8. NOISE AND VIBRATION

8.1 Introduction

This section of the environmental impact statement was prepared by TMS Environment Ltd and considers the potential noise and vibration impacts associated with the proposed development. Impacts of the construction and operational phases are considered in the context of appropriate standards and guidelines, together with requirements for noise and vibration monitoring and control.

The subject lands are located to the north of Clane town in the Townland of Capdoo in County Kildare and occupy an area of approximately 11.4ha. The proposed development for which planning permission is sought in this application comprises a residential development of approximately 366 residential units, a childcare facility, a new link road together with all associated and ancillary infrastructure and open space provision.

8.2 Methodology

8.2.1 Impact Assessment Methodology

The EPA published the draft document *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* in 2017. These draft Guidelines take account of the revised EIA Directive (2014/52/EU) and are considered in this assessment. Impacts or effects are described in the draft Guidance in terms of quality, significance, magnitude, probability, duration and type. Table 8.1 below presents the description of the significance of effects and Table 8.2 presents the description of the duration of effects as shown in the Draft Guidelines.

Table 8.1 Describing the Significance of Environmental Effects (EPA 2017)

Significance of Effects	Description
Imperceptible	An effect capable of measurement but without noticeable consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant	An effect which, by its character, magnitude, duration or intensity, alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics

Table 8.2 Describing the Duration of Environmental Effects (EPA 2017)

Duration of Effects	Description
Momentary Effects	Effects lasting from seconds to minutes.
Brief Effects	Effects lasting less than a day.
Temporary Effects	Effects lasting less than a year.
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years.
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years.

In addition to the above, the methodologies presented below were used to inform the noise and vibration impact assessment and to identify and assess all cumulative impacts with the potential to impact upon the receiving environment and to propose mitigation and avoidance measures where required.

1. Carry out a series of baseline noise measurements to provide information on existing background and specific site noise levels at the nearest sensitive receptors.

A baseline noise survey was completed in the vicinity of the subject site according to the requirements of *ISO 1996: Acoustics - Description and Measurement of Environmental Noise* and in addition, with reference to the EPA publication; *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), 2016.* Noise monitoring was carried out at a total of three representative noise monitoring locations in order to determine the existing noise environment at the proposed site locations. The detailed baseline noise monitoring survey is presented in Appendix 8.A.

2. Identify appropriate criteria against which to assess the significance of the noise and vibration impacts associated with the proposed development. Criteria for noise assessment are discussed is Section 8.2.2 and the criteria for vibration assessment are discussed in Section 8.2.3 below.

3. Provide predictions of resultant noise and vibration levels at the nearest sensitive receptors and assess these against the selected assessment criteria.

Noise prediction modelling was carried out in order to predict the noise emissions that would be experienced at sensitive receptor locations as a result of the various activities associated with the proposed development. Prediction calculations for the noise generating activities including plant and equipment operation, construction activities and vehicle movements on site have been conducted generally in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation*, 1996.

4. Propose mitigation and avoidance measures where required.

5. Identify and assess all cumulative impacts with potential to impact upon the receiving environment.

8.2.2 Noise Assessment Criteria

There is no specific Irish legislation which sets out environmental noise limits that must be achieved and therefore the assessment criteria that are presented in this report are based on the guidelines set out by regulatory bodies such as the Environmental Protection Agency (EPA), the World Health Organisation (WHO), the Department of Housing, Planning, Community and Local Government (DHPCLG) whose guidance and standards are based on international best practice.

Construction Noise Criteria

Construction noise is temporary in nature and is usually experienced over a short to medium-term period and this characteristic requires it to be considered differently to other longer term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated.

British Standard *5228-1:2009+A1:2014 –Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise* (BS 5228-1) is a commonly used Standard to assess the potential noise impacts associated with the construction phase of a project. This Standard states that noise complaints related to new industrial/commercial noise sources are more likely to arise as the difference between the industrial noise source and the existing background noise increases. Practical noise reduction measures are detailed in BS 5228-1 and these measures can be implemented in order to reduce the overall noise emissions from a construction site.

There is no Irish Guidance specifically published for the short to medium-term construction work such as that proposed for the subject site. Construction noise impacts are assessed in terms of the requirements of BS 5228-1. Annex E of this Standard details acceptable construction noise limits for differing scenarios. Annex E.2 looks at the significant of noise impacts based on fixed noise limits and states:

> *"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 and urban areas away from main road traffic and industrial noise;*
> - *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.*
>
> *These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments – and when working outside the normal hours say between 19.00 and 22.00 hours – the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10 dB(A) may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours."*

International best practice dictates that noise limits in the range 65dB $L_{Aeq,1hr}$ to 75dB $L_{Aeq,1hr}$ are generally acceptable in the community during daytime construction activities.

Transport Infrastructure Ireland (TII) (formerly the National Roads Authority (NRA)) is the only government body in Ireland to publish construction noise limits which are presented in their document *'Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA 2004)*.

The guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration. The NRA points out that there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, they say that Local Authorities, where appropriate, should control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The NRA Guidance presents indicative noise levels that are typically deemed acceptable during construction phase of road developments. These are presented below in Table 8.3.

