B - Harry Reynolds Road	6,067	4%	6,110	4%	0.0
	Arm C - R122 (SSW)	11,331	4%	11,419	4%	0.0
J9	Arm A - Cardy Rock Crescent	1,867	3%	1,886	3%	0.0
	Arm B - R132 (SE)	11,251	4%	11,354	4%	0.0
	Arm C - Hamlet Lane	4,318	3%	4,486	3%	0.2
	Arm D - R132 (NW)	8,746	4%	8,792	4%	0.0
J10	Arm A - R132 (SE)	8,801	4%	8,898	4%	0.0
	Arm B - Bremore Cottages	2,268	1%	2,336	1%	0.1
	Arm C - R132 (NW)	7,130	5%	7,176	5%	0.0
J11	Arm A - Flemington Lane North (L1130)	3,748	3%	3,781	3%	0.0
	Arm B - Flemington Lane	1,938	1%	2,006	1%	0.2
	Arm C - Flemington Lane South (L1130)	3,807	3%	3,843	3%	0.0
J12	Arm A - Trimleston	442	1%	444	1%	0.0

	Arm B - The Rise	6,087	3%	6,255	3%	0.1
	Arm C - Barons Hall Rise	5,208	3%	5,317	3%	0.1
	Arm D - Hamlet Lane	4,511	4%	4,790	4%	0.3
J13	Arm A - The Park	7,586	3%	7,698	3%	0.1
	Arm B - Moylaragh Road	3,110	3%	3,125	3%	0.0
	Arm C - Castlemill Road	8,490	2%	8,585	2%	0.0
J14	Arm A - Hampton Gardens Drive	807	2%	807	2%	0.0
	Arm B - Castlemill Link road (SSE)	10,382	2%	10,473	2%	0.0
	Arm C - Taylor Hill Walk	690	1%	690	1%	0.0
	Arm D - Castlemill Link Road (NW)	9,519	2%	9,610	2%	0.0
J15.1	Arm A - R122 (E)	21,280	4%	21,761	4%	0.1
	Arm B - M1 On Slip	6,807	4%	6,942	4%	0.1
	Arm C - R122 (W)	14,527	4%	14,821	4%	0.1
	Arm D - M1 Off Slip	2,787	7%	2,840	7%	0.1
J15.2	Arm A - R122 (ENE)	14,505	4%	14,799	4%	0.1
	Arm B - M1 Off Slip	7,143	4%	7,272	4%	0.1
	Arm C - R122 (WSW)	7,440	6%	7,550	6%	0.1
	Arm D - M1 On Slip	3,006	6%	3,061	6%	0.1

The predicted increase in AADT traffic levels associated with the development are between -1.5 and +0.8 dB(A) in the vicinity of the roads assessed for the Opening Year and between -1.4 and +0.8 dB(A) during the Future Design Years. This is largely due to the existing volume of traffic along the surrounding road network onto which the development traffic will travel. Reference to Table 9.15 confirms that the increase in the Opening Year is **negligible, not significant and long-term**. Reference to Table 9.16 and Table 9.17 confirms that the increases in the Future Design Years are **negligible, not significant and long-term**.

In summary, the predicted increase in noise levels associated with vehicles at road junctions in the vicinity of the proposed development during the operational phase constitutes a **long-term, not significant impact**.

9.6.2.2 Building Services and Plant

Once operational, there will be building services plant items required to serve the residential aspects of the proposed development. Plant items will include comms, metering equipment, water pumps and sprinkler systems. Plant items serving the apartments will be housed internally in plant rooms and therefore noise breakout will be minimal.

The specific requirements for mechanical and electrical plant items for the crèche have not yet been progressed at this stage of the design. It is expected that operation of these plant items will be in conjunction with the hours of occupancy of the building during the day. During the night-time some plant may be required to operate but will do so at low capacity and therefore produce minimal noise emissions.

In this instance, it is best practice to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for the proposed development. Plant items will be selected, designed and located so that there is no negative impact on sensitive receivers. Based on the best practice guidance the following plant noise limits have been identified:

Receptors within the development

Based on the guidance outlined the BS 8233 standard, the following external noise levels from the operation of the development itself relate to the external facades of new residential developments to control internal noise levels:

- Daytime (07:00 to 23:00 hrs): 55 dB LAeq,16hrs day
- Night-time (23:00 to 07:00 hrs): 45 dB LAeq,8hrs night

Receptors outside the development

Based on the guidance outlined the BS 4142 standard, the following external noise levels from the operation of the development itself relate to the external facades of new residential developments to control internal noise levels:

- Daytime (07:00 to 23:00 hrs): 50 dB $L_{Aeq,\ 1hrs}$
- Night-time (23:00 to 07:00 hrs): 44 dB LAeq, 15mins night

Once plant items are designed to achieve the criteria detailed above the impact will be **negative, not significant and long-term** at sensitive receivers.

