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NOISE IMPACT ASSESSMENT – DEVELOPMENT SITE AT FORTFIELD ROAD, TERENURE, CO. DUBLIN

Technical Report Prepared For

1 Celbridge West Land Ltd.

Technical Report Prepared By

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Our Reference

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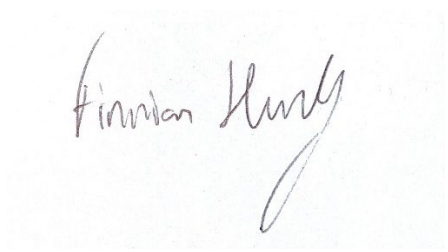
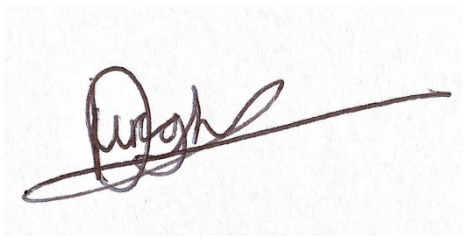
Signature		
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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts for a proposed residential development on a site at Fortfield Road, Terenure, Dublin 6W. The proposed development will be comprised of a mixture of apartments and houses with an underground car park, a creche and both communal open space and residential amenities.

A baseline noise survey has been undertaken at the development site to determine the existing environment at the site. A noise and vibration assessment has been undertaken based on the results of the noise survey, as recommended in the *ProPG: Planning & Noise* guidance document.

The assessment concludes that all residents will enjoy good to reasonable internal noise environment with windows open or closed. No enhanced acoustic performance is required to the building facades.

Outward noise assessments have been undertaken for both construction and operational phases of the proposed development.

Construction noise thresholds have been assessed and predictions have been undertaken. The predictions indicate that construction activities at distances less than 25 m from noise sensitive receivers will generate noise levels above the threshold at which a likely significant impact will occur. At distances above 25 m from areas of major works, the noise level associated with most anticipated construction activities will be below this threshold.

Appropriate construction mitigation measures have been presented within this report in order to reduce the impact of construction activities on nearby sensitive receptors.

Once operational, it is expected that noise emissions will be limited to vehicular noise and plant noise emissions, outward noise from rooftop amenity areas and a creche related to the development. The additional vehicular traffic generated by residents of the proposed development has been assessed as having no impact on the surrounding environment. Due to attenuation over distance, we do not expect noise from rooftop amenity areas or the creche to pose any negative impact.

Regarding plant noise, suitable noise thresholds have been assigned based on the measured prevailing noise levels. During detailed design stage plant and noise mitigation options should be selected so that the noise emissions at nearby sensitive receptors do not exceed the recommended thresholds.

CONTENTS

1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out an assessment in relation to the potential inward noise and impacts as well as the potential outward impact of the proposed residential development at Fortfield Road, Terenure, Dublin 6W. The proposed development comprises housing and apartment accommodation with an underground car park.

Included within this report is an assessment of the impact of inward noise and vibration across the development site as per the guidance provided in the *ProPG: Planning & Noise* document. Furthermore, the report assesses the outward noise impact of the construction and operational phases of the development.

The development site is located close to the site of the existing Terenure College on Templeogue Road, bounded to the east by a Terenure College Rugby Football Club and to the west by Fortfield Road.

Figure 1 presents the proposed development site and the surrounding area. Figure 2 presents the Ground Floor Plan of the proposed development.

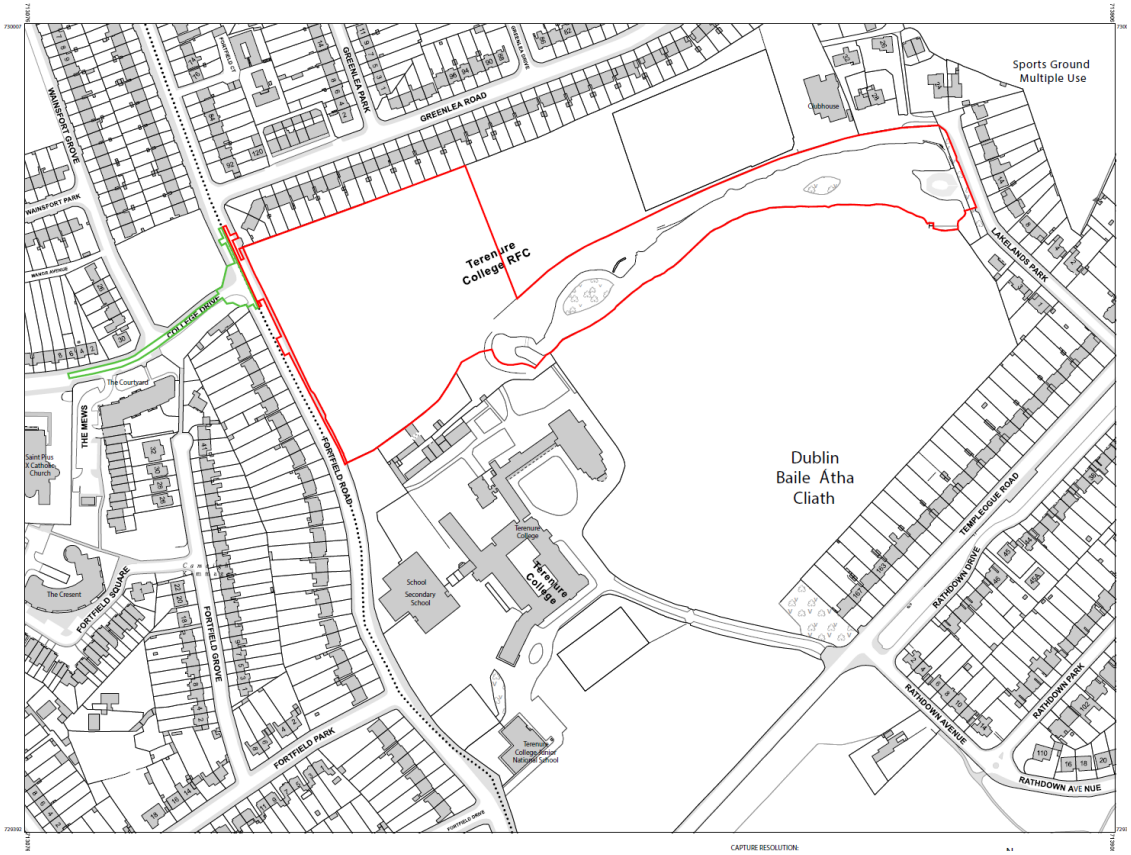

Figure 1 Location of proposed development

Figure 2 Ground Floor Plan of Proposed Development

Appendix A presents a glossary of acoustic terminology that is used throughout this report.