Table 8.3 NRA Maximum Permissible Construction Phase Noise Levels at the façade of dwellings

Days & Times	$L_{Aeq, (1hr)}$ dB	$L_{pA(max) slow}$ dB
Monday to Friday - 07:00 to 19:00hrs	70	80
Monday to Friday - 19:00 to 22:00hrs	60[2]	65[2]
Saturday - 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays - 08:00 to 16:30hrs	60[2]	65[2]

- Note 1: Noise levels measured at facade of dwellings.
- Note 2: Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority.

The Kildare County Council Second Noise Action Plan (2013 – 2018) refers to the same noise limits as those in Table 8.3 in order to control construction noise impacts at noise sensitive buildings. Therefore, the noise limits set out in Table 8.3 above represent a good compromise between the practical limitations in a construction project such as this one and the requirement to ensure acceptable noise levels at the nearest nose sensitive receptor locations.

For this development project it is considered appropriate to adopt the construction noise criteria presented in Table 8.3 above for all sensitive receptor locations.

Operational Noise Criteria

The WHO *Guidelines for Community Noise* states that, "*in dwellings, the critical effects of noise are on sleep, annoyance and speech interference*". In order to avoid sleep disturbance it is recommended that indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{AMax} for single sound events. However, it is noted that lower levels may be annoying, depending on the nature of the noise source. During the night-time, sound pressure levels at the outside facades of the living spaces should not exceed 45dB L_{Aeq} and 60dB L_{Amax}, so that people may sleep with bedroom windows open. These values have been determined by the WHO by assuming that the noise reduction from outside to inside with a window partly open is 15dB. Similarly, during the daytime the outdoor sound level from steady, continuous noise should not exceed 50dB L_{Aeq} on balconies, terraces and in outdoor living areas to protect the majority of people from being moderately annoyed.

The *Design Manual for Roads and Bridges Volume 11, Section 3* (Highways Agency 2011) also offers guidance on 'long-term' noise impacts associated with changes in traffic noise level. For the Operational Phase, traffic impacts are assessed against the 'long-term' impact classification, presented in Table 8.4.

Table 8.4 Classification of Magnitude of Traffic Noise Impacts in the Long-Term (Operational Phase)

Change in Sound Level (dB L_{A10})	Magnitude of Impact
0	No change
0.1 to 2.9	Negligible
3.0 to 4.9	Minor
5.0 to 9.9	Moderate
10+	Major

The criteria above reflect the key benchmarks that relate to human perception of noise. A change of 3dB is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10dB change in noise represents a doubling or halving of the noise level.

It is considered that the criteria specified in Table 8.4 above provide a good indication as to the likely significance of changes in noise levels in this case and have been used to assess the impact of the operational noise.

8.2.3 Vibration Assessment Criteria

Some activities during the construction phase of the proposed project have the potential to generate ground vibrations at sensitive receptor locations. Activities such as rock-breaking, movement of loaded HGVs and other construction traffic can all cause significant vibration to occur. The levels of vibration associated with these activities would not normally be expected to cause structural damage to buildings but may have the potential to impact negatively on humans depending on environmental factors such as distance from source and mitigation measures employed. Blasting activities would have the potential to cause significant negative impact on sensitive receptors but it is not planned to carry out any blasting as part of this project.

The operational phase of the proposed development will not generate any observable vibration emissions and is consequently not required to be considered.

Construction Vibration Criteria

Vibration standards are concerned with those dealing with human comfort, and those dealing with structural or cosmetic damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

Humans are particularly sensitive to vibration and can detect vibration levels as low as 0.3 mm/sec PPV and levels above this may cause annoyance. However, significantly higher levels than this are tolerated for single short-term events and do not cause annoyance or disturbance to humans. British Standard BS 5228-2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites* provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration and Table 8.5 below outlines these effects.

Table 8.5 Human Response to Vibration

Vibration Level PPV (mm/sec)	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

The response of a building to groundborne vibration is affected by numerous factors including the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

British Standard 7385 *Evaluation and Measurement for Vibration in Buildings* provides guidance on vibration measurement, data analysis and reporting as well as building classification and guide values for building damage. The damage threshold criteria presented in BS 7385-2 are based upon systematic studies using a carefully controlled vibration source in the vicinity of buildings. The Standard states that there should be no cosmetic damage to buildings if transient vibration levels do not exceed 15 mm/sec in the low frequency range and this rises to 20 mm/sec at frequencies of 15 Hz and 50 mm/sec at 40 Hz and above. These guidelines should be reduced by up to 50% for listed structures or similar. It is also noted that the probability of damage to buildings tends towards zero at 12.5 mm/sec at component PPV.

The NRA in their Guidance Document recommends vibration levels to ensure that there is no potential for vibration damage during road construction activities. These values have been derived through consideration of various European standards and compliance with their guidance should ensure that there is little to no risk of even cosmetic damage to buildings. The guide values are presented below in Table 8.6.

Table 8.6 NRA Maximum Permissible Construction Phase Vibration Levels

Vibration Level – Peak Particle Velocity at the closest part of any sensitive property to the source of vibration at a frequency of		
Less than 10Hz	**10 to 50Hz**	**50 to 100Hz (and above)**
8 mm/s	12.5 mm/s	20 mm/s

8.3 Receiving Environment

8.3.1 Introduction

The baseline noise monitoring survey consisted of carrying out noise measurements at three locations in the vicinity of the subject site. The subject site was assessed to determine the existing noise levels at sensitive

receptor locations surrounding the proposed site location. The detailed noise monitoring survey report (TMS Ref No 25215-2) is presented in Appendix 8.A.