9.6.2.3 Creche Playground Noise Breakout

There are two standalone crèche buildings within the planned development site. One located in the northeast and the other located in the mid-west of the development.

Measurement of noise levels generated by children playing outdoors at several crèches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,16hr}$ at distance of 5 metres. The closest NSL is approximately 5 metres from the standalone crèche play area. Due to the creche play area only being in use for a few hours every day the noise level produced will below $55d_{B\ Laeq,\ 16hr}$ and the external noise criteria for the NSL will be met. Therefore, it is expected in the absence of specific mitigation measures that there will be a **negative, not significant and long-term** impact at the closest off-site receptors.

9.7 'WORST CASE' SCENARIO

9.7.1 Construction Phase

Reasonable worst-case estimates have been used as part of this assessment as set out in the various sections of this report.

9.7.2 Operational Phase

Reasonable worst-case estimates have been used as part of this assessment as set out in the various sections of this report.

9.8 AVOIDANCE, REMEDIAL AND MITIGATION MEASURES

9.8.1 Construction Phase

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

- Selection of quiet plant;
- Noise control at source;
- Screening, and;
- Liaison with the public.

Further comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring, and also by referring to the preliminary Construction Environmental Management Plan (CEMP).

9.8.1.1 Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether said item can be replaced with a quieter alternative.

9.8.1.2 Noise Control at Source

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

The following best practice migration measures will be considered:

- The use lifting bulky items, dropping and loading of materials within these areas will be restricted to normal working hours.
- For mobile plant items such as cranes, dump trucks, excavators and loaders, maintaining enclosure panels closed during operation can reduce noise levels over normal operation. Mobile plant will be switched off when not in use and not left idling.

- For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system.
- For percussive tools such as pneumatic breakers, a number of noise control measures include fitting muffler or sound reducing equipment to the breaker tool and ensuring any leaks in the air lines are sealed.
- Erecting localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling, ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- For compressors, generators and pumps, these can be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- 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.

9.8.1.3 Piling

Piling is the construction activity which is most likely to cause disturbance. General guidance in relation to piling is outlined in the following paragraphs.

Piling programmes will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to prevent unacceptable disturbance at any time.

Prior to construction the planner, developer, architect and engineer, as well as the local authority, will be made aware of the proposed method of working of the piling contractor. The piling contractor will in turn have evaluated any practicable and more acceptable alternatives that would economically achieve, in the given ground conditions, equivalent structural results.

On typical piling sites the major sources of noise are essentially mobile, and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling works is typically relatively short in relation to the length of construction work as a whole, and the amount of time spent working near to noise sensitive areas can represent only a part of the piling period.

Noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover. Impact noise when piling is being driven can be reduced by introducing a non-metallic dolly between the hammer and the driving helmet.

Screening by barriers and hoardings is less effective than total enclosure but can be a useful adjunct to other noise control measures. For maximum benefit, screens should be close either to the source of noise (as with stationary plant) or to the listener. Removal of a direct line of sight between source and listener can be advantageous both physically and psychologically. In certain types of piling works there will be ancillary mechanical plant and equipment that may be stationary, in which case, care should be taken in location, having due regard also for access routes. When appropriate, screens or enclosures should be provided for such equipment.

9.8.1.4 Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. Standard construction site hoarding (2.4 m in height) with a mass per unit of surface area greater than 7 kg/m² can provide adequate sound insulation.

9.8.1.5 Liaison with the Public

A designated Community Liaison Officer (CLO) will be appointed to site during construction works. Any noise complaints will be logged and followed up in a prompt fashion by the CLO. In addition, prior to particularly noisy construction activity (e.g. piling), the CLO will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

9.8.1.6 Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling works are in progress on another site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to ensure noise limits are not exceeded due to cumulative activities. This will be reviewed in relation to other potential cumulative works occurring on adjacent construction site in close proximity to noise sensitive properties which have the potential to lead to significant construction noise impacts.