In the first instance it is appropriate to review relevant noise and vibration criteria being adopted for the assessment and to present a discussion of the site in the context of the existing noise and vibration environment.

2.0 DESIGN CRITERIA

2.1 Inward Noise Impact

2.1.1 Dublin Agglomeration Noise Action Plan

The *Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Volume 1: Dublin City Council* states the following with respect to assessing the noise impact on new residential development:

> *"Acoustic privacy is a measure of sound insulation between dwellings and between external and internal spaces. Development should have regard to the guidance on sound insulation and noise reduction for buildings contained in BS 8233:2014. The following principles are recommended for minimising disruption from noise in dwellings:*
>
> - *Utilise the site and building layout to maximise acoustic privacy by providing good building separation within the development and from neighbouring buildings and noise sources.*
> - *Arrange units within the development and the internal layout to minimise noise transmission by locating busy, noisy areas next to each other and quieter areas next to quiet areas.*
> - *Keep stairs, lifts, and service and circulation areas away from noise-sensitive rooms like bedrooms. Particular attention should be paid to the siting and acoustic isolation of the lift motor room. Proposals close to noisy places, such as busy streets may need a noise impact assessment and mitigation plan."*

2.1.2 ProPG: Planning & Noise

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

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

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

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an

informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

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

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

A summary of the ProPG approach is illustrated in Figure 3 .

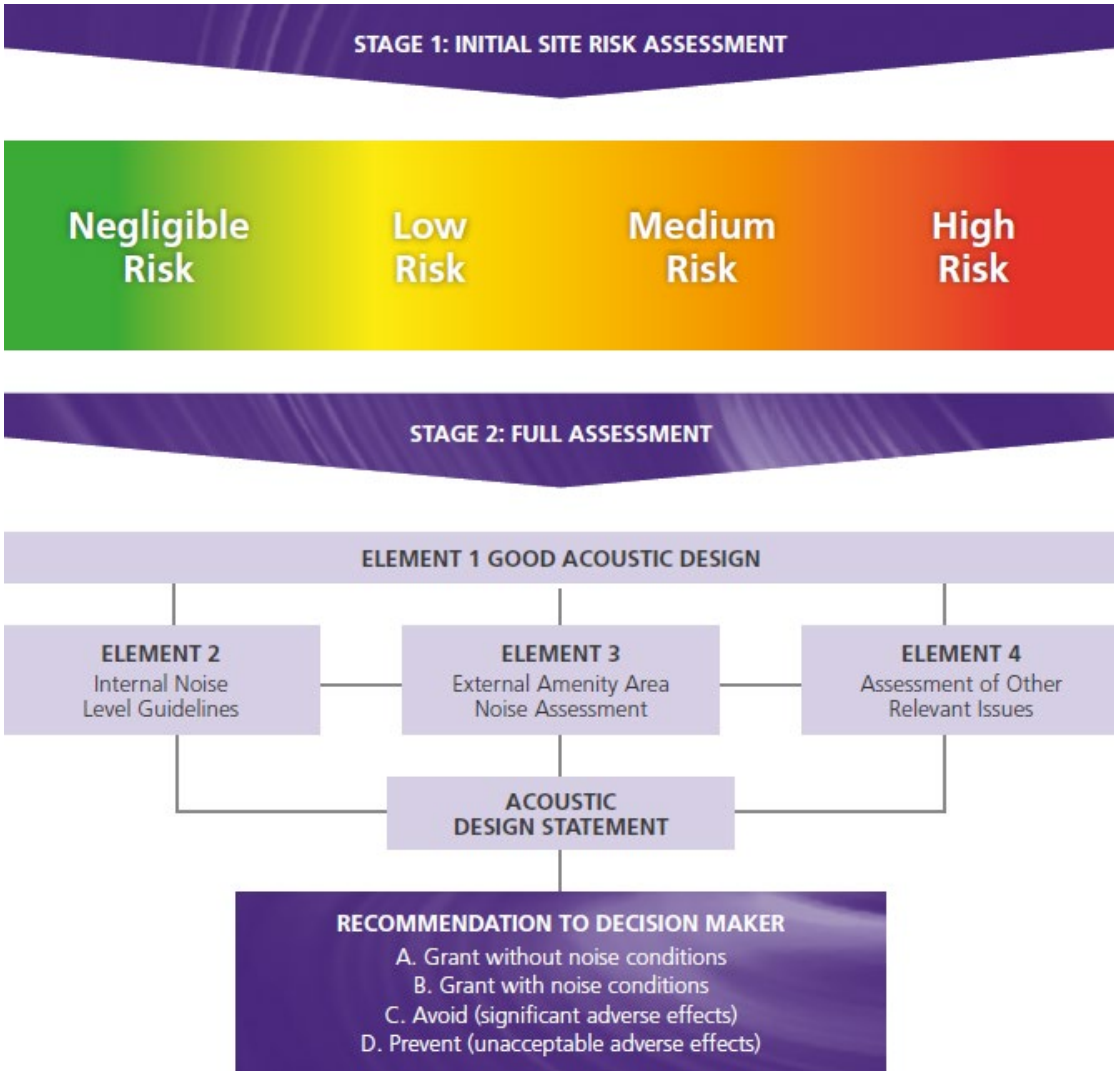

Figure 3 ProPG Approach (Source: ProPG)2.1.3 BS 8233

Internal Noise

There are no statutory guidelines or specific local guidelines relating to appropriate internal noise levels within dwellings. In this instance, reference is made to BS 8233: 2014: *Guidance on sound insulation and noise reduction for buildings.*

BS 8233 sets out recommended internal noise levels for domestic buildings from external noise sources such as traffic. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended indoor ambient noise levels for residential units are set out in Table 1.

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

Table 1 Recommended Internal Noise Levels for Domestic Buildings (ref. BS 8233)

External Noise

In relation to noise levels for external amenity areas such as gardens, patios and balconies, BS 8233 provides the following guidance:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited".*

2.2 Outward Noise Assessment – Construction Phase

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase 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.

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

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

Paragraph E.2 goes on to state:

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

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

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

Note that a typical planning condition in relation to construction noise issued by Dublin City Council (DCC) refer also to compliance with BS 5228 Part 1 as a means of controlling impacts to the surrounding environment. BS 5228, has therefore been used to inform the assessment approach for construction noise in line with DCC practice.

For residential and school properties it is considered appropriate to adopt the 70dB(A) criterion.

2.3 Outward Noise Assessment – Operational Phase

During the operational phase of the proposed development the primary sources of noise are expected to be traffic generated by residents arriving and leaving and noise from mechanical plant items serving the development.

It is anticipated that external mechanical plant items will operate continuously in order to serve the development. These will be selected and located so as not to impact surrounding noise sensitive receivers.

2.3.1 Traffic Noise

In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 2 offers guidance as to the likely impact associated with any particular change in traffic noise level due to the proposed development (Source DMRB, 2020).