8.3.2 Existing Noise Climate

The baseline noise monitoring locations were chosen in order to best represent the current noise climate at the nearest noise sensitive receptor (NSR) locations in the vicinity of the subject site. In total three noise monitoring locations were chosen to complete the baseline survey and measurements were carried out during the daytime period (07.00 to 19.00), the evening time period (19.00 to 23.00) and the night-time period (23.00 to 07.00).

The measurement parameters included meteorological observations of prevailing conditions at the time of the survey. The main measurement parameter was the equivalent continuous A-weighted sound pressure level, $L_{Aeq,\ T}$. Monitoring periods for the noise survey were 15-minute intervals. A statistical analysis of the measurement results was also completed so that the percentile levels, $L_{AN,\ T}$, for N = 90% and 10% over 15-minute measurement intervals were also recorded. The percentile levels represent the noise level in dB(A) exceeded for N% of the measurement time. A glossary of noise related terms is presented in Appendix 8.A.

The results of the baseline noise monitoring survey are summarised in Table 8.7 below. These results are an accurate representation of the existing baseline noise climate in the vicinity of the site.

Table 8.7 Baseline Noise Monitoring Results

Location ID	Date	Time Interval	Measured Noise levels / dB				Comment
			L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	
N1	16.07.18	14.19-14.34	40	36	42	64	The noise environment is dominated by the passing traffic on the R407 and the R403 Roads. Passing aircraft overhead were also noted throughout the survey.
	16.07.18	14.34-14.49	42	38	45	64	
	16.07.18	16.17-16.32	45	40	47	63	
	16.07.18	22.06-22.21	37	34	40	48	
	16.07.18	23.45-00.00	34	23	37	57	
N2	16.07.18	15.00-15.15	44	40	46	61	The noise environment is dominated by the passing traffic on the R407 and the R403 Roads. Traffic into and out of the Capdoo Park estate also contributed.
	16.07.18	15.16-15.31	45	39	48	60	
	16.07.18	16.41-16.56	47	39	50	64	
	16.07.18	22.27-22.42	41	30	42	62	
	17.07.18	00.04-00.19	36	26	32	60	
	17.07.18	00.20-00.35	32	25	31	56	
N3	16.07.18	15.38-14.53	54	47	56	74	The noise environment is dominated by the passing traffic on the adjacent R407 Road. Overhead aircraft noise was also noted here.
	16.07.18	15.54-16.09	54	45	58	66	
	16.07.18	17.33-17.48	55	47	59	64	
	16.07.18	22.50-23.05	47	31	51	64	
	16.07.18	23.06-23.21	47	29	50	64	
	16.07.18	23.22-23.37	47	32	50	63	

8.3.3 Existing Vibration Climate

There are no significant sources of vibration in the vicinity of the subject site. The main vibrations experienced at the nearest sensitive receptor locations relates to the passing traffic along the surrounding road network. Low-level, short-term vibrations could be experienced when fully loaded HGVs travelling at speeds in excess of 50km/hr pass in close proximity to private residences. There is no residential area close enough to the subject site to be of concern in terms of vibration activity for the current application.

8.4 Characteristics of the Proposed Development

The proposed development for which planning permission is sought in this application comprises a residential development of approximately 366 residential units, a childcare facility, a new link road together with all associated and ancillary infrastructure and open space provision.

8.5 Potential Impact of the Proposed Development

8.5.1 Construction Phase

8.5.1.1 Predicted Impact of Construction Noise

The proposed construction works associated with the development proposed in this planning application is expected to take approximately 5 years, with the hours of construction typically from 07.00 to 19.00 Monday to Friday and 08.00 to 16.00 Saturdays. Although there may occasionally be the need to work outside the normal hours of construction, heavy or noisy construction activities will be minimised during these periods.

A variety of items of plant will be in use for the purposes of site clearance, preparation and construction activities. There will be no blasting techniques used during construction. It is not envisaged that rock-breaking will be required as part of the site clearance works.

The actual noise level produced by construction work will vary at the nearest sensitive receptor boundary at any time depending upon a number of factors including the type of plant in use, plant location, duration of operation, hours of operation and intervening topography. It is therefore difficult to accurately determine the likely noise levels without knowing greater detail, however, the impact assessment carried out for the proposed development presents the highest likely noise levels at the nearest receptors based on soil movement, infrastructure work, general site activities and building construction work in the vicinity of the closest approach to the nearest noise sensitive receptors.

Calculations can be used to predict indicative noise levels using the guidance set out in BS 5228–1 for the main phases of the proposed construction works. The nearest noise sensitive receptor (NSR) locations to the proposed construction works are the properties within the residential estates and private houses located adjacent to and along the site boundary. The closest distance for the construction works to approach the NSRs is 15m from the private residences along the northern boundary of the site, 15m from the Mainham Woods residential estate and 20m from the Capdoo Park residential estate. All other works will occur across the site at varying distances of up to 200m. The named NSR locations for the purposes of the impact assessment are:

- **NSR1 – Northern Boundary Residences at 15m from nearest site construction works;**
- **NSR2 – Mainham Woods Residential Estate at 15m from nearest site construction works; and**
- **NSR3 – Capdoo Park Residential Estate at 20m from nearest site construction works.**

Predicted noise levels have been calculated at each of the three closest NSR locations that have been identified during the baseline noise survey completed for the subject site. Tables 8.8 to 8.11 presents the predicted noise level for each of the construction phase stages. A worst-case scenario is assumed by having all plant and equipment items operating continuously for two thirds of the day at the construction boundary point in the vicinity closest to the noise sensitive receptor even though in reality they will be much further removed. The generators and cranes are assumed to operate for 100% of the time. There is a six-foot high wall running along the boundary of the Mainham Woods and Capdoo Park residential estates and the screening effect from these has been included in the calculations. Provision is also made for an acoustic screening barrier on the northern boundary.