9.8.2 Operational Phase

9.8.2.1 Building Services and Plant

The assessment outlined previously has specified noise limits at the nearest noise sensitive properties that must be achieved in order to ensure the impact is acceptable.

To achieve these noise limits, consideration will be given, at the detailed design stage, to a variety of mitigation measures and forms of noise control techniques. Some examples of these measures are as follows:

- Duct-mounted attenuators on the atmosphere side of air moving plant;
- Splitter attenuators or acoustic louvres providing free ventilation to internal plant areas;
- Solid barriers screening any external plant; and
- Anti-vibration mounts on reciprocating plant.
-

In addition to the above, the following measures will be adopted to minimise potential noise disturbance for neighbours:

- All mechanical plant items (e.g. motors, pumps etc.) shall be regularly maintained to ensure that excessive noise generated by any worn or rattling components is minimised;
- Any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document; and
- Plant items will be selected such that site noise emissions do not contain tonal or impulsive characteristics at nearby noise sensitive locations.

9.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

9.9.1 Construction Phase

9.9.1.1 Construction Noise

The use of best practice noise control measures, hours of operation, scheduling of works within appropriate time periods, and noise monitoring during this phase will be implemented. With the inclusion of the various noise and vibration control measures on site discussed in 9.8.1, it is expected that calculated noise levels in Table 9.14 can be reduced by 5 to 10 dB.

For early-stage demolition and excavation works, there is potential for construction noise levels to remain above the CNT at NSL 1 by the order of 5 to 10 dB during specific phases of work. Whilst the adopted CNT has the potential to be exceeded for specific activities, the residual noise levels can be controlled to below the absolute construction noise limit of 75 dB $L_{Aeq,T}$ typically applied for urban sites during all phases of work. Additionally, the works are expected to be completed within the temporal criteria outlined in Section 9.2.1.1 and, hence, an overall **negative, slight to moderate and brief** impact associated with these works.

During all other construction phases, noise levels can be controlled to within the CNTs at all NSLs thus resulting in a **negative, slight to moderate and short term impact.**

9.9.1.2 Construction Phase Traffic Noise

The residual noise impact will be **negative, not significant** and **short-term** for this phase.

9.9.1.3 Construction Phase Vibration

Vibration impacts during the construction phase will be **negative, not significant and short-term.**

9.9.2 Operational Phase

Proprietary noise and vibration control measures will be employed as part of the detailed design in order to ensure that noise emissions from building services plant do not exceed the adopted criterion at any nearby NSLs. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The impact from building services and plant is predicted to be **negative, not significant and long term.**

9.9.2.1 Additional Traffic on Roads

The predicted change in noise levels associated with additional traffic is expected to be **negligible, not significant** and **long-term** along the existing road network.

9.9.2.2 Building Services and Plant

Proprietary noise and vibration control measures will be employed as part of the detailed design in order to ensure that noise emissions from building services plant do not exceed the adopted criterion at any nearby NSLs. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The impact from building services and plant is predicted to be **negative, not significant and long term.**

9.9.2.3 Crèche Playground Noise Breakout

Any change in noise levels associated with the crèche playgrounds on site are expected to be **negative, not significant** and **long term**.

9.10 MONITORING

9.10.1 Construction Phase

During the construction phase, noise monitoring will be undertaken at sample locations representative of the nearest sensitive locations to ensure construction noise limits outlined in Table 9.1 are not exceeded.

Noise monitoring will be conducted in accordance with the International Standard ISO 1996: *Acoustics – Description, measurement and assessment of environmental noise Part 1* (2016) and *Part 2* (2017). The selection of monitoring locations will be based on the nearest sensitive buildings to the working areas.

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

9.10.2 Operational Phase

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

9.11 OPERATIONAL PHASE – ACOUSTIC DESIGN STATEMENT

The Acoustic Design Statement (ADS) has been presented separately as it refers to the inward impact assessment of the residential properties within the development, rather than the outward impact assessment carried out in Section 9.6**.**

9.11.1 Stage 1 – Noise Risk Assessment

9.11.1.1 Methodology

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 9.1 previously 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 LAFmax 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."

9.11.1.2 *Noise Risk Assessment Conclusion*

Giving consideration to the noise levels presented in Section 9.3.9 earlier, the initial site noise risk assessment has concluded that the level of noise risk across the site is '*low to medium risk*'.