Change in Sound Level (dB L_{A10})	Subjective Reaction	Magnitude of Impact
10+	Doubling of loudness and above	Major
5 – 9.9	Up to a doubling of loudness	Moderate
3 – 4.9	Perceptible	Minor
0.1 – 2.9	Barely Perceptible	Negligible
0	Inaudible	No Change

Table 2 Likely Impact Associated with Change in Traffic Noise Level

2.3.2 Plant Noise Emissions

British Standard 4142: 2014: *Methods for Rating and Assessing Industrial and Commercial Sound* is the industry standard method for analysing building services plant noise emissions to residential receptors.

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

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

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

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

"ambient noise level, $L_{Aeq,T}$"	is the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"residual noise level, $L_{Aeq,T}$"	is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"specific noise level, $L_{Aeq,T}$"	is the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"rating level, $L_{Ar,T}$"	is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);
"background noise level, $L_{A90,T}$"	is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

Section 6.2 of this document discusses details in relation to the recommended plant noise criteria for the development.

2.3.4 Other Noise Sources

For operational activities associated with the development that are not continuous in nature or entertainment noise, it is considered more appropriate to set noise limits at the nearest noise sensitive locations using guidance contained within British Standard BS 8233 (2014): Guidance on Sound Insulation and Noise Reduction for Buildings. This Standard sets out recommended noise limits for indoor ambient noise levels as previously listed in Table 1.

For the purposes of this study, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window. This is typically taken to be 15dB(A).

As short periods of noise have the potential to cause a greater disturbance at night-time, a shorter assessment time period (T) is adopted. Appropriate periods are 1 hour for daytime (07:00 to 23:00 hours) and typically 5 minutes for night-time (23:00 to 07:00 hours).

In summary, the following criteria for non-plant items apply at the façades of those residential properties closest to the proposed development:

- Daytime (07:00 to 23:00 hours) 50dB $L_{Aeq,1hr}$
- Night-time (23:00 to 07:00 hours) 45dB $L_{Aeq,5min}$

3.0 ProPG STAGE 1 – NOISE RISK ASSESSMENT

3.1 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 4 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

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

Paragraph 2.9 of ProPG states that,

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

In this instance measured levels on site have been used to predict the noise levels incident on the facades of the proposed development. This is to comply with the requirements of paragraph 2.8 of ProPG which states,

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

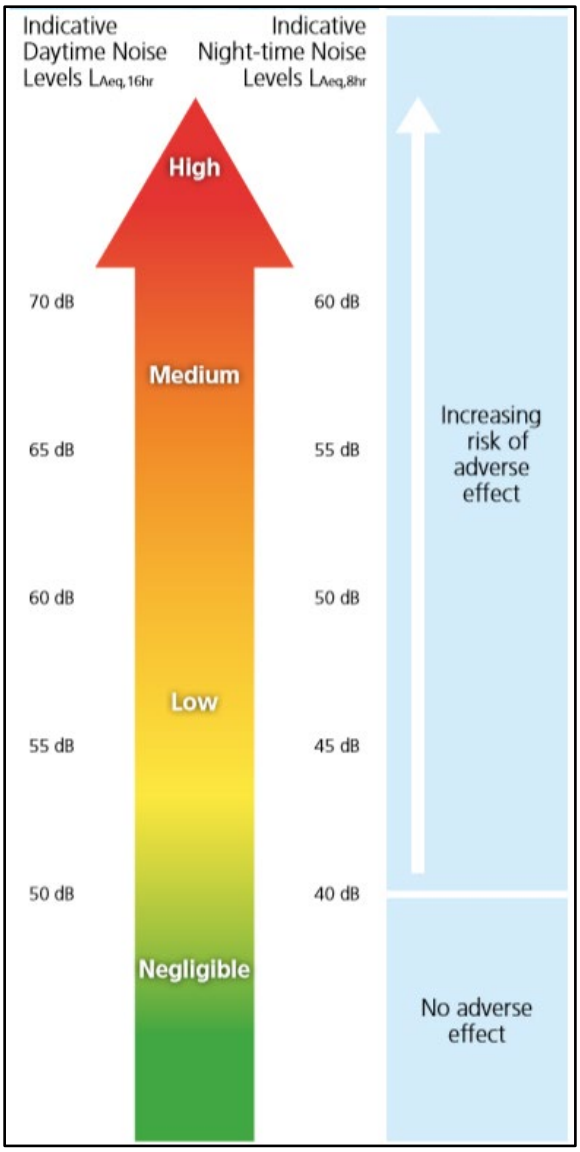

Figure 4 ProPG Stage 1 - Initial Noise Risk Assessment

3.2 Baseline Noise Survey

Environmental noise surveys have 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.

3.2.1 Methodology

Both unattended and attended environmental noise surveys were conducted at the site from 24 - 25 May 2022 by AWN Consulting to quantify the existing noise environment. The monitoring locations are detailed below in Figure 6.