Therefore, the results presented in Tables 8.8 to 8.11 show the maximum noise levels predicted for each NSR and represent the noise levels when the construction activity is ongoing at the closest point within the construction site to each NSR.

Table 8.8 Calculated Construction Noise Levels for Excavation & Site Preparation Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at the named receptor locations		
		NSR1	NSR2	NSR3
Tracked excavator	C2.2	63	63	60
Dozer	C2.11	65	65	62
Wheeled Loader	C2.28	62	62	59
Dump Truck	C2.30	65	65	62
Combined L_{Aeq} (when all plant items are operating together)		70	70	67

Table 8.9 Calculated Construction Noise Levels for General Site Activities

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at the named receptor locations		
		NSR1	NSR2	NSR3
Dump Truck	C2.30	65	65	62
Wheeled Loader	C2.28	62	62	59
Mobile Crane	C2.15	53	53	50
Generator	C4.77	46	46	43
Angle Grinder	C4.93	58	58	55
Combined L_{Aeq} (when all plant items are operating together)		67	67	64

Table 8.10 Calculated Construction Noise Levels for Building Construction Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at the named receptor locations		
		NSR1	NSR2	NSR3
Tracked Excavator	C2.2	63	63	60
Mobile Crane	C2.15	53	53	50
Tower Crane	C2.10	62	62	59
Dump Truck	C2.30	65	65	62
Generator	C4.77	46	46	43
Concrete Pump & Truck	C4.28	62	62	59
Combined L_{Aeq} (when all plant items are operating together)		69	69	66

Table 8.11 Calculated Construction Noise Levels for Road Construction Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at the named receptor locations		
		NSR1	NSR2	NSR3
Vibratory Roller	C5.20	46	61	58
Asphalt Paver (+ Tipping Lorry)	C5.30	46	61	58
Combined L_{Aeq} (when all plant items are operating together)		49	64	61

The results indicate that the predicted construction noise levels associated with site works will not exceed the NRA and Kildare County Council assessment criteria for construction works of 70dB $L_{Aeq,1hr}$ for the works assessed. There is potential for the assessment criteria to be exceeded at NSR1 when construction works are occurring at the closest boundary point, however installation of an acoustic screening barrier ensures that the impact will remain within acceptable levels.

It should be noted however, that in reality it is anticipated that noise levels as a result of construction works will be much lower than the predicted worst-case levels for the vast majority of the construction works. This is because all the items of machinery modelled will not typically be in operation simultaneously and they will not be located at the nearest boundary point but for the most part will be further removed from the NSR locations. The implementation of the mitigation measures presented in Section 8.6 will ensure that the proposed noise criteria are satisfied for all construction works.

It should be noted that the construction noise levels are short-term impacts and are transient in nature and therefore the likely noise impact is considered to vary from Imperceptible to Moderate.

8.5.1.2 Predicted Impact of Construction Traffic

The construction of the proposed Project is a modest scale works. Site works will generate a small number of staff trips (one-way) during the peak hour periods. It is envisaged that peak hour heavy goods vehicle (HGV) traffic would be in the region of 5 to 10 one-way movements, depending on the construction activities active on the site when considering the worst-case construction scenario.

Therefore, during construction works there will be a maximum of approximately 20 HGV movements per hour. Construction site employee traffic volumes will result in approximately 20 vehicle movements per day.

A doubling of road traffic volume would typically result in an approximate 3dB increase in noise level at adjacent properties. The additional traffic generated as a result of the construction phase of the proposed development results in a very small increase in peak hour traffic. Therefore, the noise contribution from site traffic during the construction phase will not be observable and can be classified as "imperceptible". The noise contribution from site traffic during the construction phase will be "temporary" and can be classified as "not significant".

8.5.1.3 Predicted Impact of Construction Vibration

The only construction activity with the potential to generate appreciable vibration levels will be the movement of loaded HGVs moving into and out of the site. There is no blasting required and it is also envisaged that there will be no rock-breaking required to excavate any ground-rock that may be encountered during site clearance

works. Therefore, considering the distance to the nearest off-site sensitive buildings, vibration levels at the closest residences are expected to significantly lower than those presented in Table 8.6 above thus ensuring no cosmetic damage to buildings will occur. Vibration levels are also expected to be below a level that would give rise to complaint from building occupants as per Table 8.5.

However, if in the unlikely event that complaints related to vibration impact are received from nearby residential receivers, vibration monitoring will be carried out at existing properties in the vicinity of the proposed development site during the construction phase.

8.5.2 Operational Phase

The proposed residential development will consist of private dwellings and will also include a crèche, car parking spaces within the curtilage of associated dwellings, pedestrian/cycle and vehicular access together with all ancillary, infrastructure, landscaping and boundary treatments. The only predicted contributions to the noise environment in the vicinity of the site will result from increased traffic movements as a result of the increased activity in the area.

