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ASSESSMENT OF INWARD TRAFFIC NOISE IMPACT ON DEVELOPMENT LANDS AT KILCOCK, CO. KILDARE

Technical Report Prepared For

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Our Reference

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EXECUTIVE SUMMARY

AWN Consulting has been requested by Teresa Monaghan to undertake an assessment of the potential noise impact associated with the M4 Motorway on a proposed residential development at Kilcock, Co. Kildare. For the assessment of noise, guidance has been taken from the following documents:

- *Kildare County Development Plan Policy (2017 – 2023),*
- *Kildare County Council Third Noise Action Plan (2019 – 2023),*
- ProPG: *Planning and Noise,*
- World Health Organization (WHO) *Community Noise*, and;
- BS 8233 (2014) *Guidelines for sound Insulation and noise reduction for buildings.*

The following daytime and night time internal noise criteria are proposed:

- 35 dB $L_{Aeq,T}$ daytime within living / bedrooms;
- 40 dB $L_{Aeq,T}$ daytime within dining rooms, and;
- 30 dB $L_{Aeq,T}$ night-time within bedrooms.

An initial site noise risk assessment has been carried out in accordance with the procedures outlined in the Kildare Noise Action Plan 2019 – 2023 using strategic noise mapping prepared by the Environmental Protection Agency as well as a detailed noise model of the site. The assessment has classified the development site as having a 'low' to 'medium' noise risk.

Modelling and assessment confirms that with the implementation of mitigation recommendations outlined in the above documents the development is predicted to be within the recommended criteria adopted from WHO and BS 8233 and that façade noise levels fall at or below the Kildare Noise Action criteria of 70 dB L_{den}. The model also confirms that ground floor facades will be exposed to noise levels below the Kildare Noise Action criteria of 57 dB L_{night}. While upper floor facades of the apartments to the north west fall in the region of 49 to 57 dB L_{night}, the proposed internal layout of dwellings in uppers storeys mitigates against any potential noise impacts arising.

Using the development building layout provided by the design team and the results of the noise surveys conducted on site, noise levels to all areas across the proposed development have been predicted. In order to control noise impacts internally the following mitigation measures are proposed:

- Standard thermal double glazing to all facades, and;
- Acoustic vents to the most exposed facades.

All ground floor facades facing away from the road can achieve *reasonable* internal noise levels with windows open during both the day and night time period. Elsewhere, appropriate acoustic specification for windows and passive vents have been provided to ensure the rooms are adequately ventilated and achieve the required internal noise levels under a closed window scenario.

Noise levels in the majority of external amenity areas fall within the range recommended in ProPg. In certain areas, the noise levels will be marginally higher but the small increase above the desirable range would be expected to be imperceptible and as such the noise levels are deemed to be acceptable. In conclusion, with the implementation of mitigation measures proposed within this report, the noise impact of the M4 on the proposed residential development can be controlled such that the impact is not significant or of a level that would have a significant negative impact on the residential amenity of the proposed dwellings.

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1.0 INTRODUCTION

AWN Consulting has been requested by Teresa Monaghan to undertake an assessment of the potential noise impact associated with the M4 Motorway on a proposed residential development at Kilcock, Co. Kildare. The noise impact assessment is being carried out in order to ensure a good environment for residential amenity is provided.

This Acoustic Design Statement is a detailed appraisal of the potential noise impacts arising on the proposed residential development due to road traffic noise from the M4. It has been prepared in accordance with both local and international policy and guidance including the Kildare *Noise Action Plan* (2019 - 2023) and the *Professional Guidance on Planning & Noise* (ProPG, May 2017).

Figure 1 presents the approximate outline of the proposed development site in the context of the adjacent M4 and the R158.

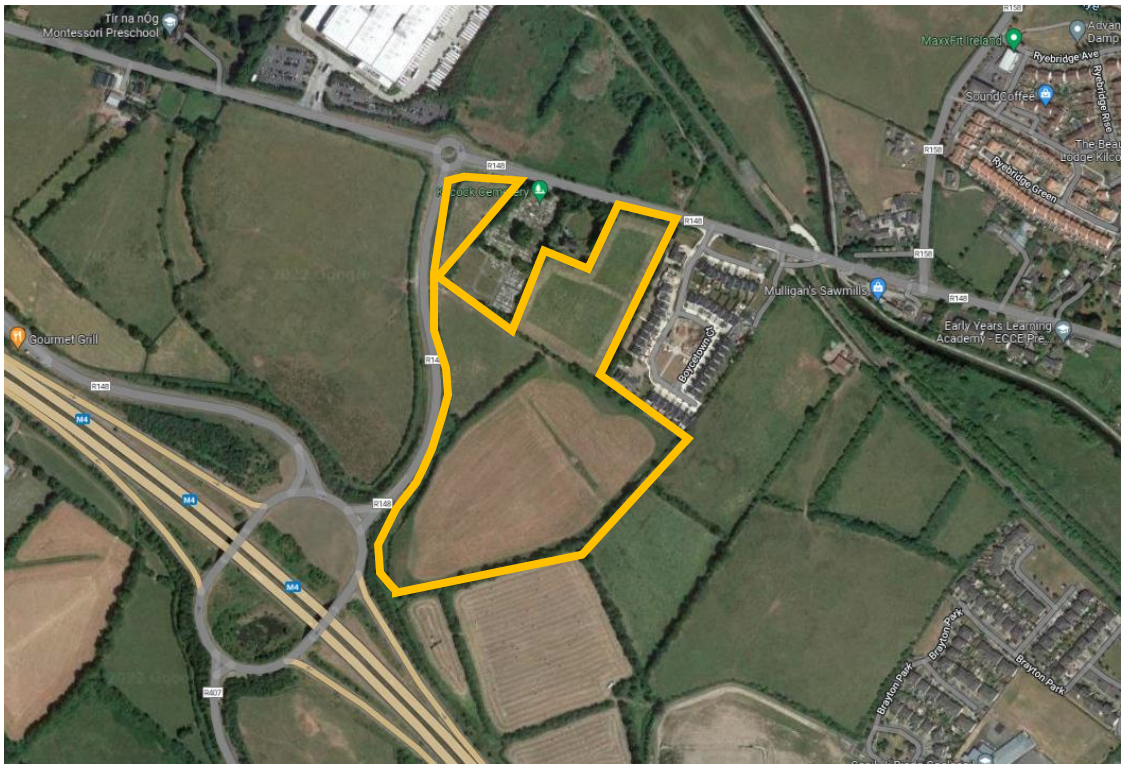

Figure 1 Location of proposed development (Source: Google)

Note* The triangular section of land to the north western corner of the site has been omitted from consideration in this assessment as no residential property is proposed for this area.

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

2.0 DESIGN GUIDANCE

2.1 Kildare County Development Plan Policy (2017 to 2023)

On 1 February 2017 Kildare County Council, adopted the Kildare County Development Plan covering the period 2017-2023 for its functional area. The Development Plan includes a range of noise related objectives, however the most pertinent in this instance is the following:

> *"EN 4 To facilitate the implementation of the Kildare Noise Action Plan 2013-2018 and Litter Management Plan 2016-2019 and any subsequent amendments during the period of this Plan."*

In addition, Section 17 of the Plan outlines the following in respect of building standards:

> *"17.7.2 Proposals for residential developments near busy roads in urban areas may be required to show how it is proposed that impacts of noise are mitigated. A Noise Impact Assessment along with noise screening measures such as facade insulation and noise barriers should form part of proposals, as appropriate."*

It is important to note that the Kildare Noise Action Plan (2013-2018) has been superseded by the Kildare Noise Action Plan (2019 – 2023). The 2019 Noise Action Plan (NAP) has been discussed in more detail in the following section.

2.2 Kildare Noise Action Plan (2019 – 2023)

The 2019 Kildare Noise Action Plan was published on 27 September 2019. The objective of the Noise Action Plan is to:

> *"Avoid, prevent and reduce on a prioritised basis, where necessary, the harmful effects due to long term exposure to environmental noise. This can be achieved by taking a strategic approach to managing environmental noise and following a balanced approach in the context of sustainable development."*

Section 7.7 *Planning for Noise Management* of the plan outlines guidance in relation to residential development in the areas of high noise levels such as that proposed.

