

8. NOISE AND VIBRATION

8.1 Introduction

This section of the EIAR has been prepared by AWN Consulting Limited to identify and assess the potential noise and vibration impacts associated with the proposed strategic housing development at Newcastle South and Ballynakelly, Newcastle, Co. Dublin.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the proposed development site, an assessment of the potential noise and vibration impact associated with the proposed development during both the short-term construction phase and the long term operational phase on its surrounding environment.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated in an environmentally sustainable manner in order to ensure its minimal impact on the receiving noise climate.

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this chapter and included in the references section. In addition to specific noise guidance documents, the following guidelines were considered and consulted for the purposes of this chapter:

- EPA *Guidelines on the Information to be contained in Environmental Impact Statements*, (EPA, 2002);
- EPA *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*, (EPA, 2003);
- EPA *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* Draft August 2017
- EPA *Advice Notes for Preparing Environmental Impact Statements*, (Draft, September 2015)

8.2 Characteristics of the Proposed Development

The proposed development will involve the construction of 406 no. residential units within a mix of apartments, duplex units and houses. In addition the proposed development includes a childcare facility and 1 no. retail unit ground floor level of a mixed-use block together with all associated and ancillary infrastructure, landscaping and boundary treatments. A full description of the proposed development is included in Chapter 3 of this EIAR.

When considering a development of this nature, the potential noise and vibration impacts on the surroundings must be considered for each of two distinct stages, the short-term construction phase and the permanent operational phase.

Highest potential impacts associated with residential developments are associated with the short-term construction phase when site development works will occur potentially in close proximity to existing

residential properties. During this phase the main site activities will include site clearance, building construction, road works, and landscaping.

During the operational phase of the development, no significant sources of noise or vibration are expected with the development. The primary source of outward noise in the operational context relates to any changes in traffic flows along the local road network and any operational plant noise associated with retail units within the ground floor of one of the development buildings.

8.3 Receiving Environment

The site under consideration is located in the townlands of Newcastle South and Ballynakelly. The site is bound to the north by Newcastle Main Street which includes a combination of residential and commercial buildings. The main site is bound to the east by residential dwellings and agricultural lands, to the west by agricultural lands and St Finian's National School and to the south by agricultural lands. The closest noise sensitive locations to the proposed development are St Finian's National and the residential developments to the north and east which bound the immediate red boundary of the proposed development.