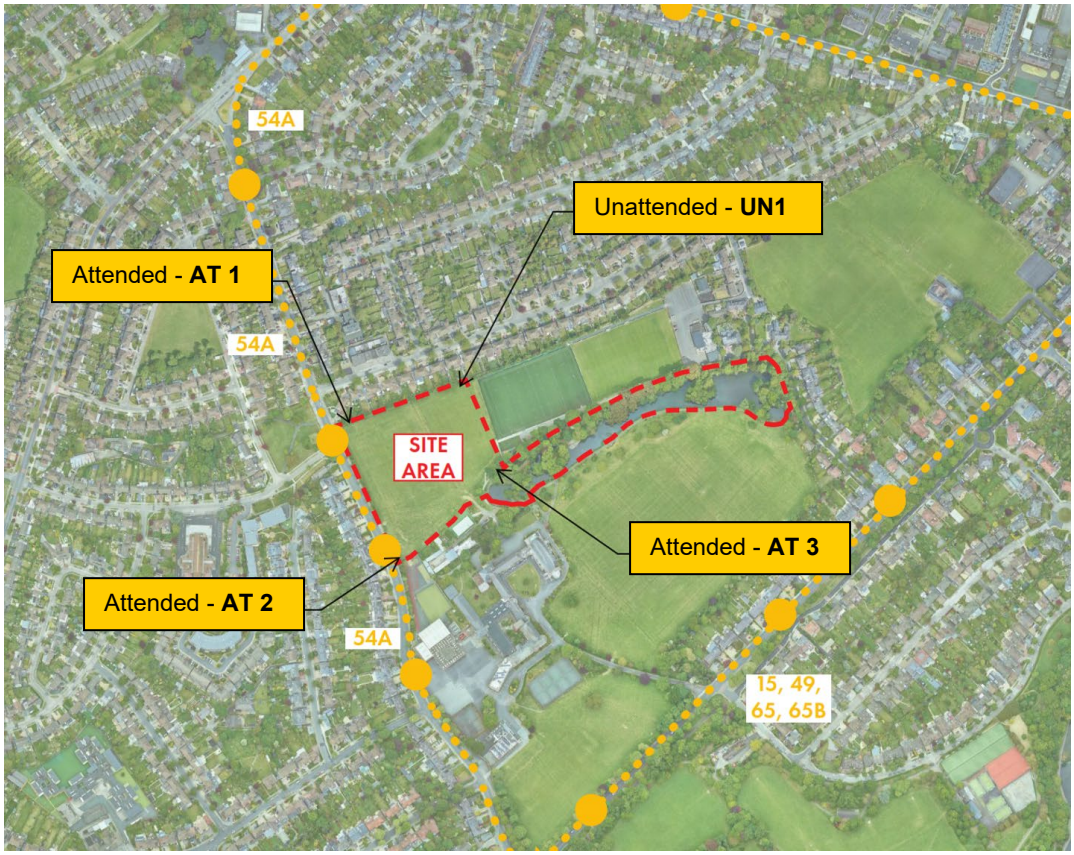

Figure 5 Noise Monitoring Locations

UN1 Unattended noise monitor, Northeast of the site bordering on the Terenure College Rugby Football Club Facilities.

AT1 Attended noise monitor, Northeast of the site bordering on the Fortfield Road.

AT2 Attended noise monitor, South of the site bordering on the boundary of Terenure College.

AT3 Attended noise monitor, Southeast of the site to the boundary of Terenure College Rugby Football Club and the body of water within Terenure College grounds.

3.2.2 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 maximum sound pressure level recorded during the sample period.

L_{AFMin} is the minimum sound pressure level recorded during the sample period.

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

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

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

3.2.3 Survey Results

Location UN1

Table 6 presents a summary of the average noise levels measured during the unattended noise survey at UN1 from 24 to 25 May 2022. It should be noted that a logarithmic average is used for the L_{Aeq} parameter, while an arithmetic average is used for the L_{A10} and L_{A90} parameters. The L_{Amax} and L_{Amin} values are the maximum and minimum values measured during each period.

Date	Period	L_{Aeq} dB	L_{Amax} dB	L_{Amin} dB	L_{A10} dB	L_{A90} dB
24/05/2022 - 25/05/2022	07:00 – 19:00 (Day Time)	53 dB	88 dB	36 dB	52 dB	45 dB
	19:00 – 23:00 (Evening Time)	41 dB	72 dB	35 dB	48 dB	41 dB
	23:00 – 07:00 (Night Time)	50 dB	77 dB	32 dB	53 dB	42 dB

Table 3 Summary of Unattended Measured Noise Levels

L_{Aeq} values were measured at 15 minute intervals over the duration of the unattended monitoring period. Figure presents the measured $L_{Aeq,\ 15min}$ events for day evening and night.

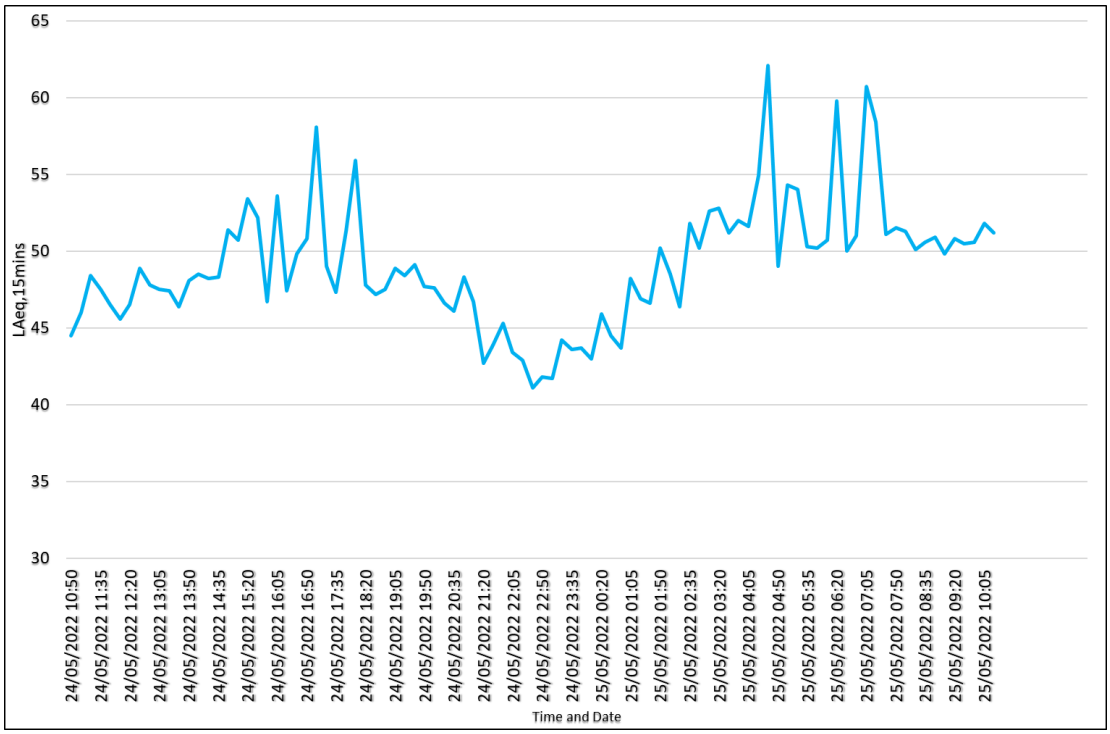

Figure 6 Measured $L_{Aeq,15min}$ Noise Levels

Location AT1

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
10:50	50	65	40	54	44
11:50	51	71	40	53	45
12:50	51	71	40	53	45
Average	51	-	-	53	45

Table 4 Summary of attended daytime noise measurements at AT1

The primary noise contributor at location AT1 was road noise from the Fortfield Road close to the measurement point. Other noise sources included birdsong, wind in foliage and intermittent movements from neighbouring properties. The measured ambient noise levels at this location were in the range of 50 to 51 dB $L_{Aeq,15mins.}$ The background noise levels measured were in the range of 44 to 45 dB $L_{A90,15mins.}$

Location AT2

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
11:10	53	77	40	57	44
12:10	53	63	41	57	45
13:10	56	72	43	58	47
Average	54	-	-	57	45

Table 5 Summary of attended daytime noise measurements at AT2

The primary noise contributors at location AT2 was road noise from the Fortfield Road, birdsong and distant outdoor activities from the adjacent Terenure College. Other noise sources included intermittent nearby movements from members of the public. The measured ambient noise levels at this location were in the range of 53 to 56 dB $L_{Aeq,15mins.}$ The background noise levels measured were in the range of 44 to 47 dB $L_{A90,15mins.}$

Location AT3

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
11:30	54	69	46	56	50
12:30	52	70	46	54	48
13:30	51	71	44	54	46
Average	53	-	-	55	48

Table 6 Summary of attended daytime noise measurements at AT3

The primary noise contributors at location AT3 were groundskeeping activities such as lawnmowing from Terenure College, birdsong and distant outdoor activities. Other noise sources included wind in foliage and intermittent vehicle movements from the

car park behind the measurement location. The measured ambient noise levels at this location were in the range of 51 to 54 dB $L_{Aeq,15mins.}$ The background noise levels measured were in the range of 48 to 50 dB $L_{A90,15mins.}$

3.3 Assessment Noise Level

The measured and predicted noise levels associated with road noise and other activities within the vicinity have been summed where appropriate to obtain an assumed assessment noise level at the façades of the proposed development. A noise spectrum for the assessment noise is presented below for daytime and night-time.