A detailed Traffic Impact Assessment has been prepared by DBFL. Information from this report has been used to determine the predicted change in noise levels in the vicinity of the roads and junctions that pass the entrance to the subject site.

For the purposes of assessing potential noise impact, the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development are considered. The traffic figures used in the assessment are taken from the Traffic Impact Assessment report. The change in traffic movements is typically less than 6% for most receptors and 17% for the maximum change that would be expected to occur; this latter maximum is not at sensitive receptors. The change in noise level for the surrounding road network for the sensitive receptors that could be affected by the proposed development traffic for the Opening Year and Design Year scenarios is less than 1 decibel and consequently is insignificant and imperceptible.

Table 8.4 offers guidance as to the likely impact associated with any particular change in traffic noise level. The predicted increase in traffic noise is less than 1dB, which is imperceptible with a negligible impact.

Overall, the noise climate in the area would be expected to remain very similar to the present situation as currently the predominant source of noise is passing traffic on the R403/R407 Road. There is no significant change in traffic patterns predicted for the area and overall traffic volumes are predicted to remain approximately at current levels hence there is no observable change to the noise climate predicted.

In summary, the predicted change in noise levels associated with vehicles is neutral, long term and not significant.

8.6 Mitigation Measures

8.6.1 Construction Phase

Whilst the construction phase is not expected to give rise to negative noise impacts at sensitive receptors, the guidance on the control of noise and vibration from demolition and construction activities presented in BS 5228 will be followed. These measures include the following:

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start-up plant and vehicles sequentially rather than all together;
- In accordance with best practicable means, plant and activities to be employed on site will be reviewed to ensure that they are the quietest available for the required purpose;
- Where required, improved sound reduction methods, e.g. enclosures will be used;
- Site equipment will be located away from noise sensitive areas, as much as is feasible;
- Regular and effective maintenance by trained personnel will be carried out to reduce noise and/or vibration from plant and machinery;
- Limit noisy construction works to 8am to 6pm weekdays with Saturday working from 8am to 1pm unless otherwise agreed with the local authority. Relatively quiet construction activities could be carried out outside these hours, subject to controls in place;
- Maintain ongoing contact with local residents to ensure any complaints relating to construction phase noise for the project from local residents can be addressed. Also, prior to any particularly noisy activities, local residents will be contacted in order to minimise the perceived noise impact;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations for comparison with limits and background levels; If there is a requirement to undertake vibration monitoring, the following guidance on vibration monitoring (monitoring of peak particle velocity) should be followed; The instrumentation should monitor three orthogonal components of peak particle velocity (p.p.v) and the trigger values / limits are set based on the maximum of these (the peak component particle velocity) as follows:

  - Warning Level = 7.5 mm/s (Operatives should be notified if this level is reached; work may continue but with caution – review of working method should be considered).
  - Stop Level = 10 mm/s: work should be stopped if this level is reached and working method reviewed; revised method of working to be agreed prior to works proceeding again; Site Foreman & Operatives to be notified immediately.
  - Visible & audible alarms should form part of the monitoring system so that it is easily established when the trigger / alarm levels are reached.

The contractor will erect construction site hoarding along noise sensitive boundaries, particularly where no existing screening such as boundary walls are in place at the nearest NSRs. This will be particularly required at some of the properties along the northern boundary of the proposed site.

It will be required that the site contractor will prepare a Noise and Vibration Management Plan (NVMP) which will deal specifically with onsite activities in a strategic manner to remove or reduce significant noise and

vibration impacts associated with the construction works. The NVMP will specify the noise and vibration monitoring and reporting that will be carried out.

In addition, the contractor will appoint a community relations officer who will deal on a one-to-one basis with local stakeholders and will notify them before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The community relations officer will also distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

8.6.2 Operation Phase

There are no adverse noise impacts associated with the operational phase of the development and consequently there are no mitigation measures proposed.

8.7 Residual Impacts

During the construction phase of the proposed development there will be some noise impacts experienced at the nearest receptors to the subject site. It is predicted that the mitigation measures proposed will ensure that noise and vibration impacts are kept to a minimum. The predicted noise and vibration impacts on the receiving environment during the construction phase are considered to be moderate and temporary and only affecting a small number of properties over a short time-period.

The potential for noise generation during the operational phase of the proposed development is limited to additional vehicles on the surrounding road network. The change in vehicle numbers predicted is not significant in an overall context. The predicted noise and vibration impacts on the receiving environment during the operational phase are considered to be not significant and long-term.

8.8 Interactions Arising

The main interactions with noise are in relation to human beings and flora and fauna. The impact of noise on human beings living in the area of the proposed development has been addressed above for both the construction and operational phase of the proposed development. The impact assessment shows that the noise impacts that will be experienced by human beings in the vicinity of the proposed development are all within the prescribed criteria. This interaction is described as negative for the construction phase and neutral for the operational phase and is quantified as Not Significant for both phases.

In relation to the interaction of noise from the proposed development with flora and fauna, the noise generated by the development will not have a significant adverse impact on the local birdlife and wildlife. Local birdlife and wildlife will quickly accustom to any change in the noise climate of the area as typically occurs for projects of this type. This interaction is described as neutral and quantified as Not Significant

8.9 References

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National Roads Authority (2004). Guidelines for the Treatment of Noise and Vibration in National Road Schemes.