> *"Kildare Local Authority shall require quantifiable noise assessments to be carried where any part of the residential developments is located within 150m of a rail corridor or adjacent to the "Major Roads" within the county. The quantifiable assessment of environmental noise shall include, inter alia, the situation internally with open windows and externally in the amenity areas of development".*
>
> *"Whilst the control of external levels of environmental noise constitutes one aspect of noise management within planning and aims to provide benefit to amenity spaces, the control of noise levels within residential properties and other noise sensitive premises also plays an important role".*

In addition to a requirement to complete a noise impact assessment, the NAP also provides guidance on design goals in respect of external noise levels:

"In the scenario where new noise sensitive premises are introduced to locations already exposed to significant levels of long term environmental noise as set out in the Environmental Noise Regulations, i.e. 70 dB (A) L_{den} and 57 dB (A) L_{night}, it is considered appropriate to consider aiming to achieve target internal noise levels within noise sensitive rooms, such as living rooms and bedrooms.

In the case of new development, or conversions, these targets could be introduced through the use of appropriate planning conditions, and possibly some form of pre-completion testing as used in a number of other EU countries. The choice of targets for internal noise levels can be informed by the:

1. *WHO-Guidelines for Community Noise (1999),*
2. *WHO-Night Noise Guidelines for Europe (2009),*
3. *WHO-Environmental Noise Guidelines for the European Region (2018),*
4. *BS 8233 (2014) Guidance on Sound Insulation and Noise,*
5. *ProPG: Professional Practice guidance on Planning and Noise for new Residential Development (May 2017),*
6. *AACI: Environmental Noise Guidance for Local Authority Planning & Enforcement Departments (June 2019)."*

In this instance, it is proposed to adopt internal noise criteria as outlined in BS 8233 (2014) *Guidance on Sound Insulation and Noise*, further discussion on this has been provided in Section 5.2.1.

The approach to the assessment of the noise incident at the site has been based on the procedures outlined in the *ProPG: Professional Practice guidance on Planning and Noise for new Residential Development* document (May 2017). This is discussed further in the following section.

2.3 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 UK or Irish government document, since it's publication it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

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

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

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning

authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

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

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

A summary of the ProPG approach is illustrated in Figure 2.

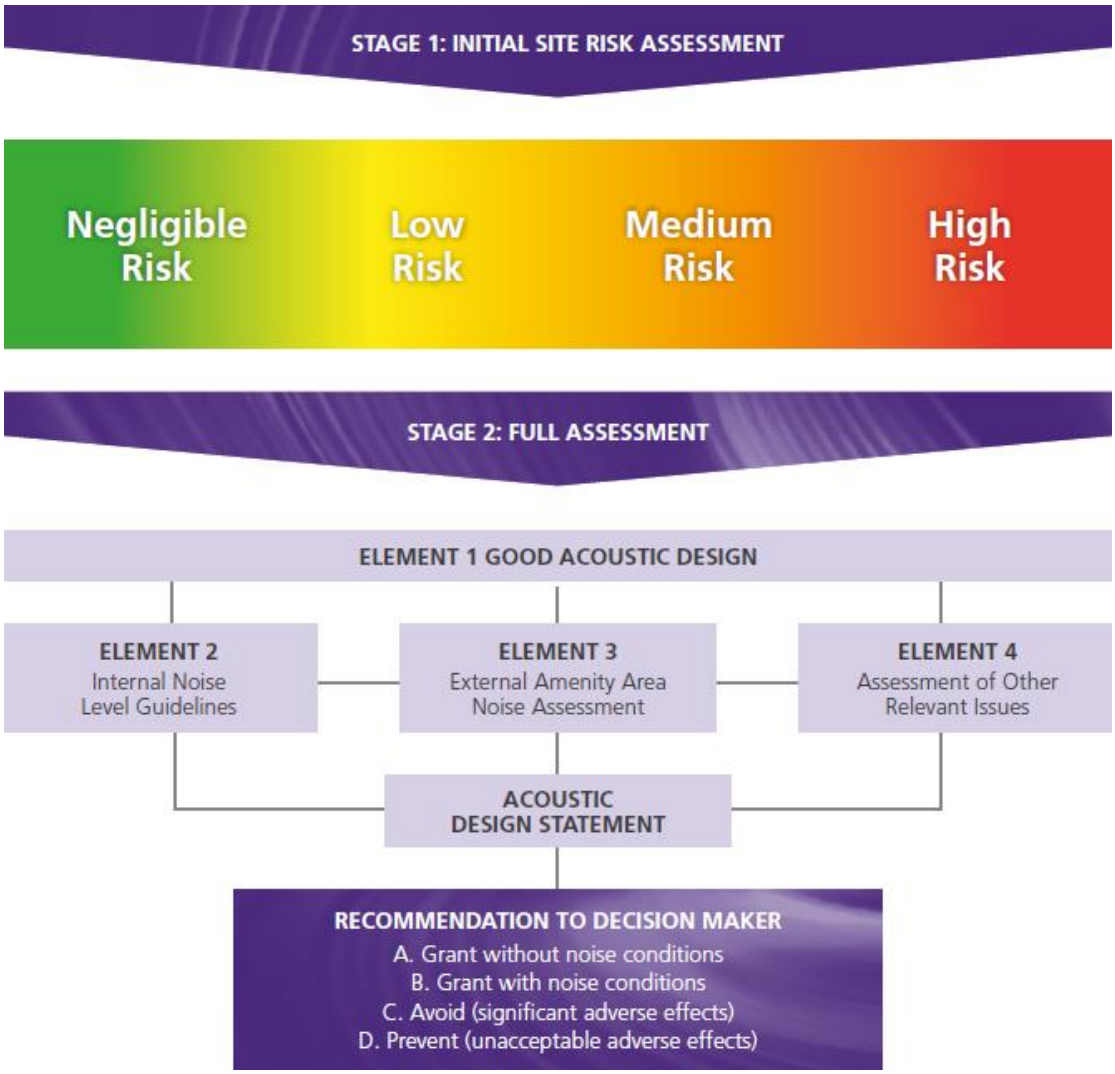

Figure 2 ProPG Approach (Source: ProPG)

2.4 WHO Environmental Noise Guidelines for Europe

The World Health Organisation (WHO) have published in October 2018 *Environmental Noise Guidelines for the European Region*. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

However, It should be noted that the WHO guideline values referred to here are recommended to serve as the basis for a policy-making process to allow evidence based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines,

> *"The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices."*

It is therefore not intended to refer to the WHO guidelines in an absolute sense as part of this assessment and it will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits for use.

3.0 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 3 (overleaf) presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels using either measured and/or predicted on site. 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 a 3D predictive noise model of the site has been developed to determine noise levels and assess the initial noise risk. The model has been calibrated against measured noise levels (Pre Covid19 as well as strategic noise maps).

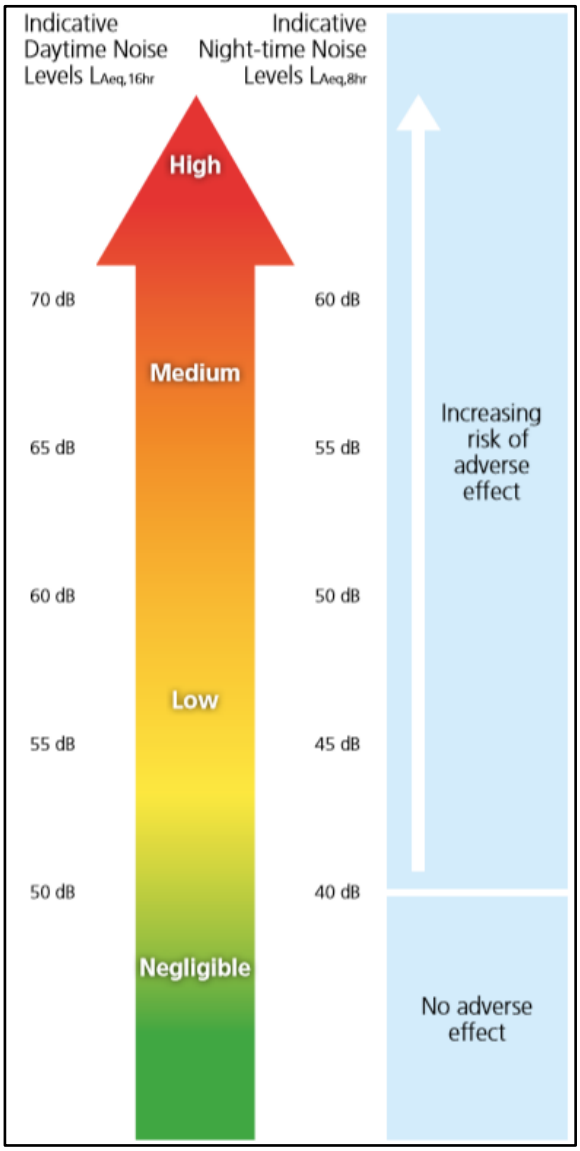

Figure 3 ProPG Stage 1 - Initial Noise Risk Assessment

3.2 Baseline Noise Environment

An environmental noise survey was conducted at the development site as part of the assessment. The noise survey was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise.* Specific details are set out below.