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

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

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

9.11.2 Stage 2 Assessment

9.11.2.1 Element 1 – Good Acoustic Design Principles

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 or Reduction of Noise from Source

Due to the size and scale of the residential units in the development it is not practicable to screen the buildings from the main noise source of the road.

Planning, Layout and Orientation

As part of the project design, the majority of the amenity areas are set back from the roads boundaries and screened from the road traffic noise by the developments buildings. The area identified with elevated noise levels front the Clonard Road and new proposed road however only a portion of the rooms within face the roads, with the remaining facades will have enhanced glazing and ventilation specifications.

Selection Construction Types for Meeting Building Regulations

Constructions for external walls and roof of the development will offer significantly higher levels of sound insulation performance compared to the glazing, hence noise ingress via this pathway will be minimal. As is typically the case in any residential building, 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 in terms of sound insulation performance.

Consideration will therefore be given to the provision of suitable glazing and acoustic ventilators where required to achieve the required level of sound insulation to control both road traffic and air traffic noise intrusion. For units where it will not be possible to achieve the desirable internal acoustic environments with windows open, the proposal here will be to provide dwelling units with glazed elements and ventilators that have good acoustic insulation properties so that when the windows are closed the noise levels internally are good. Inhabitants will be able to open the windows if they wish, however, doing so will

increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following (note emphasis has been added in bold),

"2.22 Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; ***occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open.*** *Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents "*

2.34 Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal LAeq target noise levels should not generally be exceeded."

It is very important to note that it is impractical to achieve the good internal noise levels with windows open across the vast majority of development sites in close proximity to major infrastructure such as roads or airports. Such sites would need to be classified as having a negligible risk in accordance with the ProPG noise risk assessment approach. For this reason, there are no guidance documents either at a local level or an international level that AWN is aware of which would support the approach of achieving the ideal internal noise levels only in the open window scenario. It is therefore considered entirely correct and justifiable to provide building facades with a moderate degree of sound insulation such that with windows closed but vents opened a good internal acoustic environment is achieved.

Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc.

The acoustic design measures that are proposed as part of the design i.e. any upgraded glazing or acoustic passive ventilation are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

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 LAeq,16hr."

It is noted that a proportion of the amenity areas located on site may be just above the desirable level of 55 dB $L_{Aeq,16hr}$, it is not possible to reduce the noise level across external spaces, due to road traffic noise being the dominant noise source. It is noted that the majority of gardens of new houses will achieve these external noise levels. Efforts have been made to provide private external space to each dwelling to the rear of the houses, and a large external amenity area is located serving the proposed units.

9.11.2.2 Element 2 – Internal Noise Levels

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014) which are set out in Table 9.8.

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.