World Health Organization (1999). Guidelines for Community Noise.

Appendix 8.A Baseline Noise Monitoring Survey

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21
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BASELINE NOISE MONITORING SURVEY

CLANE, CO KILDARE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Report Ref. 25215-2
TMS Environment Ltd
Issued: 23rd July 2018

Approved By:

Tom Ryan
Senior Consultant

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1.0 SCOPE

This report presents the results of a baseline environmental noise survey carried out at a number of different noise monitoring locations in the vicinity of the proposed development site on lands in Capdoo, Clane, Co. Kildare.

2.0 REGIONAL ENVIRONMENTAL SETTING

The proposed site is located in the townland of Capdoo, immediately northwest of Clane town centre. The northern boundary of the site is characterised by one-off dwellings which are generally single or dormer properties on large sites. The eastern boundary is similarly characterised by the rear of one-off dwellings and a local. The southern boundary is characterised by the Capdoo Park residential development and the western boundary adjoins residential properties on College Road East and Mainham Wood residential estate and the R407 Road.

3.0 NOISE SENSITIVE RECEPTORS

The noise monitoring locations were chosen in order to best represent the current noise climate at the nearest noise sensitive receptor (NSR) locations and other key NSR locations in the vicinity of the proposed development site.

The closest sensitive receptors to the site are the private residences private residences along the northern boundary of the site, the Mainham Woods residential estate to the west of the site and the Capdoo Park residential estate to the south of the site.

Three NSR locations (N1 to N3) were selected at the various locations described above and these are presented graphically in Appendix I and summarised in Table 1 below.

Table 1 Noise Monitoring Locations

Monitoring Location	Description
N1	In field along northern boundary of the site
N2	15m off bend on road into Capdoo residential estate
N3	On the green in the Mainham Wood residential estate

Note: Refer to noise monitoring location map in Appendix I.

Noise measurements were carried out at or near the boundaries of the NSRs and this noise survey is an accurate representation of the current day, evening and night-time noise levels in the vicinity of the site locations presented.

4.0 SURVEY PROTOCOL

4.1 Monitoring Locations

The monitoring locations were selected in accordance with the *ISO 1996 Acoustics - Description and Measurement of Environmental Noise* guidelines. Monitoring was carried out in accordance with the above-mentioned document and in all cases the instrument was positioned in the location most sensitive to noise from the proposed site. Due care was taken to minimise potential interference from wind generated noises from trees etc during the course of the measurement programme.

4.2 Instrumentation and Methodology

Noise measurements were made according to the requirements of *ISO 1996: Acoustics - Description and Measurement of Environmental Noise* and in addition, with reference to the EPA publication; *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), 2016.* The measurements were made using a Bruel & Kjaer (B&K) 2260 integrating sound level meter fitted with an octave band filter. The instrument was calibrated *in situ* at 94 dB prior to use and the calibration was cross-checked after the measurements using a B&K acoustic calibrator. The sound level meter was orientated towards the noise source and mounted on a tripod at 1.5m above ground level. This instrument is a Type 1 instrument in accordance with IEC 651 regulations. The Time Weighting used was Fast and the Frequency Weighting was A-weighted as per IEC 651.

4.3 Glossary of Terms Used

- L_{Aeq} : The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over a given period. The L_{Aeq} measurement is typically used to describe the average ambient noise level.
- L_{A90}: the sound pressure level in dB(A) which is exceeded for 90% of the time. The L_{A90} measurement is typically used to describe the average background noise level.
- L_{A10}: the sound pressure level in dB(A) which is exceeded for 10% of the time. The L_{A10} measurement is typically used to describe traffic noise.
- L_{ArT}: the sound pressure level in dB(A) with penalty adjustments added following the detection of tonal and/or impulsive noise.
- 1:3 Octave band Analysis: Frequency analysis of sound such that the frequency spectrum is sub-divided into bands of one-third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit. The unit of frequency is the Hertz, Hz.
- Tonal Noise: A tone is deemed to be present when the level difference between the Leq at the 1:3 octave band of the tone and each adjacent 1:3 octave band is greater than or equal to 15dB for low-frequencies (25Hz to 125Hz), 8dB for middle-frequencies (160Hz to 400Hz) or 5dB for high-frequencies (500Hz to 10,000Hz).

4.4 Survey Implementation

TMS Environment Ltd personnel (Tom Ryan) conducted the noise monitoring survey on the 16th and 17th of July 2018. All monitoring was carried out in accordance with the methodology set out above.

The measurement parameters included meteorological observations of prevailing conditions at the time of the survey. The main measurement parameter was the equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$. Monitoring periods for the noise survey were 15 minute intervals. A statistical analysis of the measurement results was also completed so that the percentile levels, $L_{AN, T}$, for N = 90% and 10% over 15-minute measurement intervals were also recorded. The percentile levels represent the noise level in dB(A) exceeded for N% of the measurement time.

5.0 WEATHER CONDITIONS

The weather conditions were good for noise monitoring during the monitoring survey. The weather conditions were dry and generally calm with moderate cloud cover. There was a light breeze with wind speeds between 2 and 3m/sec for the daytime, evening time and night-time surveys.