3.2.1 Strategic Noise Maps – Round 3

The strategic noise mapping of the major roads across Ireland is undertaken by the Transport Infrastructure Authority (TII) with the support of the local authorities within whose functional areas the major roads were located. The mapping provides supplementary information relating to the Noise Action Plans developed in 2013 for the major roads in Ireland as part of the second round of the implementation of the EC Directive 2002/49/EC which was transposed into Irish Law as Statutory Instrument, S.I. 140 of 2006 (Environmental Noise Regulation 2006).

Figures 4 and 5 present the strategic noise maps for Round 3 (published 2017) with the proposed development site indicated.

The maps indicate that the baseline noise levels across the site fall between 55 to 65 dB L_{den} and <50 to 60 dB L_{night}.

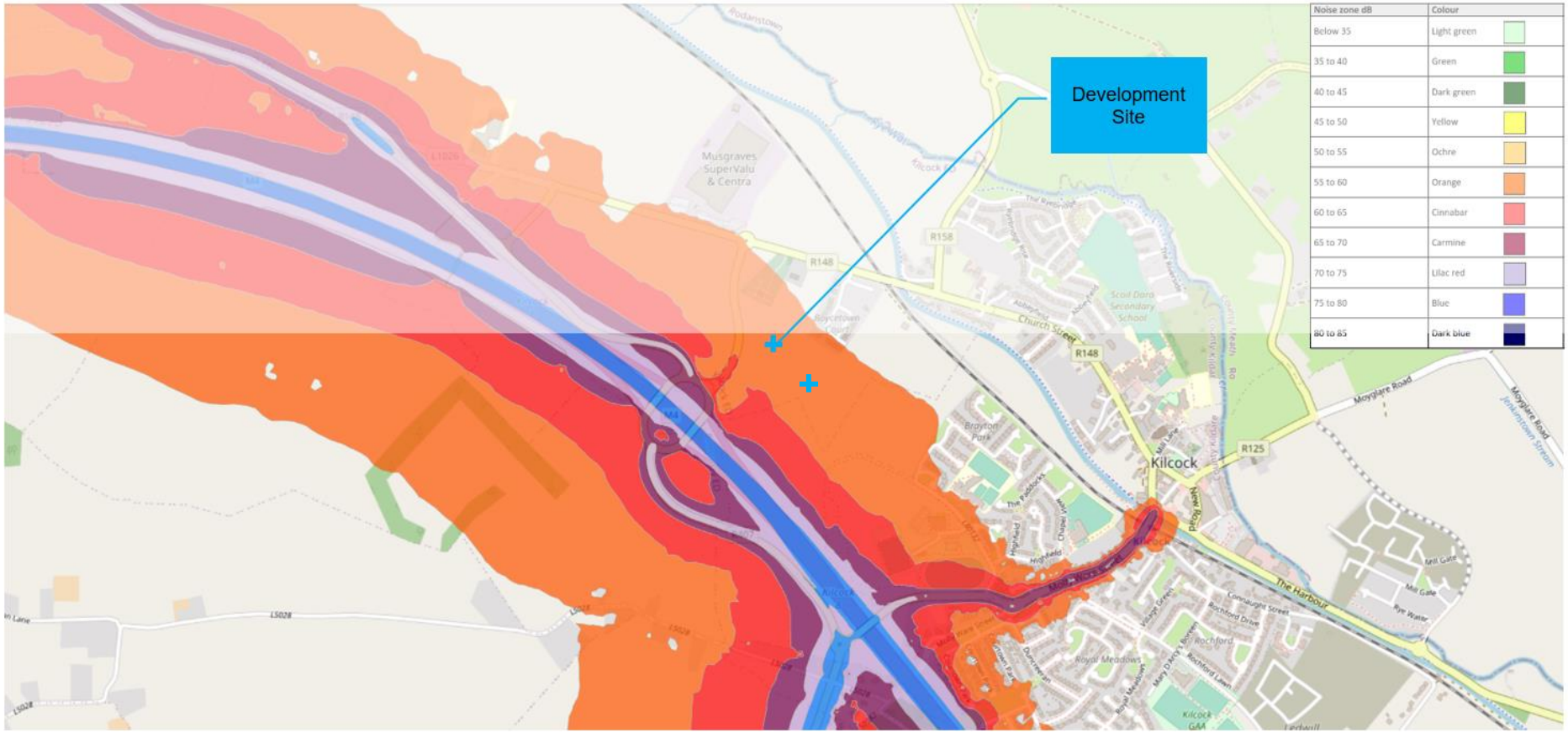

Figure 4 Round 3 Noise Mapping – dB L_{den} (Source: TII and Google Earth)



Figure 5 Round 3 Noise Mapping – dB L_{night} (Source: TII and Google Earth)

3.2.2 Unattended Noise Survey

An environmental noise survey was conducted at the site between the 7th January and 8th January 2021 by AWN Consulting in order to quantify the existing noise environment. A continuous noise monitor was installed at the site to measure the noise levels. The approximate noise measurement location was selected at the proposed site as shown in Figure 6 this location was selected to allow the environmental noise model that will be developed to be calibrated. It was therefore located in a secure location in proximity to the M4 and R158 as the dominant noise sources in the area. Measurements were taken at a height of 2.2m above ground level.

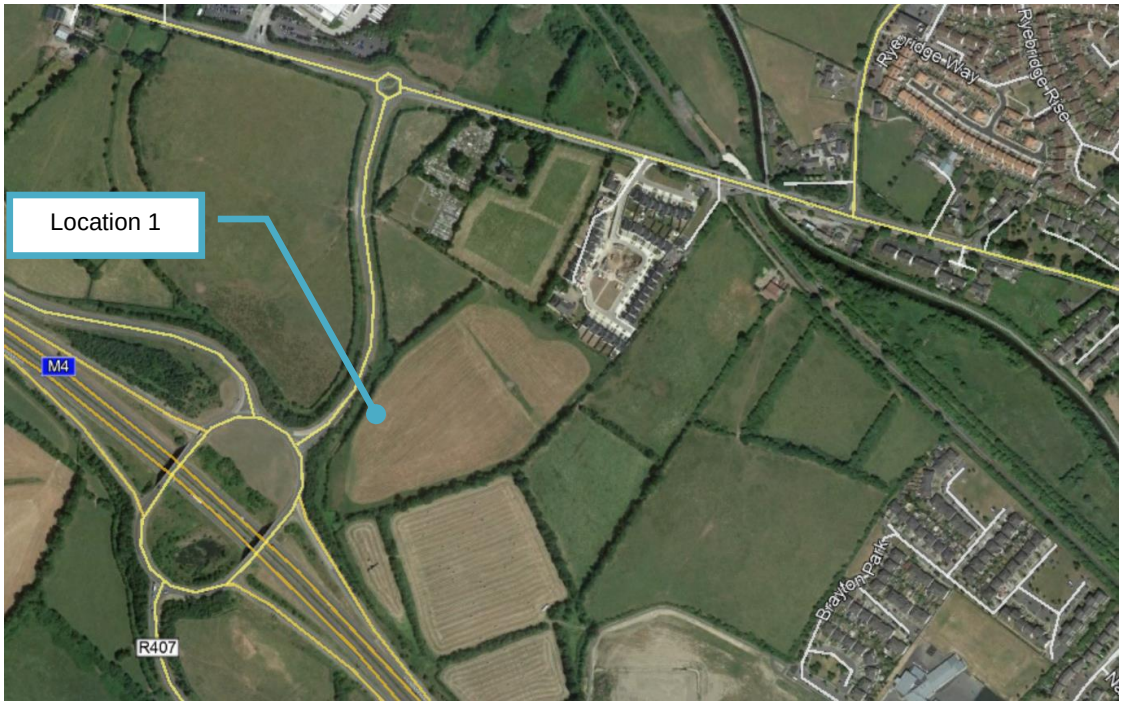

Figure 6 Noise Survey Location

3.2.3 Survey Results

The survey results for Location 1 are summarised in 1 hour periods below.