Discussion on Open/Closed Windows

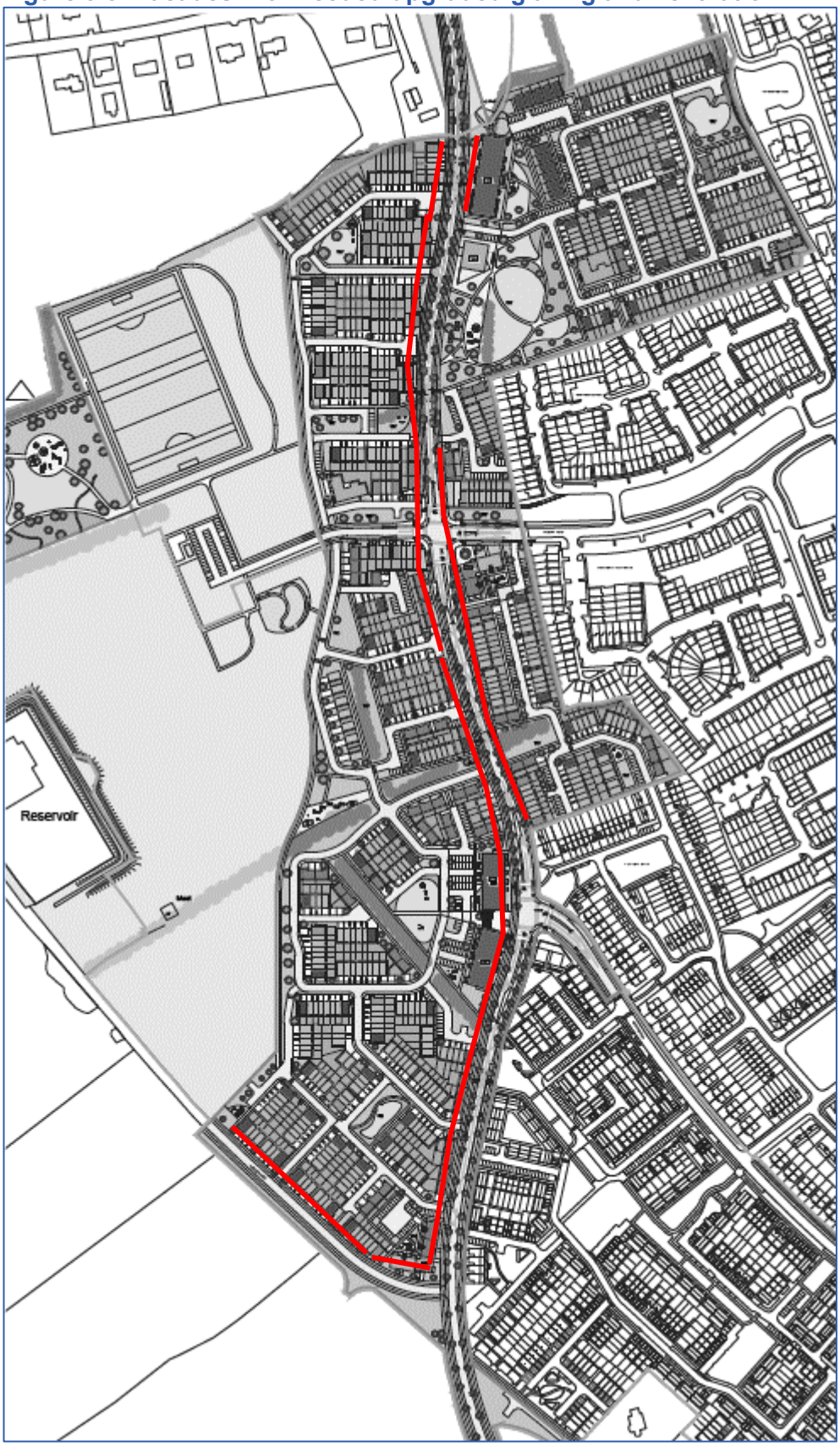
The typical level of sound reduction offered by a partially open window falls in the region of 10 to 15 dB. Considering the design goals outlined in Table 9.8 and a sound reduction across an open window of 15 dB, the free-field noise levels that would be required to ensure that internal noise levels 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 9.18.

Table 9-18: External Noise Levels Required to Achieve Internal Noise Levels

Level Desired	Day (07:00 to 23:00 hrs)	Night (23:00 to 07:00 hrs)
Good (i.e. at or below the internal noise levels from BS 8233)	50 – 55 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels from BS 8233)	55 – 60 dB $L_{Aeq,16hour}$	50 dB $L_{Aeq,8hour}$

The baseline noise levels presented in Section 9.3 indicate that internal noise levels will not meet either the '*good*' or '*reasonable*' internal noise criteria when windows are open for rooms overlooking the main road network, hence, mitigation will be required for those facades. Fig 9.5 indicates the rooms or facades that require mitigation to meet the guidance indoor noise thresholds.

Figure 9.5: Facades with needed upgraded glazing and ventilation



Glazing

Taking account of the measured day and night-time noise levels associated with road traffic from UN1, and calculated noise values from the proposed future road, the glazing specifications in Table 9.19 are applied to the identified facades discussed above. For all other facades within the development there are no specific glazing requirements beyond standard double glazing to meet reasonable internal noise levels at all development buildings

Table 9-19: Minimum Sound Insulation Performance Requirements (SRI) to Glazing

Element	Octave Band Sound Reduction Index – dB R						dB R_w
	125	250	500	1k	2k	4k	
Glazing SRI to identified facades	24	22	29	39	33	38	33

The specifications provided in Table 9-19 are those determined to achieve the internal noise levels within bedrooms and living rooms in accordance with the design criteria from BS 8233 (2014). This acoustic SRI is not significant in terms of uplift above a standard glazing configuration that would be installed and can be achieved with double glazed system. Alternative specifications will be acceptable provided the internal ambient noise criteria outlined in Table 9-8 can be achieved. During the detailed design stage, the acoustic performance of any glazing systems installed to noise sensitive internal areas will be reviewed alongside the building design to determine compliance with the relevant internal design criteria.