8.3.1 Environmental Noise Survey

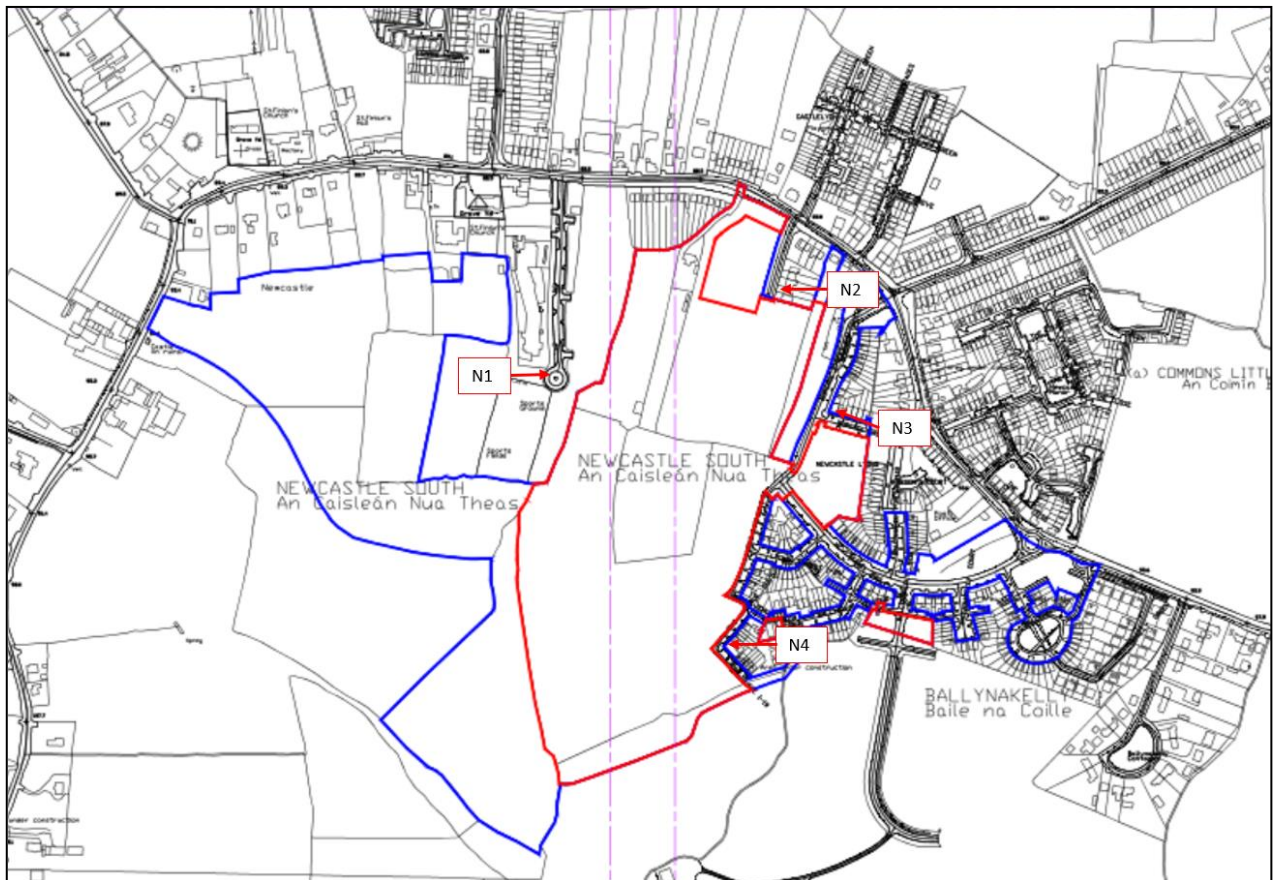
An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Specific details are set out below.

Choice of Measurement Locations

Four measurement locations were selected as shown in Figure 8.1 and described below.

- Location N1** is located along the north western boundary of development site along the access road serving St Finian's National School.
- Location N2** is located along the north-eastern boundary of the development outside properties along Orchard Grove residential properties cul de sac.
- Location N3** is located along the mid-eastern boundary of the development opposite residential buildings within the Burgage Crescent development site. Measurements at this location are representative of those associated with the residential properties along this boundary.
- Location N4** is located along the south-eastern boundary of development site outside residential buildings within Lyons Avenue South, representative of noise sensitive buildings along this boundary of the development.

Figure 8.1 Baseline Noise Monitoring Locations



Survey Periods and Instrumentation

Attended noise measurements were conducted at Locations N1 to N4 between 09:05 to 13:04hrs 2 November 2018.

The measurements were made using a Brüel and Kjær Type 2250 Sound Level Meter. Sample periods were 15-minutes. Before and after the survey the measurement instruments were check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Measurement Parameters

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

- L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.
- L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

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

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

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

Survey Results and Discussion

The results of the surveys at the four monitoring locations are summarised below.

Location N1

Table 8.1 presents a summary of noise levels measured at Location N1.

Table 8.1 Noise Survey Results at Location N1

| Start Time | L_{Aeq} | L_{AFmax} | L_{A10} | L_{A90} |
|------------|-----------|-------------|-----------|-----------|
| 09:05 | 48 | 65 | 50 | 45 |
| 10:28 | 47 | 59 | 50 | 42 |
| 11:47 | 44 | 61 | 45 | 42 |

During the noise survey, the dominant noise sources were noted to be from distant road traffic, aircraft overhead, birdsong, landscaping activities and people conversing within school grounds. Ambient noise levels were measured in the range of 44 to 48dB L_{Aeq} . The background noise was measured in the range of 42 to 45dB L_{A90} with distant traffic being the dominant source noted.

Location N2

Table 8.2 presents a summary of noise levels measured at Location N2.