Start Time	Sound Pressure Level (dB re $2x10^{-5}$ Pa)				
	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
07/01/21 11:00	56	75	43	60	49
07/01/21 12:00	58	74	44	61	51
07/01/21 13:00	60	86	48	62	53
07/01/21 14:00	60	82	47	62	54
07/01/21 15:00	62	77	52	64	58
07/01/21 16:00	61	73	53	63	58
07/01/21 17:00	59	71	48	62	54
07/01/21 18:00	57	72	46	61	51
07/01/21 19:00	55	70	42	59	47
07/01/21 20:00	53	66	39	57	44
07/01/21 21:00	51	68	35	56	43
07/01/21 22:00	53	69	35	57	42
07/01/21 23:00	50	68	30	52	38
08/01/21 00:00	50	76	28	51	36
08/01/21 01:00	45	64	27	45	35

Start Time	Sound Pressure Level (dB re 2x10^{-5} Pa)				
	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
08/01/21 02:00	44	64	23	45	33
08/01/21 03:00	49	68	31	50	36
08/01/21 04:00	51	69	33	55	39
08/01/21 05:00	54	74	36	57	43
08/01/21 06:00	58	71	45	61	51
08/01/21 07:00	58	71	48	62	51
08/01/21 08:00	59	79	45	62	50
08/01/21 09:00	58	70	44	62	49

Table 1 Summary of Measured Noise Levels

Table 2 summarizes the long term indicators at this location.

Measured Noise Levels at Location 1, dB(A)			
L_{day}	$L_{evening}$	L_{night}	L_{den}
60	53	52	61

Table 2 Summary of long term indicators at Location 1

The results indicate that the ambient daytime noise levels are in the range of 55 to 63 dB $L_{Aeq,1hr}$. The ambient night-time noise levels ranged from 42 to 59 dB $L_{Aeq,1hr}$ with maximum levels ranging from 59 to 76 dB L_{AFMax}.

The noise climate was typically dominated by road traffic movements along the M4 and R158.

A previous survey was carried out on this site in 2016. Monitoring equipment was placed in a similar location and for a 24 hour period from 12:00 on 04/01/2016 to 11:00 on 05/01/2016. The results for this survey are summarised in 1 hour periods below.

Start Time	Sound Pressure Level (dB re 2x10^{-5} Pa)				
	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
04/01/16 12:00	60	73	49	63	55
04/01/16 13:00	59	73	49	62	54
04/01/16 14:00	59	81	45	62	51
04/01/16 15:00	60	72	47	63	53
04/01/16 16:00	61	72	52	63	56
04/01/16 17:00	61	78	52	63	57
04/01/16 18:00	59	71	47	62	53
04/01/16 19:00	57	68	47	60	52
04/01/16 20:00	58	76	49	60	53
04/01/16 21:00	56	72	47	60	51
04/01/16 22:00	55	69	38	58	46
04/01/16 23:00	51	71	33	53	39
05/01/16 00:00	48	69	30	49	38
05/01/16 01:00	46	68	34	46	38
05/01/16 02:00	48	72	32	47	37
05/01/16 03:00	51	73	32	51	38
05/01/16 04:00	53	72	37	54	41
05/01/16 05:00	56	74	38	60	44
05/01/16 06:00	59	73	45	63	51
05/01/16 07:00	61	75	48	64	52
05/01/16 08:00	62	76	48	65	53
05/01/16 09:00	61	75	48	65	52

Start Time	Sound Pressure Level (dB re $2x10^{-5}$ Pa)				
	$L_{Aeq,1hr}$	L_{AFmax}	L_{AFmin}	L_{AF10}	L_{AF90}
05/01/16 10:00	61	82	47	64	51
05/01/16 11:00	61	74	48	64	52

Table 3 Summary of Measured Noise Levels

Table 4 summarizes the long term indicators of the 2016 survey.

Measured Noise Levels at Location 1, dB(A)			
L_{day}	$L_{evening}$	L_{night}	L_{den}
60	57	54	62

Table 4 Summary of long term indicators at Location 1

The results indicate that the ambient daytime noise level are in the range of 59 to 62 dB $L_{Aeq,1hr}$. The ambient night-time noise levels ranged from 46 to 59 dB $L_{Aeq,1hr}$ with maximum levels ranging from 68 to 74 dB L_{AFMax}. The noise climate was typically dominated by road traffic movements along the M4 and R158.

Comparing the results of the surveys conducted in 2021 with those of the survey conducted in 2016 indicates that the receiving environment of the proposed development site has remained relatively similar.

Similarly, a review of publicly available TII traffic flow numbers along the stretch of the M4 motorway of which the proposed development lies show an increase of less than 7% in traffic. Traffic figures for 2019 were utilised as the most recent year of traffic flows unaffected by the Coronavirus pandemic. An increase of this low level would have a negligible effect on noise levels across the site.

Note that measurements taken include noise from all sources including the elevated interchange with the M4.

3.3 Noise Model of Site

3.3.1 Methodology

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels on the proposed site. The selected software, Brüel & Kjær Type 7810 *Predictor*, calculates noise levels in accordance with the *Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3)* issued by the UK Department of Transport in 1988. This the standard recognised for the prediction of road traffic noise by Transport Infrastructure Ireland (TII).

The following information was included in the model:

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

The noise model includes the M4, the R158 and associated slip roads including the elevated interchange.

3.3.2 Model Validation

Noise levels recorded during the baseline noise survey were used to calibrate the noise model to within 1 dB of the 2016 measured values. This is regarded as very strong correlation in respect of predicted noise levels.

3.3.3 Future Traffic Data

It is important to note that the noise model is based on the measured noise levels and is representative of current traffic volumes. It is acknowledged that an increase in road traffic volumes would give rise to a corresponding increase in noise levels. With road traffic noise, typically a 25% increase in volumes would be required to give rise to a 1 dB increase in noise levels. As stated above (section 3.2.3) a 7% increase in traffic numbers would be insignificant.

3.3.4 Comment on Rail Noise

The northern portion of the development is within 150m of the Sligo to Dublin rail line. This rail line carries the Intercity rail between Dublin and Sligo at a frequency of 10 trains per day eastbound and 11 trains per day westbound. Only one of these train movements occurs during night-time hours.

To assess the potential noise impact from rail movements on the development a screening exercise was carried out to determine the noise impact from the rail movements described above on the northern most dwellings in the development, ~120m from the rail line.

The noise level associated with an event of short duration, such as a train movement, may be expressed in terms of its Sound Exposure Level (LAX). The SEL can be used to calculate the contribution of an event or series of events to the overall noise level in a given period. The appropriate formula is given below.

$$L_{Aeq,T} = L_{Ax} + 10\log10(N) - 10\log10(T) \quad dB$$

Where,

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (s);
L_{Ax} is the "A-weighted" Sound Exposure Level of the event under consideration (dB);
N is the number of events over the course of time period T.

The mean value of Sound Exposure Level for a commuter train movement, at moderate speeds, is of the order of 92 dB(A) at a distance of 3m. This figure is based on a series of measurements conducted by AWN.