The glazing specifications relate to bedrooms and living spaces. For staircore and windows to non-sensitive spaces, standard double glazing provides a suitable level of sound insulation.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. 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.

Wall Construction

In general, all wall constructions (i.e. blockwork or concrete) offer a high degree of sound insulation, much greater than that offered by glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50 dB R_w for this construction.

Ventilation

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations and will be finalised at the detail design stage. Options which will be considered to achieve compliance with background ventilation requirements will be a closed heat recovery system, adjustable hit-and-miss acoustic ventilators or trickle vents built into the façade or window frames, respectively.

For the proposed development, where passive ventilation forms part of the design, the inclusion of any window trickle vents or through wall vents will be required to achieve a sound insulation performance shown in Table 9-20 for apartments when the vent is in the open position. This applies to bedroom, living rooms, study room, kitchens, and other noise sensitive internal spaces. For toilets and stairwells, an acoustic vent is not required.

Table 9-20: Minimum Sound Insulation Performance Requirements (SRI) to Glazing

Element	Octave Band Sound Reduction Index – dB R						dB $D_{n,e,w}$
	125	250	500	1k	2k	4k	
Ventilation SRI to identified facades	33	32	31	37	47	47	37

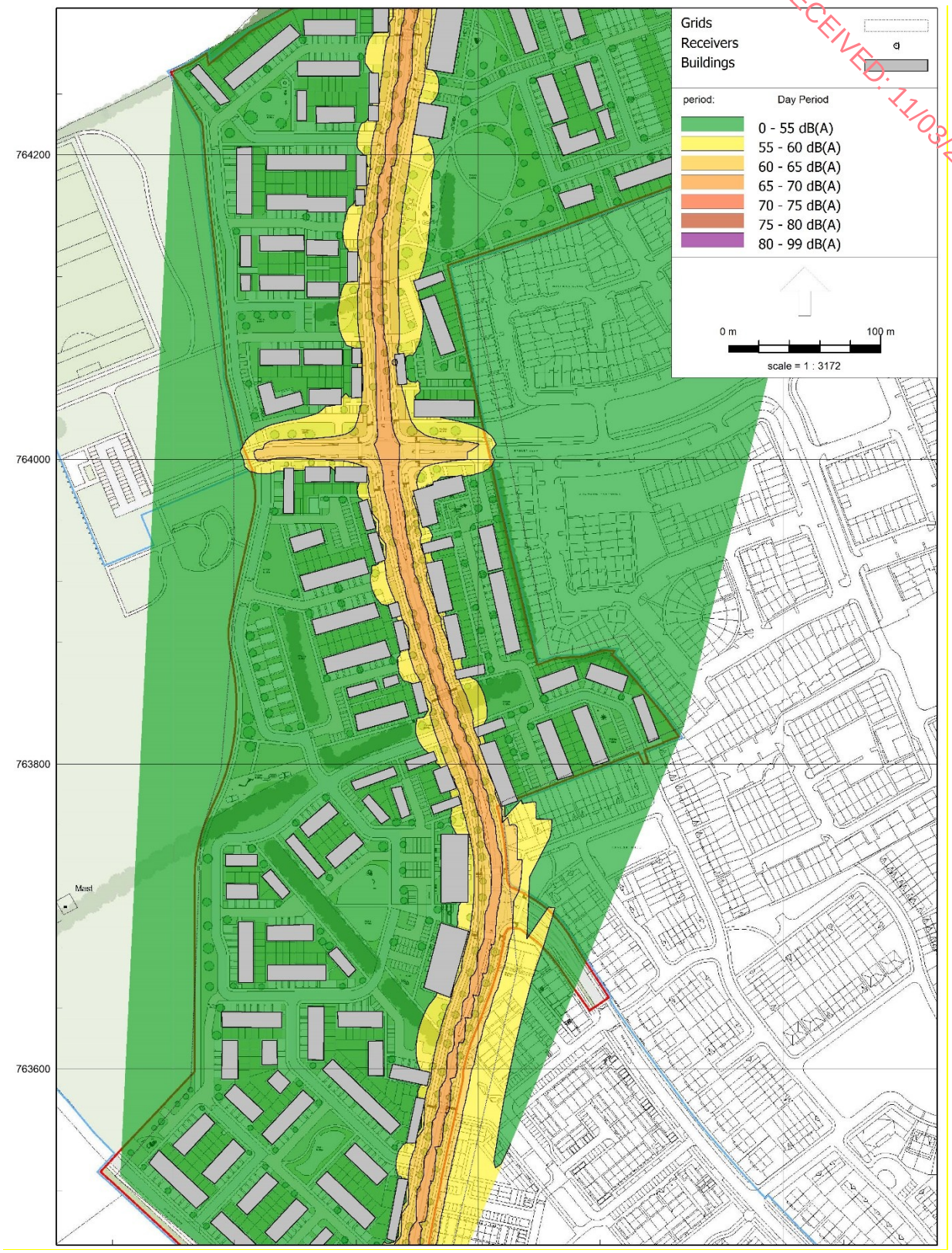
9.11.2.3 Element 3– External Amenity Area Noise Assessment