Table 8.2 Noise Survey Results at Location N2

| Start Time | L_{Aeq} | L_{AFmax} | L_{A10} | L_{A90} |
|------------|-----------|-------------|-----------|-----------|
| 09:25 | 48 | 63 | 51 | 45 |
| 10:48 | 46 | 64 | 49 | 42 |
| 12:06 | 51 | 75 | 52 | 44 |

During the noise survey, the dominant noise sources were noted to be from road traffic along Newcastle main street (R405) and from distant road traffic on surrounding roads, birdsong, local vehicular movement and general sub-urban activities. Ambient noise levels were measured in the range of 46 to 51dB L_{Aeq} , the higher being due to dog barking and children playing near the measurement position. The

background noise was measured in the range of 42 to 45dB L_{A90} with distant traffic being the dominant source noted.

Location N3

Table 8.3 presents a summary of noise levels measured at Location N3.

Table 8.3 Noise Survey Results at Location N3

| Start Time | L_{Aeq} | L_{AFmax} | L_{A10} | L_{A90} |
|------------|-----------|-------------|-----------|-----------|
| 09:47 | 50 | 71 | 47 | 44 |
| 11:07 | 50 | 69 | 52 | 43 |
| 12:31 | 51 | 67 | 52 | 44 |

During the noise survey, the dominant noise sources were noted to be distant road traffic on surrounding roads and birdsong. Children playing in proximity to the monitoring position were also noted during the third monitoring round. Ambient noise levels were measured in the range of 50 to 51dB L_{Aeq} . The background noise was measured in the range of 43 to 44dB L_{A90} with distant traffic being the dominant source noted.

Location N4

Table 8.4 below presents a summary of noise levels measured at Location N4.

Table 8.4 Noise Survey Results at Location N4

| Start Time | L_{Aeq} | L_{AFmax} | L_{A10} | L_{A90} |
|------------|-----------|-------------|-----------|-----------|
| 10:08 | 47 | 56 | 48 | 46 |
| 11:26 | 52 | 71 | 49 | 46 |
| 12:49 | 49 | 63 | 50 | 48 |

During the noise survey, the dominant noise sources were noted to be distant road traffic on surrounding roads, birdsong, occasional local traffic, intermittent aircraft overhead. Ambient noise levels were measured in the range of 47 to 52dB L_{Aeq} . The background noise was measured in the range of 46 to 48dB L_{A90} with distant traffic being the dominant source noted.

8.3.2 Baseline Summary

The baseline environment within and adjacent to the development site is found to be typical of a suburban environment where road traffic, localised vehicle and pedestrian activities and environmental sources including bird song are the main contributors to the prevailing noise environment.

8.4 Assessment Methodology

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken in the vicinity of the development site in order to characterise the existing noise environment and to identify sensitive noise receptors;
- A review of the most applicable standards and guidelines relating to environmental noise and vibration has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed during the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operational of the development, and;
- A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

8.4.1 Assessment Criteria

Construction Phase - Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Volume 4 of the *Dublin Agglomeration Noise Action Plan 2018 – 2023* relates to South Dublin City County Council (SDCC). In terms of the control of construction noise, the action plan document refers to the County Development Plan 2016 – 2022, Section 11.3.6 *Environmental Hazard Management*, which notes the following with respect to the control of construction noise at existing noise sensitive locations:

"Where development sites adjoin residential properties, the Planning Authority will generally attach a condition to grants of planning permission restricting the operation of equipment or machinery (to include pneumatic drills, construction vehicles, generators, etc.) on or adjacent to the site before 07:00 hours on weekdays and 09:00 hours on Saturdays, after 19:00 hours on weekdays and 13:00 hours on Saturdays and at any time on Sundays, Bank Holidays or Public Holidays"

Whilst no specific construction noise limits are set by SDCC with respect to noise, a common approach across the Dublin Agglomeration refers to the use of BS 5228 2009 +A1 2014 *Code of practice for noise and vibration control on construction and open sites* Parts 1 and 2 with respect to the controlling noise and vibration impacts. In this instance, appropriate criteria relating to permissible construction noise levels are taken from Part one of the standard *Noise*

This document suggests an absolute construction noise limits depending on the receiving environment. The documents states:

"Noise from construction and demolition sites should not exceed the level at which conversations in the nearest building would be difficult with windows shut.... Noise levels between 07:00 and 19:00hrs, outside the nearest window of the occupied room closest to the site boundary should not exceed:

70dB in rural, suburban and urban areas away from main road traffic and industrial noise;

75dB in urban areas near main roads in heavy industrial areas."