Using the equation above and the projected figure of 20 movements during the daytime period between 7am and 11pm, the noise level due to commuter train movements at a distance of 120m from the track has been calculated as being of the order of 25 dB $L_{Aeq,16hr}$. Night-time noise levels are considerably lower given the single train movement that occurs over the 8 hour night-time period.

Due to the infrequent nature of train movements and the distance from the trains the calculated rail noise level is low at the development site. No specific mitigation will be required for rail noise at this development site.

3.3.5 Noise Model Output

To assess the initial noise risk assessment across the development site the noise model has been used to prepare noise contour maps for both daytime and night-time periods. These maps are presented in Figures 7 and 8 below.

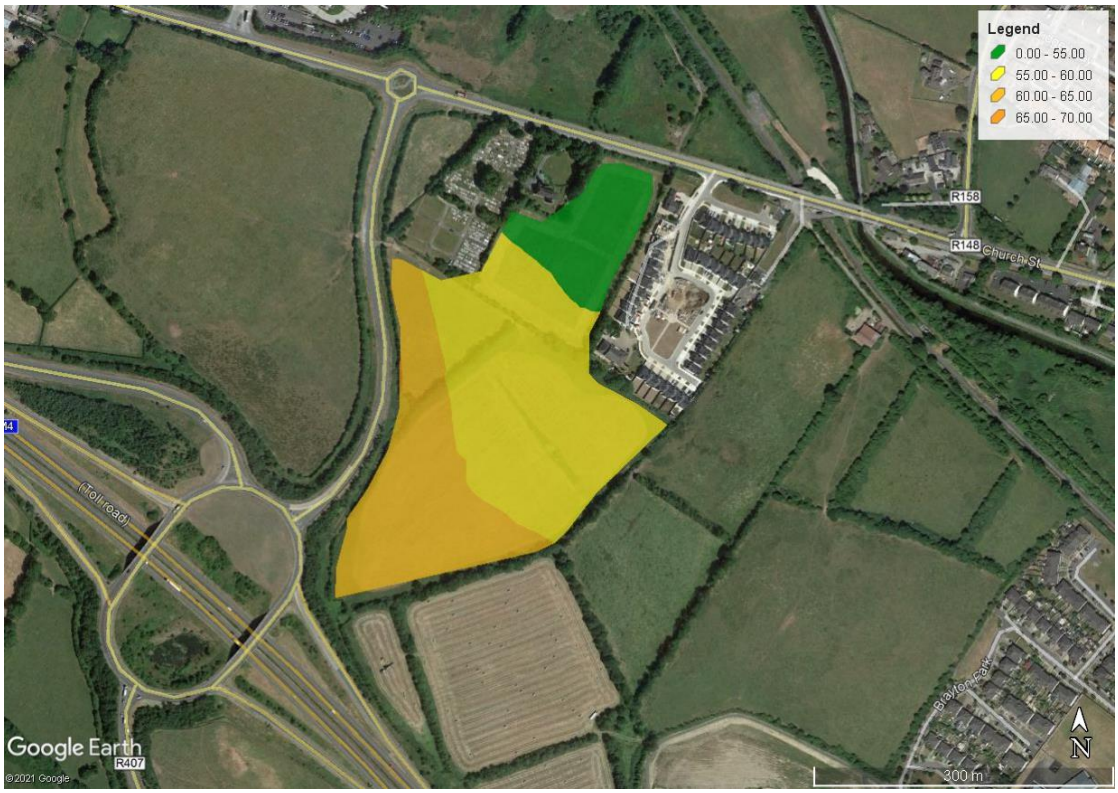

Figure 7 Noise Impact Across the Site – L_{den} – contours at 4 meter height

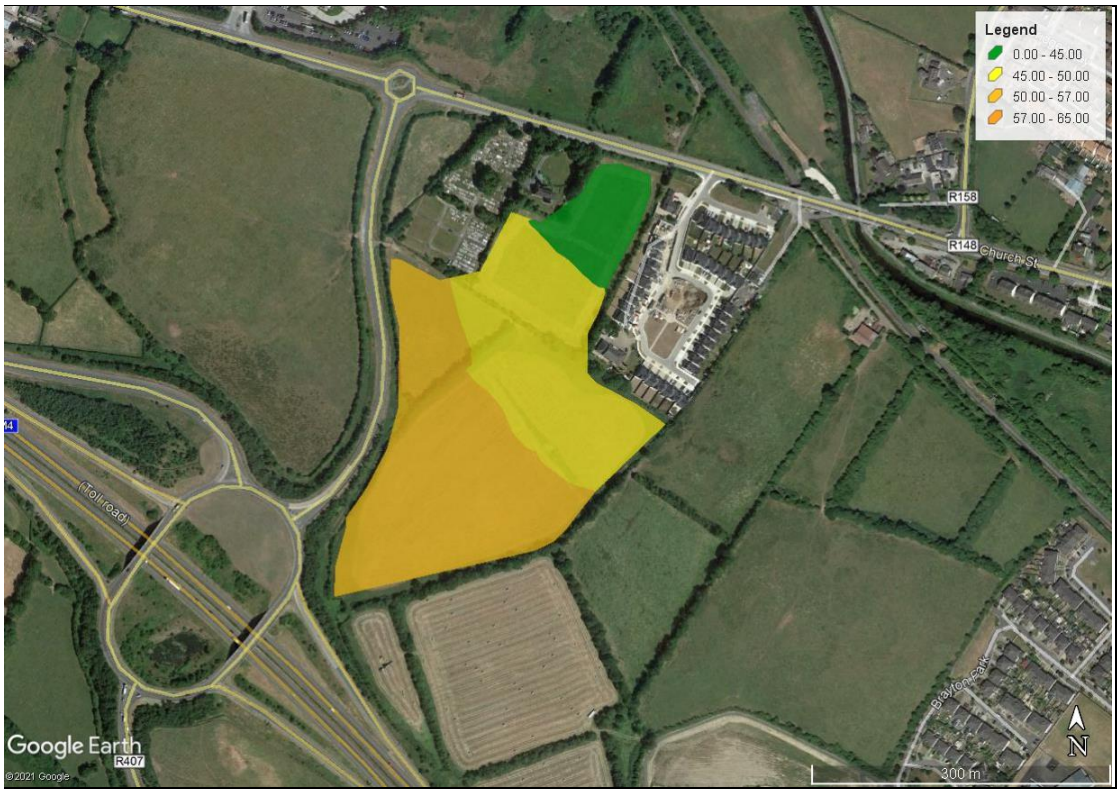

Figure 8 Noise Impact Across the Site – L_{night} – contours at 4 meter height

Figures 7 and 8 show that no portion of the site is exposed to noise levels above the onset values of 70 dB L_{den} or 57dB L_{night} as defined in the Kildare Noise Action Plan. Therefore, based on the results of the noise monitoring and noise modelling, it is considered that the subject site is suitable for residential development, once consideration is given to appropriate noise mitigation measures.