External noise levels have been modelled using software implementing the CRTN methodology. The model takes account of the future traffic flows predicted along the new road. Results are presented in Figure 9.6 where the green contours show areas that are predicted to be within the external noise level guidelines. The model shows that balcony areas and front gardens facing onto the new internal site road are expected to exceed the recommended noise levels for external areas. All other areas set back beyond the initial façade, including all public amenity spaces, are predicted to meet the guidelines.

The ProPG document allows for the impact of higher than desirable external noise levels to be offset through assessment of a hierarchy of measures *including "a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings" or "a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)"*. In this instance there are public amenity spaces throughout the development that are predicted to achieve the external guidelines noise levels, as can be seen in the Figure.

Given that all properties will have access to either a private or public amenity space that meets the guidelines it is considered that the external guideline noise levels are achieved.

Figure 9.6 Modelled External Noise Levels



9.12 CUMULATIVE IMPACT ASSESSMENT

9.12.1 Construction Phase

The proximity of the construction works outlined above, indicates that at the nearest NSLs it is possible that cumulative impacts could occur at the nearest receptors should all sites progress construction simultaneously. Chapter 17 of the EIAR outlines the potential cumulative projects (table 17.1 refers). In this scenario elevated construction noise emissions due to cumulative noise are potentially likely to occur at receptor locations as well as a potential increase in the length of time that the receptor will be exposed to construction noise. However, this would only occur during peaks in construction noise over short periods. Hence, cumulative construction impacts will need to be considered and managed during the construction phase. It is recommended that liaison between construction sites is on-going throughout the duration of the construction phase. Contractors should schedule work in a co-operative effort to limit the duration and magnitude of potential cumulative impacts on nearby sensitive receptors. Cumulative construction noise impacts are expected to be **negative, moderate to significant** and **short-term.**

9.12.2 Operational Phase

During the operational phase any cumulative impacts will be due to an increase in road traffic noise. However, given the insignificant levels of noise increase as a result of the traffic associated with this proposed development, it is not expected that cumulative traffic noise will increase by any significant margin as a result of this proposed development.

9.13 INTERACTIONS

For Construction and operational phases chapter 11 traffic and transportation, has been referenced with respect to expected number of vehicle movements in each phase. This data has been used to calculate changes in noise level associated with construction traffic and new operational traffic as a result of the development. This was then used to determine the significance traffic associated with the proposed development, during the construction and operational phases, would have on the noise levels in the area.

9.14 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no experienced difficulties encountered during the completion of this chapter.

9.15 REFERENCES

- ANC, IOA & CIEH (2017). ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise – New Residential Development.
- British Standard BS 8233: 2014: Guidance on sound insulation and noise reduction for buildings.
- British Standard BS 4142: 2014+A1:2019: Methods for Rating and Assessing Industrial and Commercial Sound.
- British Standard BS 5228: 2009 +A1:2014: Code of Practice for Control of Noise and Vibration on Construction and Open Sites Part 1: Noise & Part 2: Vibration.
- British Standard BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration.
- Department of Transport Welsh Office, HMSO (1988). Calculation of Road Traffic Noise.
- EPA (2022). Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- Fingal County Council Fingal Development Plan 2023 -2029.
- The UK Highways Agency (2020). Design Manual for Roads & Bridges – LA111 -Revision 2.
- ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.
- ISO 9613-2: 2024: Acoustics – Attenuation of sound during propagation outdoors, Part 2.
- WHO (2018). Environmental Noise Guidelines for the European Region.