Given the suburban location of the facility, a limit value of 70dB $L_{Aeq,T}$ during daytime periods for construction is considered to be reasonable.

This limit value is also in agreement with those set by Transport Infrastructure Ireland (TII) for construction projects. Their 2014 document *Good Practice Guidance for the Treatment of Noise during the planning of National Road Schemes* recommends the following construction noise limit values.

Table 8.5 TII Maximum Recommended Noise Levels at the Façade of Nearby Dwellings during Construction

| Days & Times | L_{Aeq} | L_{AFmax} |
|---|-----------|-------------|
| Monday to Friday (07:00 to 19:00hrs) | 70 | 80 |
| Monday to Friday 19:00 to 22:00hrs | 60 | 65 |
| Saturday 08:00 to 16:30hrs | 65 | 75 |
| Sundays and Bank Holidays 08:00 to 16:30hrs | 60 | 65 |

Construction Phase - Vibration

Building Response

Guidance relevant to acceptable vibration within buildings during construction works is contained in the following documents:

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

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this

lower value. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%.

Both standards note that important buildings that are difficult to repair might require special consideration on a case by case basis but building of historical importance should not (unless it is structurally unsound) be assumed to be more sensitive. If a building is in a very unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration or any other groundborne disturbance. Taking the above into consideration the vibration criteria in Table 8.6 are recommended.

Table 8.6 Recommended Vibration Criteria during Construction Phase

| Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:- | | |
|--|------------|----------------|
| Less than 15Hz | 15 to 40Hz | 40Hz and above |
| 12 mm/s | 20 mm/s | 50 mm/s |

Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes depending on the duration and the source. However, higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin and or the duration of vibration is known. For example, piling can typically be tolerated at vibration levels up to 6 mm/s if adequate public relations are in place. These values refer to the day-time periods only.

During surface construction works the vibration limits set within Table 8.6 would be perceptible to building occupants and have the potential to cause subjective impacts. The level of impact is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication relating to planned works, their duration and vibration monitoring can significantly reduce vibration impacts to the neighbouring properties.

Operational Phase

The main potential source of outward noise impact associated with the proposed development relates to additional traffic flows on the surrounding road network and any operational plant items that may be required to serve the retail elements of the mixed-use block or childcare facility. There is no Irish Standard containing appropriate noise limit guidance that is applicable in this instance. In the absence of such standards, best practice dictates that the potential noise impact of the proposed development is assessed against appropriate British and/or International Standards.

Vehicular Traffic

In terms of traffic, given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 8.7 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2011).

Table 8.7 Likely Impact Associated with Change in Traffic Noise Level

| Change in Sound Level, dB(A) | Subjective Reaction | DMRB Magnitude of Impact | Impact Guidelines on the Information to be contained in EIAR (EPA) |
|------------------------------|--------------------------------|--------------------------|--|
| 0 | Inaudible | No Impact | Imperceptible |
| 0.1 – 2.9 | Barely Perceptible | Negligible | Not Significant |
| 3 – 4.9 | Perceptible | Minor | Slight, Moderate |
| 5 – 9.9 | Up to a doubling of loudness | Moderate | Significant |
| 10+ | Doubling of loudness and above | Major | Very Significant |

Table 8.7 presents the DMRB (2011) likely impacts associated with change in traffic noise level. The corresponding significance of impact presented in the 'EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017 is presented in the Table also for consistency in wording and terminology for the assessment of impact significance.

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

Building Services Plant Items

The most appropriate standard used to assess the impact of a new continuous source (i.e. plant items) to a residential environment is BS 4142 *Methods for rating and assessing industrial and commercial sound* (2014). This standard describes a method for assessing the impact of a specific noise source at a specific location with respect to the increase in "background" noise level that the specific noise source generates. The standard provides the following definitions that are pertinent to this application:

"Specific sound level, $L_{Aeq, Tr}$ " is equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T . This level has been determined with reference to manufacturers information for specific plant items.