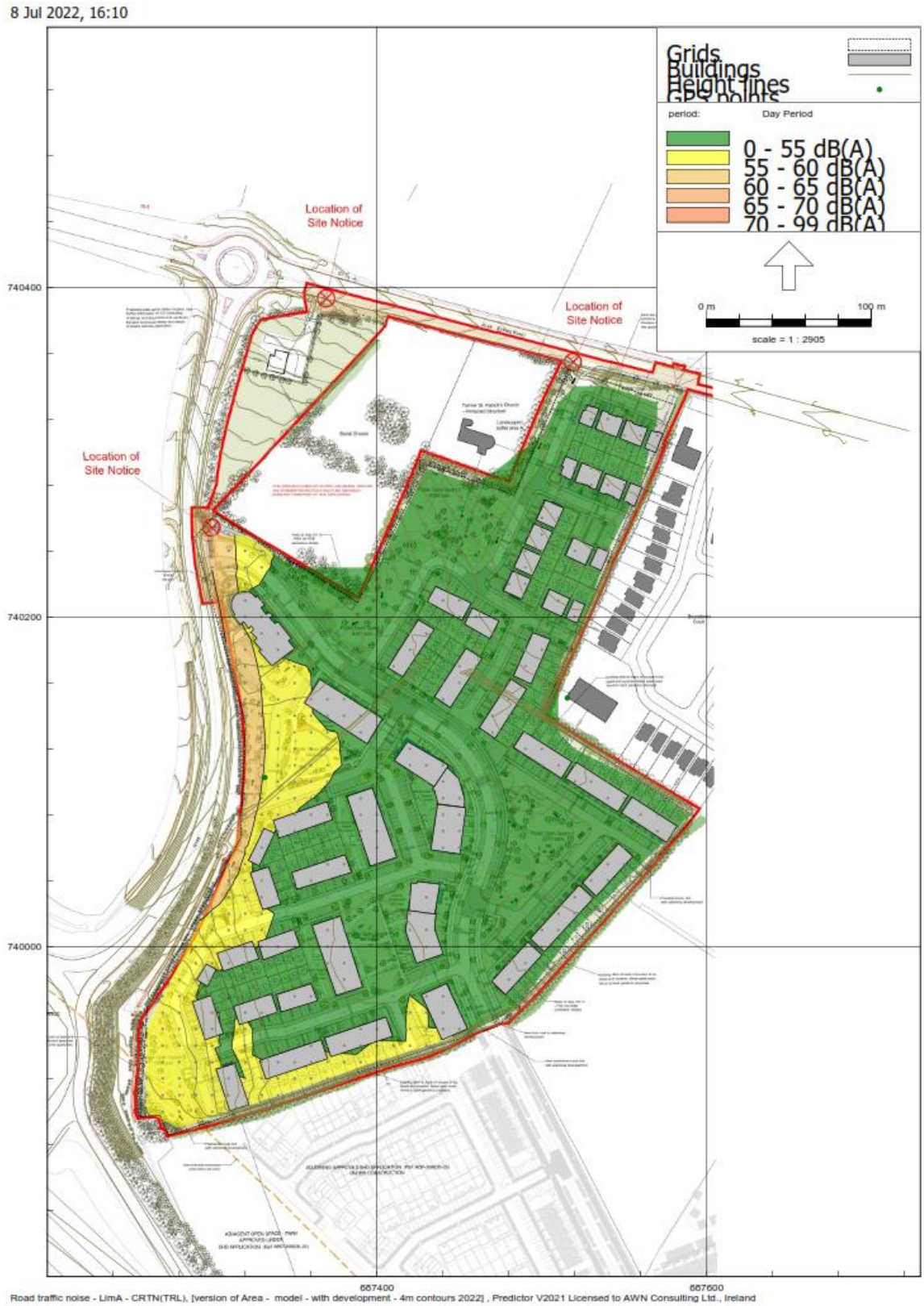

Figure 9 Noise Impact Across the Proposed Development – Daytime



Figure 10 Noise Impact Across the Proposed Development – Night-time

Making reference to Figures 9 and 10 the most exposed facades of the development are those properties located close to the southern and western boundaries.

To assess the specific noise impacts against the Kildare Noise Action Plan thresholds of 70 dB L_{den} and 57 dB L_{night}, receivers were placed at all building facades in the model. A total of 1951 receivers were placed in the model, these are illustrated in Figure 11.



Figure 11 Noise Model Receiver Locations (indicated in blue)

An analysis of the calculated L_{den} and L_{night} noise levels at each receiver has been undertaken to determine the range of noise levels experienced across the site. Figure 12 presents the results of this analysis.

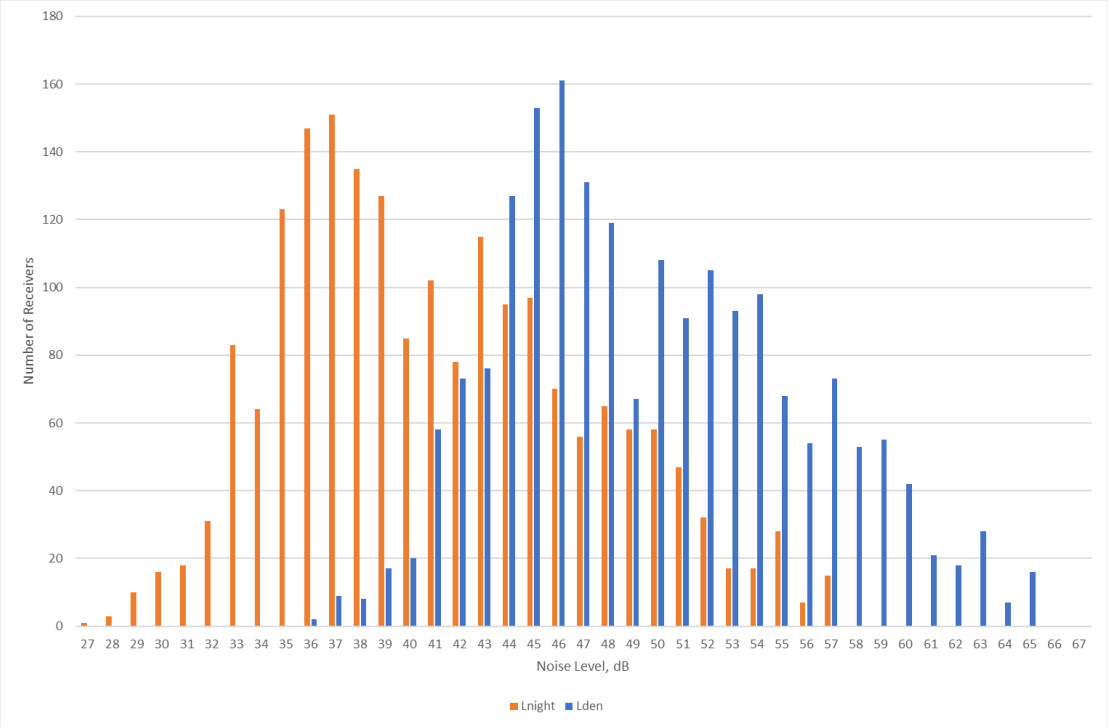

Figure 12 Analysis of Calculated Noise Levels at all Receivers

L_{den} values range from 36 dB L_{den} to 65 dB L_{den} with no receivers exposed to noise levels above the 70 dB L_{den} threshold.

L_{night} values range from 27 dB to 57 dB L_{night} with no receivers exposed to noise levels above the 57 dB L_{night} threshold.

Notwithstanding the noise levels not exceeding the Kildare Noise Action Plan thresholds, mitigation measures will be required to ensure that internal noise levels are controlled to within the values outlined in Section 5.2, either with windows in the open position or with the inclusion of attenuated ventilators at locations where the internal design goals cannot be met with windows in the open position.

Appropriate noise mitigation measures are discussed in detail in the following sections.

3.4 Noise Risk Assessment Conclusion

ProPG states the following with respect to risks:

Negligible Risk — *These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.*

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

Medium Risk — *As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse*

impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.

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

Considering the initial risk assessment indicated in Figures 7 and 8 and the predicted noise levels presented in Section 3.3.3, it can be concluded that the development site may be categorised as 'low' to 'medium' risk and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that any adverse noise impact will be avoided in the final development.

It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used,

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

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

4.0 STAGE 2 – FULL ACOUSTIC ASSESSMENT

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 of 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:

- 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 main noise source is located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

Extensive consideration has been given to good acoustic design in layout and orientation of the scheme including:

- External amenity areas located to the north, north west and north east of the site have been orientated so as to maximise distance to the main noise source of the M4 and offer inherent acoustic screening from the buildings themselves;
- A terrace arrangement has been proposed for houses facing onto the M4 to maximise screening to the rear gardens of each;
- The internal layout of apartments with four and five storeys has been specifically designed to ensure that rooms with lower noise sensitivity (i.e. Living room, kitchen, store and bathroom) are located on the façade overlooking the road. The impact of noise levels falling above the NAP threshold is therefore negated on these facades due to the internal layout.

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. However, as is typically the case 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 upgraded glazing and acoustic ventilators where required. 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,

> *"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 "*
>
> *Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal LAeq target levels should not normally be exceeded*
>
> *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. 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.

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 properties away from the road are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

The model results confirm that noise levels fall at or below 70 dB L_{den} for all facades across the development. The model results also confirm that while all ground floor facades will be exposed to L_{night} levels below 57 dB, first floor facades of the nearest houses and apartments would fall in the region of 56 to 57 dB L_{night} for the most exposed facades. Further discussion on revisions to internal layout to avoid impacts arising at these facades is provided in the following section.