Facade	Period	Octave Band Centre Frequency (Hz)						Overall $L_{Aeq,T}$ dB
		125	250	500	1k	2k	4k	
Predicted Noise Levels at all Façades	Day	48	45	43	45	40	45	53
	Night	47	49	46	43	40	42	50

Table 7 Predicted $L_{Aeq,T}$ Noise Levels External to Proposed Development

3.4 Noise Risk Assessment Conclusion

Considering the measured and predicted noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site is low.

Period	Noise Level (dB, $L_{Aeq,T}$)	"Risk Category"
Daytime	≤ 53	Low
Night time	≤ 50	Low

Table 8 Categorising Proposed Site

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the L_{AFmax} noise levels. The results indicate that the L_{AFmax} noise levels with the exemption of some outliers are in the region of 50-60 dB and events of 80 dB or more do not occur more than 20 times per night. Therefore, baseline noise levels do not exceed the threshold whereby ProPG recommends that the site is considered as high risk.

ProPG states the following with respect to medium and high 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.*

Given the above it can be concluded that the development site may be categorised as *Low Risk* and as such an Acoustic Design Strategy will be not be required to minimise noise impact to such an extent that an adverse noise impact will be avoided in the final development so long as standard construction procedures are followed.

4.0 ProPG STAGE 2 – ACOUSTIC DESIGN STATEMENT

4.1 Element 1 – Good Acoustic Design Process

4.1.1 ProPG Guidance

In practice, good acoustic design should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life or occupants or compromising other sustainable design objectives. It is important to note that ProPG specifically states that good acoustic design is not equivalent to overdesign or "*gold plating"* of all new development but that it seeks to deliver the optimum acoustic environment for a given site.

Section 2.23 of the ProPG outlines the following checklist for Good Acoustic Design (GAD):

- 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.

4.1.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

The proposed development adjoins both an existing road and college facilities, therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

Consideration has been given to the location of the building and external amenity areas. Communal open spaces are located at roof and ground level of the development in a manner that provides a reduction in incident traffic or extraneous noise. The proposed development site is compact in nature limiting opportunities to reduce façade noise levels through relocation or reorientation of buildings.

Select Construction Types for meeting Building Regulations

Masonry constructions will be used in constructing the external walls of the development. This construction type offers high levels of sound insulation performance. Thermally insulated windows will be used and ventilation systems to comply with Part F of the Building Regulations.

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

The good acoustic design measures that have been implemented on site, e.g. locating residences away from the road where practicable and placing outdoor space on the quiet side of buildings, are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

Additional noise mitigation measures are not necessary for the development in question.

Assess External Amenity Area Noise

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

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

Assessment of amenity spaces is presented in Section 4.3.

Summary

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

4.2 Element 2 – Internal Noise Guidelines

4.2.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in Table 1 in Section 2.1 and are based on annual average data.

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

4.2.2 Façade Levels

Based on measured noise levels, façade noise levels have been predicted for the most exposed proposed facades in the development site during day and night-time periods. Table 7 presents the noise levels that have been assumed for this assessment.

4.2.3 Discussion on Open/Closed Windows

The level of sound reduction offered by a partially open window is typically applied as 10dB[1] to 15dB.

[1] Section 2.33 of ProPG, additional information can be found in the DEFRA NANR116: *'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows'*

Considering the design goals outlined in Table 1 and sound reduction across an open window of 10 to 15dB, the free-field noise levels that would be required to ensure that the desired internal noise levels do not exceed 'good' or 'reasonable' internal noise levels have been summarised in Table 9.

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

Table 9 External Noise Levels Required to Achieve Internal Noise Levels

For rooms on all facades, a 'Good' internal noise level will be achieved with windows open during the daytime.

For rooms on all facades, a 'Reasonable' internal noise level will be achieved with windows open during the night-time periods.

4.2.4 Recommended Façade Treatment

No enhanced acoustic performance is required for the façade treatment, based on the measured and predicted noise levels.

4.3 Element 3 – Amenity Areas and Child Creche

For the current layout the private outdoor amenity areas should achieve noise levels equal or lower than the measured baseline noise levels, which are ≤55dB $L_{Aeq,16hr}$. The creche has been located as to be set back from the main source of traffic noise and to benefit from acoustic screening from development buildings. Therefore, noise intrusion will be minimal.

4.4 Element 4 – Assessment of Other Relevant Issues

Element 4 gives consideration to other factors that *may* prove pertinent to the assessment, these are defined in the document as:

- 4(i) compliance with relevant national and local policy
- 4(ii) magnitude and extent of compliance with ProPG
- 4(iii) likely occupants of the development
- 4(iv) acoustic design v unintended adverse consequences
- 4(v) acoustic design v wider planning objectives

Each is discussed in turn below.

4.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally the Dublin Noise Action Plan specifies that the guidance contained within ProPG should be used in assessing the noise impact on new residential developments.

This Acoustic Design Statement has been prepared in compliance with the requirements of ProPG and therefore complies with the requirements of local policy.

4.4.2 Magnitude and Extent of Compliance with ProPG

As discussed within this report the following conclusions have been drawn with regards to the extent of compliance with ProPG:

- All dwellings as part of the development have been designed to achieve the good level of internal noise levels specified within ProPG.
- All external amenity areas have been shown to have an external noise level that complies with the recommended criterion set out in ProPG.

Based on the preceding it is concluded that the proposed development is in full compliance with the requirements of ProPG.

4.4.3 Likely Occupants of the Development

The acoustic design for the proposed development has been based on an understanding of standard residential dwellings.

4.4.4 Acoustic Design v Unintended Adverse Consequences

Design aspects such as roadside barriers that remove views or prevent crossing roads, sealed facades that affect personal control over the internal environment etc., have been avoided through implementation of Good Acoustic Design principles. Unintended adverse conditions did not occur on this project.