6.0 SURVEY RESULTS

The results of the baseline environmental noise survey are presented in Table 2 and Figure 1 below.

Table 2 Baseline Noise Monitoring Results

Location ID	Date	Time Interval	Measured Noise levels / dB(A)				Comment
			L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	
N1	16.07.18	14.19-14.34	40	36	42	64	The noise environment is dominated by the passing traffic on the R407 and the R403 Roads. Passing aircraft overhead were also noted throughout the survey
	16.07.18	14.34-14.49	42	38	45	64	
	16.07.18	16.17-16.32	45	40	47	63	
	16.07.18	22.06-22.21	37	34	40	48	
	16.07.18	23.45-00.00	34	23	37	57	
N2	16.07.18	15.00-15.15	44	40	46	61	The noise environment is dominated by the passing traffic on the R407 and the R403 Roads. Traffic into and out of the Capdoo Park estate also contributed.
	16.07.18	15.16-15.31	45	39	48	60	
	16.07.18	16.41-16.56	47	39	50	64	
	16.07.18	22.27-22.42	41	30	42	62	
	17.07.18	00.04-00.19	36	26	32	60	
	17.07.18	00.20-00.35	32	25	31	56	
N3	16.07.18	15.38-14.53	54	47	56	74	The noise environment is dominated by the passing traffic on the adjacent R407 Road. Overhead aircraft noise was also noted here.
	16.07.18	15.54-16.09	54	45	58	66	
	16.07.18	17.33-17.48	55	47	59	64	
	16.07.18	22.50-23.05	47	31	51	64	
	16.07.18	23.06-23.21	47	29	50	64	
	16.07.18	23.22-23.37	47	32	50	63	

7.0 EVALUATION OF RESULTS

7.1 Daytime Noise Survey

This survey was completed in order to assess the existing baseline noise environment in the vicinity of the proposed development site. The baseline data collected can be used to identify the potential for impact that activities associated with the proposed development could have on the local noise environment.

The daytime noise measurements were carried out between the hours of 07.00 and 19.00 and ranged in value from 40dB L_{Aeq} at monitoring location N1 to 55dB L_{Aeq} at monitoring location N3. The background noise characterised by the L_{A90} measurements ranged from 36dB L_{A90} at monitoring location N1 to 47dB L_{A90} at monitoring location N3.

It was observed that the dominant source of noise at all noise monitoring locations was passing traffic on the surrounding road network. Other anthropogenic noise sources that were noted

included passing aircraft. Non-anthropogenic noise sources such as dogs barking, bird noise and grazing animals had an insignificant impact on the noise environment at the noise monitoring locations. The dominance of the traffic on the noise environment is reflected in the similar results obtained for all three measurement parameters L_{Aeq}, L_{A90} and L_{A10} at each of the locations.

7.2 Evening time Noise Survey

The evening time noise measurements were carried out between the hours of 19.00 and 23.00 and ranged in value from 37dB L_{Aeq} at monitoring location N1 to 47dB L_{Aeq} at monitoring location N3. The background noise characterised by the L_{A90} measurements ranged from 30dB L_{A90} at monitoring locations N2 to 34dB L_{A90} at monitoring location N1.

Again the main source of noise at all noise monitoring locations during the evening time period was passing traffic on the surrounding road network. Other anthropogenic noise sources that were occasionally noted included passing aircraft overhead. Non-anthropogenic noise sources such as dogs barking and bird noise had an insignificant impact on the noise environment at the noise monitoring locations. The dominance of the constant traffic on the noise environment is reflected in the similar results obtained for all three measurement parameters L_{Aeq}, L_{A90} and L_{A10}.