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 $L_{Aeq,16hr}$."*

Good acoustic design has been applied in the consideration of site layout to significantly lower noise levels in external amenity areas. The impact of noise on external amenity areas is comprehensively addressed in Section 4.3 below.

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 5 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur, such as New Year's Eve.

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

Table 5 ProPG Internal Noise Levels

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

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

4.2.2 Discussion on Open/Closed Windows

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

Considering the design goals outlined in Table 5 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 6.

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 – 55 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels)	55 – 60 dB $L_{Aeq,16hour}$	50 dB $L_{Aeq,8hour}$

Table 6 External Noise Levels Required to Achieve Internal Noise Levels

Figures 11 through 14 below indicate that the majority of facades across the site can achieve *Good* internal noise levels with open windows except for those of the apartment block and houses along the western and southern boundaries in closest proximity to the M4 and R158 roadways.

Note that all ground floor facades facing away from the road can achieve *Good* internal noise levels with windows open during both the day and night time period.

Elsewhere, the external noise levels will be such that it will not be possible to achieve the desired good internal noise levels with windows open during either the day or night time periods. Appropriate acoustic specifications to windows and passive vents will be

provided for these facades to ensure the rooms are adequately ventilated and achieve the good internal noise levels detailed in Table 6.



Figure 11 Internal noise levels with open windows - Day with contours at 1.5m



Figure 12 Internal noise levels with open windows - Day with contours at 4m



Figure 13 Internal noise levels with open windows - Night with contours at 1.5m



Figure 14 Internal noise levels with open windows - Night with contours at 4m

4.2.3 Proposed Façade Treatment

The British Standard BS EN 12354-3: 2000: *Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound* provides a calculation methodology for determining the sound insulation performance of the external envelope of a building. The method

is based on an elemental analysis of the building envelope and can take into account both the direct and flanking transmission paths.

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

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

The principles outlined in BS EN 12354-3 are also referred to in BS8233 and Annex G of BS8233 provides a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS8233 has been adopted here to determine the required performance of the building facades. This approach corrects the noise levels to account for the frequency content of road traffic noise which has been determined by AWN from numerous noise surveys in the vicinity of national roads.

Glazing

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. A standard thermal double glazed unit will provide adequate sound insulation performance for all proposed development buildings. Table 7 lists the sound insulation performances used in this assessment.

Glazing Specification	Octave Band Centre Frequency (Hz)						Typical Glazing Configuration
	125	250	500	1k	2k	4k	
Standard Double Glazed	20	19	29	38	36	45	6-12-6

Table 7 Sound insulation performance requirements for glazing, SRI (dB)

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system (including doors). 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. block work or concrete) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 55 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 adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively. The implication of Nearly Zero-Energy Buildings (NZEB)

regulations may also require that all ventilation be mechanical although this is a consideration for detailed design stage. For those facades incident to noise from the motorway, where passive vents are specified, it will be necessary that the vents are specified to achieve a sound insulation performance of:

- 38 dB $D_{n,e,w}$ in the areas specified in Figure 15 below.

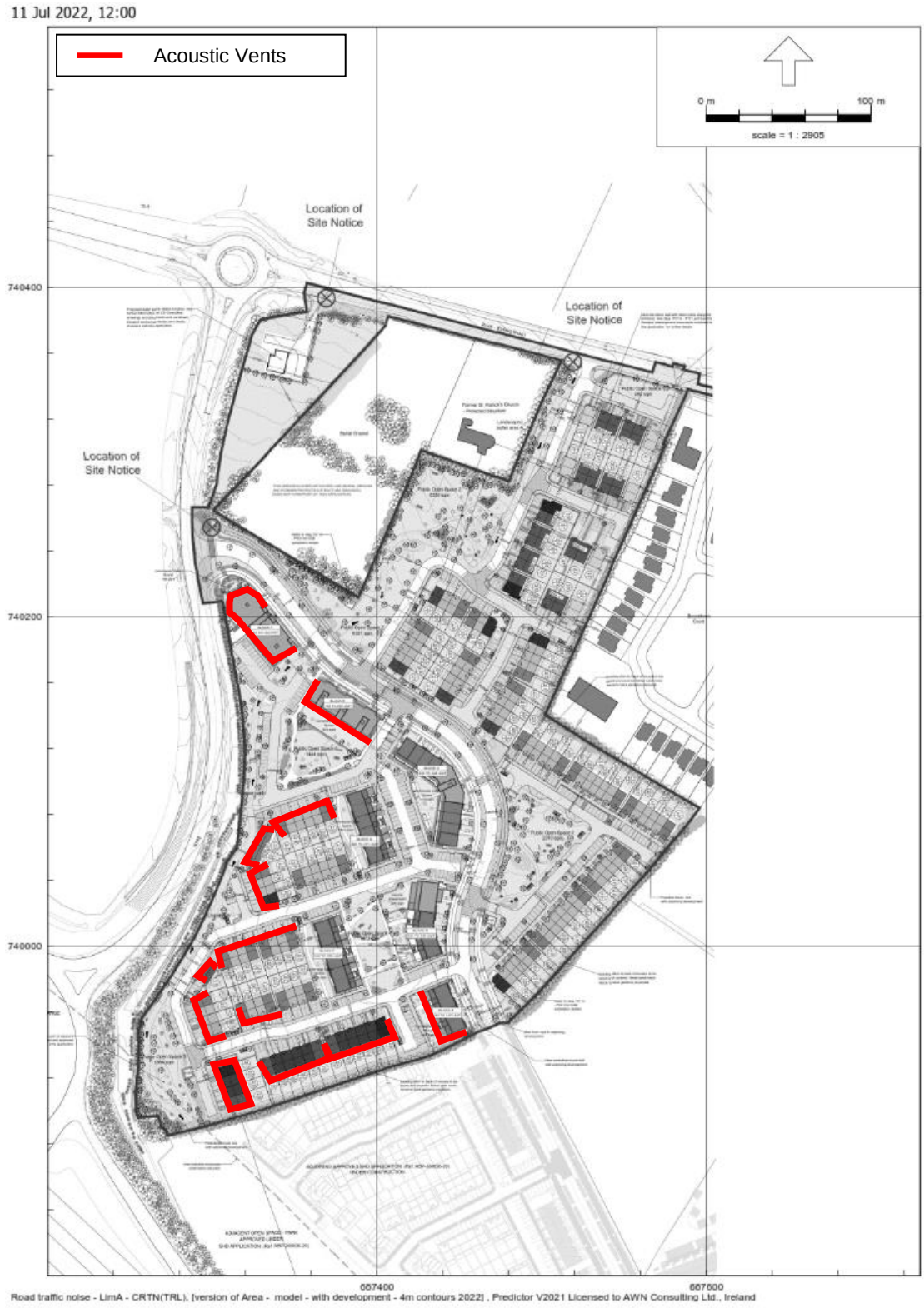

Figure 15 Proposed Façade Locations for Acoustic Vents
Roof

There is some limited potential for the roof structure to allow the passage of sound into the rooms. In order to control potential sound transmission via this route of ceiling/roof construction, it will be necessary to ensure that the surface mass of ceilings offer 18 kg/m^2 or greater and any penetrations through the ceiling boards must be as small as possible and made good by fully filling with plaster or with an acoustic sealant.

4.2.4 Predicted Internal Noise Levels

The predicted internal noise level for the proposed dwellings with façade treatment measures outlined above under a closed window/open vent scenario will ensure that internal noise levels within all sensitive rooms will achieve the BS8233:2014 criteria as follows:

- 35 dB $L_{Aeq,16hour}$ during the daytime period; and,
- 30 dB $L_{Aeq,8hour}$ during the night time period.

4.3 Element 3 – External Amenity Area Noise Assessment

4.3.1 Guidance

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

> *"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 $L_{Aeq,16hr}$."*

BS8233:2014 provides further guidance with respect to the ability to achieve these levels in certain areas where development is desirable.