4.4.5 Acoustic Design v Wider Planning Objectives

It is understood that wider planning objectives have been adhered to during the process of developing the design for the subject development.

4.5 Acoustic Design Statement Conclusion

An initial site noise risk assessment has been carried out on the proposed residential development at Fortfield Road, Dublin 6W. The assessment has classified the development site as having a *Low* noise risk. This was determined through measurement and analysis of noise levels recorded on site.

Further discussion is presented in terms of the likely noise impact of both the external and internal areas of the proposed development. It has been found that inhabitants will have access to a quiet external area that is screened by the development itself from road traffic noise. All habitable rooms will achieve a good to reasonable internal noise environment with windows open. With windows closed all rooms will achieve a good internal noise environment.

5.0 CONSTRUCTION ASSESSMENT

5.1 Construction Phase Overview

A variety of items of plant will be in use for the purposes of site clearance/groundworks, demolition and construction. 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.

During the construction phase, it is anticipated that there will be a number of HGV's moving to/from site. Excavators will be employed to excavate and piling rigs will be used for foundation work. Following this standard construction tools and methods will be employed for general construction and landscaping.

Review of aerial imagery has identified the closest noise sensitive receivers (NSLs), i.e. residential properties. The nearest NSLs are houses at Greenlea Road adjacent to the Northern site boundary, Residences on Fortfield Road to the West, Terenure College to the south and houses to the south on Templeogue Road. These identified NSLs are illustrated in Figure 10 below.

5.2 Construction Criteria

5.2.1 Noise

The closest sensitive residential receptor locations have been assigned the value 70dB $L_{Aeq,1hr}$. This is the value for construction noise at a sensitive receiver that, above which, a significant impact is likely to occur.

5.3 Predicted Construction Noise

It is possible to predict indicative noise levels using guidance set out in BS 5228-1:2009+A1:2014 for the main phases of the proposed construction works. Table summarises the construction noise prediction calculations at the nearest residences. The predictions assume a 66 % on-time for all items of plant (i.e. the items of plant are operational for 8 of the 12 hour period) and 5 dB attenuation due to partial screening of plant from the receptors.

Comparison of the proposed plans with the surrounding area indicates that the closest area where significant works are to take place is approximately 10m from the nearest residential properties with the remainder of works taking place across the site at varying distances. The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard site hoarding, typically 2.4m height, will be erected around the perimeter of the construction site for the duration of works.

NSLs 1 Residences at Greenlea Road, 20m from the northern site boundary.

NSLs 2 Horizons after school care, 25m from the southern site boundary

NSLs 3 Residences at Fortfield Road, 30m from the western site boundary.

NSLs 4 Terenure College, 65m from southern site boundary.

NSLs 5 Residences at Templeogue Road, 260m from the south-eastern site boundary.

The nearest noise sensitive locations are illustrated in the figure below.

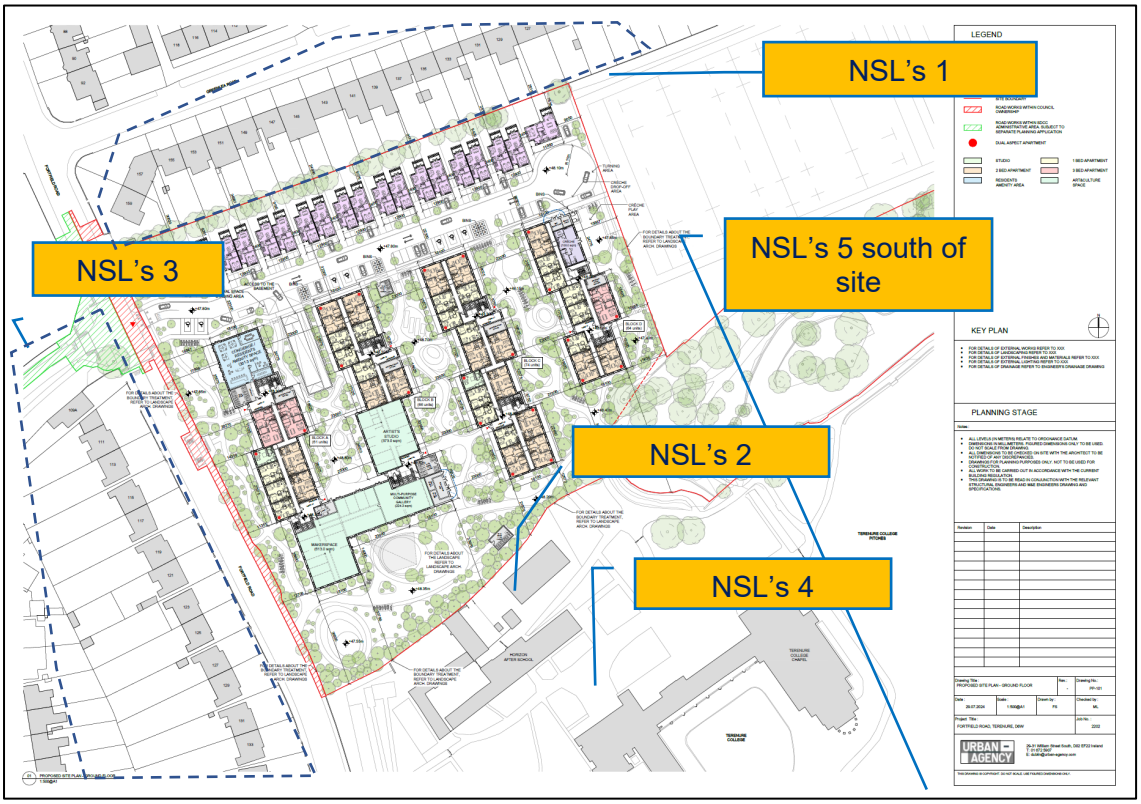

Figure 7 Indication of Sensitive Receptors Locations Close to Site

The predicted construction noise associated with each of the expected construction activities is presented below for each of the identified NSLs. Note that these are outline calculations only based on the likely construction activities. Piling may be required depending on ground conditions encountered.