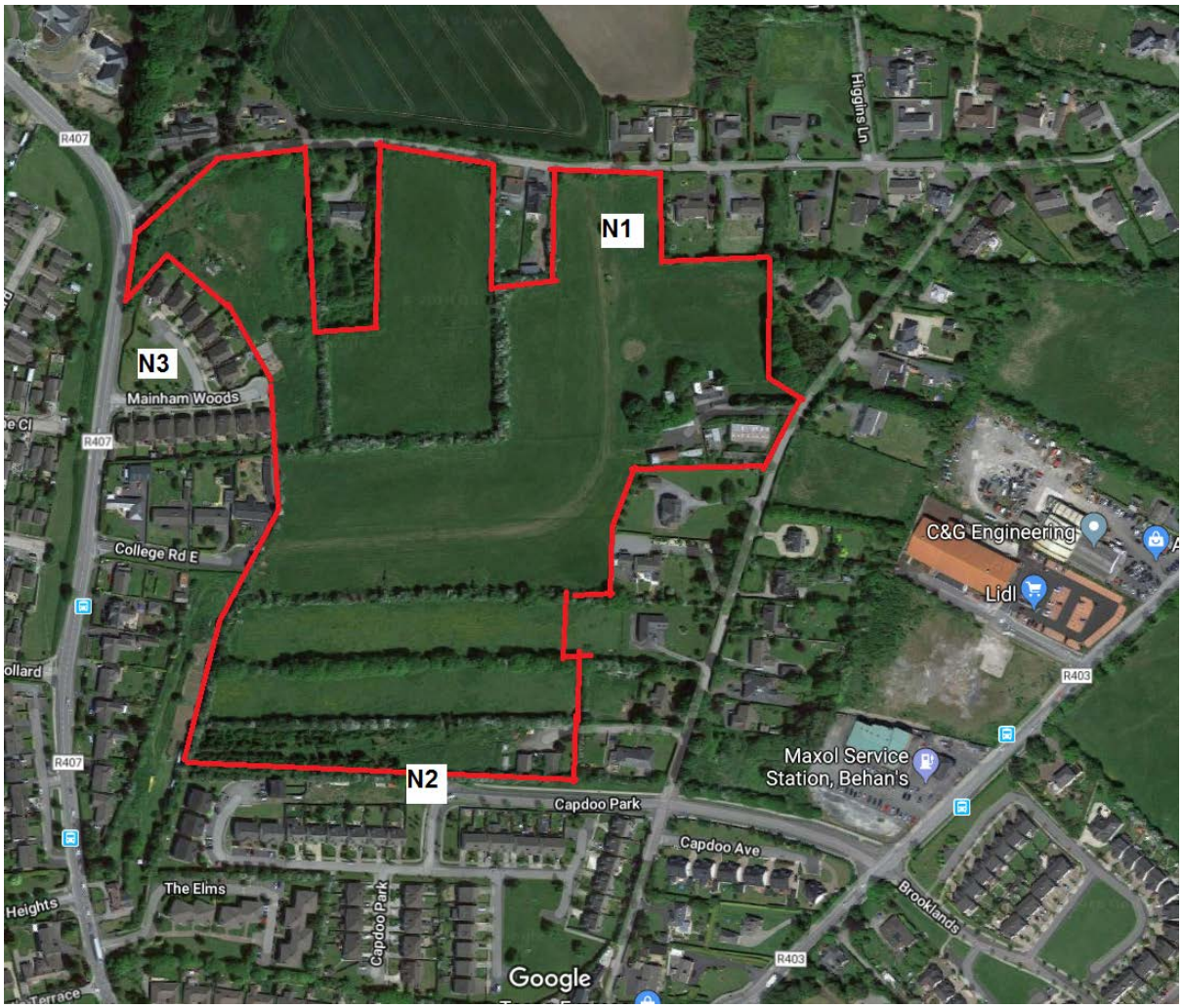
7.3 Night time Noise Survey

The night time noise measurements were carried out between the hours of 23.00 and 07.00 and ranged in value from 32dB L_{Aeq} at monitoring location N2 to 47dB L_{Aeq} at monitoring location N3. The background noise characterised by the L_{A90} measurements ranged from 23dB L_{A90} at monitoring location N1 to 32dB L_{A90} also at monitoring location N3.

The main source of noise at all noise monitoring locations during the night time period was again passing traffic on the surrounding road network.

APPENDIX I

Map Illustrating Noise Monitoring Locations


N1
N2
N3
Higgins Ln
R407
Mainham Woods
College Rd E
C&G Engineering
Lidl
R403
Maxol Service Station, Behan's
Capdoo Park
Capdoo Ave
The Elms
Brooklands
Google

APPENDIX II

Calibration Certificates

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [x] Andy Moorhouse [ ]
Gary Phillips [ ] Danny McCaul [ ]

acoustic calibration laboratory
The University of Salford, Salford, Greater Manchester, M5 4WT, UK
http://www.acoustics.salford.ac.uk
t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk

UKAS CALIBRATION
0801

University of Salford MANCHESTER

Certificate Number: 03805/1 Date of Issue: 7 June 2018

CALIBRATION OF A SOUND CALIBRATOR

FOR:	Enfonic Ltd Office Suites, Level 2 Charlestown Centre St. Margaret's Road Dublin D11 KXC7
FOR THE ATTENTION OF:	Gary Duffy
DESCRIPTION:	Calibrator with housing for one-inch microphones and adaptor type UC 0210 for half-inch microphones.
MANUFACTURER:	Bruel & Kjaer
TYPE:	4231
SERIAL NUMBER:	2460008
DATE OF CALIBRATION:	06/06/2018
TEST PROCEDURE:	CTP06 (Laboratory Manual)

Test Engineer (initial): GP Name: Gary Phillips

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Certificate Number: 03805/1 Date of Issue: 7 June 2018

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in this certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The results have been corrected to the reference pressure of 101.325 kPa using manufacturer's data.

RESULTS

Coupler configuration:	Half-inch
Microphone type:	GRAS 40AG
Output level (dB re 20μPa):	94.01 dB ± 0.11 dB
Frequency (Hz):	999.97 Hz ± 0.01 %
Total Distortion (%):	0.38 % ± 0.39 %

Average environmental conditions at the time of measurement were:

Pressure:	101.264 kPa ± 0.023 kPa
Temperature:	23.1 °C ± 0.4 °C
Relative humidity:	45.8 % ± 1.8 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK1698997

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 3001350	Id: - 3001350
Microphone:	Brüel & Kjær Type 4950	No: 2778447	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 16741	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2615338	
Software version:	BZ7222 Version 2.1	Pattern Approval:	PTB1.63-4046158
Instruction manual:	BE1712-18		

CUSTOMER

Enfonic Ltd
Tecpro House
Dublin
D17 NX50
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.9 - DB: 4.90) by using procedure 2250-4189.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2017-07-19

Date of issue: 2017-07-19

M. Önder

Mikail Önder
Calibration Technician

Susanne Jørgensen

Susanne Jørgensen
Approved Signatory