> *In higher noise areas, such 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.*

Furthermore BS8233:2014 goes on to state that:

> *In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.*

4.3.2 Predicted External Noise Levels

Figure 16 below outline predicted noise levels in external amenity.

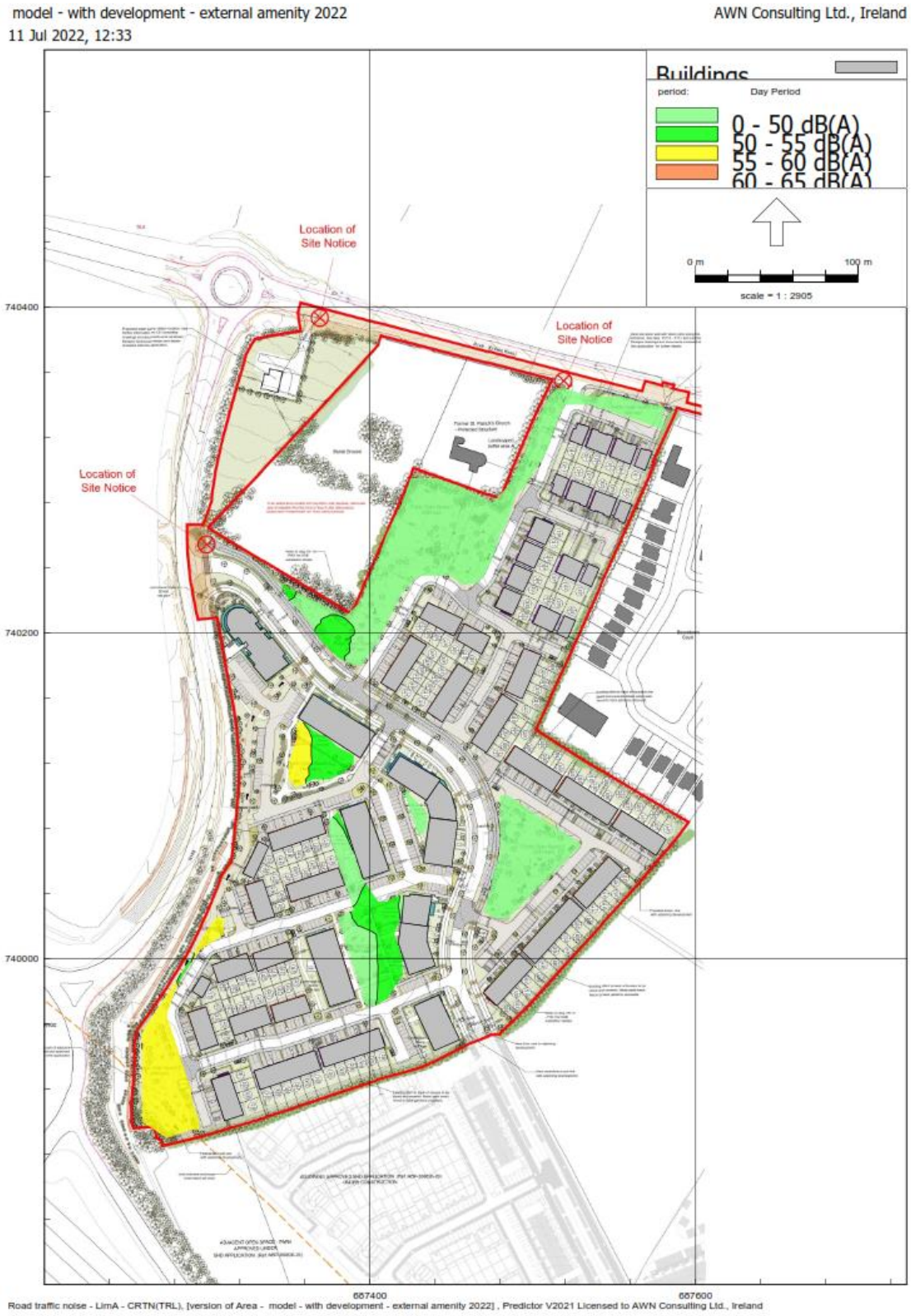

Figure 16 Noise Impact Across Amenity Areas – Daytime

This contour maps confirm that the majority of shared external amenity space within the proposed development will experience noise levels lower than 55 dB $L_{Aeq,16hour}$. Areas to the north and north east fall entirely within the guidelines, the area to the north west is partially above the guideline levels whilst the area to the south west of the site will experience levels slightly above the guidelines.

Special consideration has been given to the external playground area of the Creche, located in the centre of the site. Figure 17 shows that without mitigation the playground area is subject to levels below the desired 55 dB $L_{Aeq,16hour}$.



Figure 17 Noise Impact on Creche Playground without mitigation – Daytime

Considering the noise levels presented above and the guidance outlined in Section 4.3.1, the levels of noise in the majority of external amenity areas across the site are therefore considered to be acceptable.

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

The assessment completed and noise levels arising post mitigation demonstrate compliance with the requirements of the Kildare Noise Action Plan (2019 – 2023).

This Acoustic Design Statement has also been prepared following procedures outlined in the ProPG guidance document espoused within the Kildare Noise Action Plan (2019 – 2023) 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. A small minority of units will require closed windows and open vents to achieve this level;
- The majority of 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 criteria adopted as part of this assessment are based on those recommended for permanent dwellings and are therefore considered robust and appropriate for the likely occupants.

4.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

5.0 CONCLUSIONS

An initial site noise risk assessment has been carried out in accordance with the procedures outlined in the Kildare Noise Action Plan 2019 – 2023 using strategic noise mapping prepared by the Environmental Protection Agency as well as a detailed noise model of the site. The assessment has classified the development site as having a ‘low’ to ‘medium’ noise risk.

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 proposed scheme. Measures that have been incorporated into the design to address road traffic noise include the following:

- The majority of external amenity areas have been orientated to the northern side of the development, therefore maximising distance to the M4 and providing acoustic screening from the buildings themselves;
- A terrace arrangement has been proposed for houses facing onto the M4 to maximise screening to the rear gardens of each dwelling;
- The apartments have been laid out in a manner that utilises the acoustic screening potential of the apartment building itself to reduce noise levels in those external amenity spaces to the rear;

- The Creche has been relocated to the centre of the site to provide an external play area that is screened from noise;
- The internal layout of apartments with four and five storeys has been specifically designed to ensure that rooms with lower noise sensitivity (i.e. Living room, kitchen, store and bathroom) are located on the façade overlooking the road. The impact of noise levels falling above the NAP threshold is therefore negated on these facades due to the internal layout.

The model results confirm all façade noise levels fall at or below the Kildare Noise Action criteria of 70 dB L_{den} and 57 dB L_{night}. The majority of facades can achieve good internal noise levels with windows open during both the day and night time period. Elsewhere, appropriate acoustic specification for windows and passive vents have been provided to ensure the rooms are adequately ventilated and achieve the required internal noise levels under a closed window scenario.

Noise levels in the majority of private and shared external amenity areas fall within the range recommended in ProPg. In certain areas, the noise levels will be marginally higher but the small increase above the desirable range would be expected to be imperceptible and as such the noise levels are deemed to be acceptable.

In conclusion, the proposed development has been assessed to be in compliance with the Kildare County Council Third Noise Action Plan 2019 - 2023 and the British Standards BS 8233:2014. The Developer commits to incorporate mitigation measures into the design of the residential buildings as outlined in this report to ensure that noise impacts do not have an adverse impact on the internal environment within the development and to ensures that the ProPG internal noise limit criteria specified are achieved.

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 ($L_{AF90,T}$).

broadband — Sounds that contain energy distributed across a wide range of frequencies.

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 L_{pA} — 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.

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. As standard it is measured using the fast time weighting constant of 125ms.

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

APPENDIX A (Cont.)
GLOSSARY OF ACOUSTIC TERMINOLOGY

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.

noise Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

noise sensitive receptor NSR – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

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.

sound pressure level The sound pressure level at a point is defined as:

$$Lp = 20Log\frac{P}{P_0} \text{ dB}$$

R_w Weighted Sound Reduction Index – This is the value of airborne 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 airborne sound insulation across a defined frequency spectrum.

$^1/_3$ octave analysis Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.