Construction Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref)	Predicted Noise Level, dB $L_{Aeq,12hr}$				
		NSL1 (20m)	NSL2 (25m)	NSL3 (30m)	NSL4 (65m)	NSL5 (260m)
Site Clearance/ Groundworks	Tracked excavator (C2.21)	55	53	51	43	29
	Dump Truck (C2.30)	63	61	59	51	37
	Tracked Mobile Crane (C4.50)	60	58	56	48	34
	Diesel Generator (C4.76)	45	43	41	33	19
	Cumulative	66	63	61	53	39
Piling	Dump Truck (C2.30)	68	66	64	56	41
	Large Rotary Bored Piling Rig (C3.14)	70	68	66	58	44
	Tracked excavator (D2.21)	61	59	57	49	35
	Cumulative	73	70	69	61	46
General Construction	Compressor (D7.08)	57	55	53	45	31
	Telescopic Handler (D4.54)	66	64	62	54	40
	Hand Held Circular Saw (D4.72)	68	66	64	56	41

Construction Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref)	Predicted Noise Level, dB $L_{Aeq,12hr}$				
		NSL1 (20m)	NSL2 (25m)	NSL3 (30m)	NSL4 (65m)	NSL5 (260m)
	Diesel Generator (D4.76)	48	46	44	36	22
	Internal Fit out	59	57	55	47	32
	Cumulative	71	69	67	59	44
Landscaping and Road Paving	Asphalt Paver & Tipping Lorry (D5.30)	62	60	58	50	36
	Electric Water Pump (D5.40)	55	53	51	43	29
	Vibratory Roller (D5.20)	62	60	58	50	36
	Cumulative	66	64	62	54	39

Table 10 Predicted Construction Noise Levels

It is important to note that the calculations set out above are based on assumed site activity and a combination of plant items operating simultaneously, as such they are typically worst-case scenarios. The use of construction noise and vibration mitigation measured measures will be employed during the construction phase with a view to minimising noise impacts.

The predicted construction noise levels at 20m and 25m from areas of major works represented by NSL's 1 and 2 are above the threshold level for some construction activities, i.e. the level above which a significant impact is likely to occur.

At distances of 25m and greater from the works there is a marginal exceedance of the threshold for certain construction activities, however for the most part expected activities are below the construction noise threshold. Construction mitigation measures are outlined in Section 7.1

5.4 Predicted Construction Vibration

The main potential source of vibration during the construction phase is associated with piling activities that may be required.

For the purposes of this assessment the expected vibration levels during piling have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2*: Vibration*, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54mm/s at a distance of 5m, for auguring;

Considering the low vibration levels at very close distances to augured piling rigs, vibration levels at the adjoining buildings are not expected to pose any significance in terms of cosmetic or structural damage to any of the protected structures in proximity to the development works or any of the other adjacent buildings.

Construction mitigation measures are outlined in Section 7.1

6.0 OPERATIONAL NOISE ASSESSMENT

6.1 Traffic Noise Assessment

In terms of the additional construction traffic on local roads that will be generated as a result of the proposed development, the following comment is presented: As stated in the DMRB Noise and Vibration (UKHA 2020), Volume 11, Section 3, Part 7, in order to increase traffic noise levels by 1 dB traffic volumes would need to increase by the order of 25%; considering the small number of potential vehicle movements in comparison to the existing level of traffic on Fortfield Road, the increase in traffic volume is expected to generate insignificant level of additional noise.

The predictions indicate that the subjective reaction to the change in noise levels will be inaudible and the associated impact will be 'no change'.

6.2 Plant Noise Assessment

Table 11 presents the average background noise levels (in terms of L_{A90}) measured in the vicinity of the site during the day period. The background noise levels are representative of the closest NSLs.

Location Ref	Average Background Noise Level (L_{A90} dB)
	Day
UN1	40 – 45

Table 11 Background Noise Levels

In accordance with BS 4142 if the plant noise level does not exceed the background sound level it is an indication of a low impact, it is recommended in this instance that noise emissions from all plant installed on site (considered cumulatively) do not exceed the background noise levels presented in Table 11.

It is understood that various external plant items are proposed for the development. There is also provision for an ESB substation as part of the development plans. These items of plant have the potential to emit noise to the environment and consequently an exercise should be undertaken at detailed design stage to ensure that the finalised items of plant do not exceed the proposed noise thresholds.

6.3 Rooftop Amenity Areas

Outdoor areas are being provided for residents of the scheme at roof level. The potential noise impact associated with this area is limited to voices from residents of the scheme and noise associated with an outdoor open space.

In order to predict the impact of the proposed rooftop terraces on the nearest noise sensitive locations, calculations have been carried out based on standardised noise source data for a typical human voice. Table 16 details the standardised sound power pressure level of a normal human voice at a distance of 1m from the speaker's mouth. This level is taken from the American National Standards Institute document *ANSI 3.5:1997 – Methods for calculation of the speech intelligibility index.* This sound pressure level is an average of male and female voices and is a free-field level.

Description	Sound Pressure Level, dB re $2x10^{-5}$ Pa at Octave Band Centre Frequency (Hz)						dB(A)
	250	500	1000	2000	4000	8000	
Normal Voice Effort	57	60	54	49	44	39	60
Raised Voice Effort	62	66	62	57	51	43	67
Shouted Voice Effort	65	75	80	76	69	58	82

Table 12 Sound Pressure Level of Normal Voice Effort

For the purposes of this assessment, it is assumed that the rooftop terraces will be busy with up to 30 people conversing simultaneously. We have also added a 10dB penalty to account for raised voices. This represents a worst-case assessment as typically there will be fewer people using the rooftop terraces.

Taking this into account and including the noise attenuation due to distance and the shielding discussed earlier the noise level at the nearest sensitive locations is predicted to be of the order of 50dB $L_{Aeq,T}$.

The predicted noise level is within the day criterion of 50dB $L_{Aeq,1hr}$. It should be noted that rooftop terraces will not be open for residents during night-time hours, i.e. 23:00hrs to 07:00hrs.

It is concluded that the likely noise impact of rooftop terrace activity is not significant. Notwithstanding this, noise management policies are discussed in Section 7.1 of this report.

6.4 Internal Sound Insulation

The separating wall and floor constructions between rooms will be finalised at the detailed design stage. It is envisaged that across typical floors where residential areas are located, the acoustic requirements for sound insulation will be readily achieved by an appropriately selected partition system and concrete floor plus ceiling.

For those residential areas directly above commercial units and communal space on the ground floor a higher performance separating construction will be required. This will be fully determined at the detailed design stage, however, it is likely to require additional suspended ceiling constructions below the concrete separating floor slab. Similarly separating wall constructions between noisy spaces on the ground floor may require higher levels of sound insulation which could be achieved using wider lightweight partitions or masonry partitions.

Gym spaces may also require acoustic flooring buildups to limit the transfer of impact noise during exercise activity to other parts of the building.

6.5 Child Creche

Measurement of noise levels generated by children playing outdoors at several crèches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,1hr}$ at a distance of 5 metres. The nearest noise sensitive receptors are located at the Greenlea Road estate to the Northeast of the site, with the closest receptor located approximately 65 m from the creche. At this distance, it is expected that the noise levels will be in the order of around 34 dB $L_{Aeq,1hr}$, which is below the measured baseline noise levels representative of this location, at 55dB $L_{Aeq,16hr}$. Therefore, the resultant noise impact due to the creche is not significant.

6.6 Community Indoor Culture/Art Spaces

There are indoor community and art spaces within the proposed development. These spaces are located at a distance where noise levels are unlikely to exceed the current background noise levels at the closest NSLs. Additionally, it is predicted that noise emanating from these spaces will be internal and contained within the associated buildings. Therefore, no significant breakout to nearby NSLs is expected.

7.0 Mitigation Measures

7.1 Construction Mitigation Measures

The following noise mitigation measures may be utilised to reduce the effects of noise on the surrounding receptors:

- Use of a standard site hoarding, typically 2.4m height will be erected around the perimeter of the construction site for the duration of works;
- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Maintaining site access roads even so as to mitigate the potential for vibration from lorries;
- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of barriers as necessary around items such as generators or high duty compressors;
- Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary
- Establishing channels of communication between the contractor/developer, Local Authority and residents, and;

Appointing a site representative responsible for matters relating to noise and vibration.

7.2 Roof Amenity Areas

The developer will implement in full the following noise management policy throughout the operational phase of the development to minimise further any noise impact from the rooftop terrace areas. The implementation of this policy will ensure that noise from the rooftop terraces will be minimised. The noise management policy outlines the following measures:

- Rooftop terrace opening hours will be 07:00hrs to 23:00hrs with no activity at night, and areas will operate without music of any type.

- Members of staff will conduct regular checks of the external area at all times. The area will also be subject to CCTV coverage. Coverage will operate for 24 hours with images retained for 30 days.

- Signage will be erected in the external area and by all exits to the premises to remind residents of the need to respect the rights of our neighbours to the quiet enjoyment of their homes, businesses and other activities.

- A telephone number will be circulated to residents to allow any complaints as to noise from the premises or as to any other elements of its operation to be communicated easily.

- If any complaints of noise disturbance are received immediate steps will be taken to prevent a recurrence of the situation.

- The premises management will ensure that all residents and staff are made aware of the need to respect the rights of our neighbours to the quiet enjoyment of their homes, businesses, and other activities.

With the above measures in place, it is considered that the dominant source of noise associated with the use of the facility will be associated with the human voice.

Regular residents' meetings will be convened unless it is apparent that attendance at such meetings means they may no longer be necessary. The meetings will allow any issues which arise from the operation of the premises to be discussed.

7.3 Operational Plant

Plant noise from the creche, culture/art spaces and the ESB substations are expected to be below the background noise levels presented in Section 6.2. Best practice mitigation measures may be necessary in order to ensure that these thresholds are met, as an indication these measures could include attenuators and acoustic barriers or louvres plant areas.

At the detailed design stage, plant items associated with the crèche and art spaces will be selected with appropriate noise ratings and, where necessary, appropriately selected remedial measures (e.g. enclosures, silencers etc.) will be specified in order to minimize further any noise impact In relation to operational plant.

8.0 CONCLUSION

Planning Permission is being sought for a proposed residential development at Fortfield Road Dublin 6W. The development comprises of houses and apartment accommodation with an underground car park.

A baseline noise survey has been undertaken at the development site to determine the existing noise environment at the site. An inward noise assessment has been undertaken based on the results of the noise survey as recommended in the *ProPG: Planning & Noise* guidance document.

The measured noise levels on the site have been used to calculate noise levels at specific facades of proposed residential properties and to predict the internal noise levels within living room and bedroom spaces, taking account of the proposed building envelope and conditions in the receiving rooms (e.g. volumes and room acoustic characteristics). Based on these noise levels enhanced acoustic specifications to building facades is not required.

Based on the implementation of the measures outlined in this assessment the predicted noise levels conform to the criteria taken from BS8233:2014 for acceptable internal noise levels. It should be noted that the predicted internal noise levels detailed above assume that windows and doors will be closed. As discussed in Section 4.1.2 there is no requirement for assessment of internal noise levels with windows open, however it is expected that the majority of the site will achieve at least 'reasonable' internal noise levels with windows open.

It is predicted that the amenity spaces will experience noise levels of ≤55dB $L_{Aeq,16hr}$ in line with the recommended noise level.

The noise and vibration impact of the construction phase and operational phase of the proposed development has been assessed.

During the construction phase potentially significant levels of noise are predicted while works are taking place in proximity to the nearest NSL's. Mitigation measures have been recommended so that any negative impact may be reduced. Vibration during the construction phase is expected to be minimal and considering the distance between works and the nearest noise sensitive locations, it is not expected that a negative impact will occur.

During the operational phase, noise associated with the proposed development has been considered. There is predicted to be no change in noise levels associated with vehicular traffic on the road network local to the development.

Operational plant noise thresholds have been specified to ensure that no negative impact occurs at the nearest noise sensitive receivers, particularly at night-time. A cumulative mechanical plant noise criteria has been set so as to achieve required internal noise levels in apartments within the development. At detailed design stage plant items and openings to atmosphere can be selected and located such that the criteria set in this document will be achieved. Assuming the operational noise levels do not exceed the adopted design goals, the resultant residual noise impact from this source would be imperceptible.

Noise emissions from either rooftop amenity areas or surface level open spaces, as well as the creche are expected to cause negative impact.

APPENDIX A
GLOSSARY OF ACOUSTIC TERMINOLOGY

Ambient noise — The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.

Background noise — The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).

dB — Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dB(A) — An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

$D_{n,e,w}$ — Weighted element-normalized level difference. This is the value of sound insulation performance of a ventilator measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature for acoustic ventilators typically presents sound insulation data in terms of the $D_{n,e,w}$ parameter.

Hertz (Hz) — The unit of sound frequency in cycles per second.

$L_{Aeq,T}$ — This 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 (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

L_{AFN} — The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{AF90} — Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

L_{AF10} — Refers to those A-weighted noise levels in the upper 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting.

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

Octave band A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.

PPV Peak Particle Velocity (PPV) is defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is measured in mm/s.

R_w Weighted Sound Reduction Index – This is the value of the sound insulation performance of a partition or element measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature typically presents sound insulation data in terms of the R_w parameter.

R'_w Weighted Apparent Sound Reduction Index – This is similar to R_w but is used to express *in-situ* sound insulation performance, where issues such as flanking issue noise transfer may affect the measured level. As stated previously, technical literature typically uses the R_w parameter. In order to reflect the likely *in-situ* performance of an element an appropriate correction should be applied for the expected reduction in performance. Note that in instances where significant flanking issues are present the *in-situ* performance may be further reduced.

VDV Vibration Dose Value (VDV). This is an assessment of the effect of building vibration on the people within. The VDV is the fourth root of the integral of the fourth power of acceleration after it has been frequency-weighted (as defined in BS6472: 2008). The frequency-weighted acceleration is measured in m/s^2 and the time period over which the VDV is measured is in seconds. This yields VDVs in $m/s^{1.75}$.