"Rating level" $L_{Ar,T}$ is the specific noise level plus adjustments for the character features of the sound (if any), and;

"Background noise level" is the sound A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T . This level is expressed using the L_{A90} parameter. These levels were measured as part of the baseline survey.

The assessment procedure in BS4142: 2014 is outlined as follows:

1. determine the specific noise level;
2. determine the rating level as appropriate;
3. determine the background noise level, and;
4. subtract the background noise level from the specific noise level in order to calculate the assessment level.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific source will have an adverse impact or a significant adverse impact. A difference of +10dB or more is a likely to be an indication of a significant adverse impact. A difference of around +5dB is likely to be an indication of an adverse impact, dependent on the context. Where the rated plant noise level is equivalent to the background noise level, noise impacts are typically considered to be neutral.

Other Activities

For other activities that are not continuous the following guidance provides recommendations for internal noise levels within dwellings. This also relates to design guidance for new residential dwellings within the development.

Appropriate guidance for acceptable indoor ambient noise levels is contained within BS8233: 2014: *Guidance on Sound Insulation and Noise Reduction for Buildings*. This standard provides recommended indoor ambient noise levels for buildings as follows:

Table 8.8 Indoor Ambient Noise Levels for Dwellings from BS8233: 2014

| Criterion | Typical Situation | Desirable Noise Level, dB L_{Aeq} |
|-----------------------|---------------------|-------------------------------------|
| Indoor Ambient Levels | Living Rooms | 35 |
| | Dining Rooms | 40 |
| | Bedrooms Night-time | 30 |

For the purposes of this study, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window and typical 15dB attenuation is noted in this British Standard. Using this correction value across an open window, the following external noise levels would achieve the internal noise levels noted in Table 8.8 above.

- Daytime / Evening (07:00 to 23:00 hours) 50 - 55dB $L_{Aeq,1hr}$
- Night-time (23:00 to 07:00 hours) 45dB $L_{Aeq,15min}$

Due to the fact that there is the potential for short periods of noise to cause a greater disturbance at night-time, a shorter assessment time period (T) is adopted. Appropriate periods are 1hour for day / evening time (07:00 to 23:00 hours) and 15 minutes for night-time (23:00 to 07:00 hours).

There are no expected sources of vibration associated with the operational phase, therefore, vibration criteria have not been specified for this phase.

Noise and Human Health

In terms of the noise exposure of construction workers and potential hearing damage that may be caused due to exposure to high levels of noise, the Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) provides guidance in terms of allowable workplace noise exposure levels for employees. The Regulations specify two noise Action Levels at which the employer is legally obliged to reduce the risk of exposure to noise. The developer will be required to comply with the Regulations and provide appropriate noise exposure mitigation measures where necessary. The noise exposure level to off-site receptors during the construction phase will be below the lower Action Level and therefore the risk of noise exposure resulting in potential hearing damage to off-site receptors is minimal.

No significant noise impacts associated with the operational phase of the proposed development. As such, there is no anticipated risk of long-term exposure to noise on human health resulting from the proposed development.

8.5 Identification of Likely Significant Impacts

8.5.1 Construction Phase - Noise

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

The closest noise sensitive locations to the main building works are residential dwellings to the north along Newcastle Main street, to the northeast within the Orchard Grove, along the eastern boundary at Burgage Crescent and Lyons Avenue residential areas and to the west at St. Killian's National School. The closest noise sensitive locations being approximately 10 to 15m from the new proposed dwellings along the north-eastern boundary in proximity to Orchard Grove and those within the infill sites at Ballynakelly, Ballynakelly Rise and Ballynakelly Edge. The remainder of works will take place across the site at varying distances of up to 100m.

For site clearance, building construction works and landscaping works (excavators, loaders, dozers, concreting works, mobile cranes, generators), noise source levels are quoted in the range of 70 to 80dB L_{Aeq} at distances of 10m within BS 5228-1.

Given, the type and number of construction equipment will vary over the course of the construction phase, noise levels have been calculated at the closest noise sensitive locations assuming the numbers of plant items and reference noise levels at 10m detailed in Table 8.9. For the purpose of the assessment, the inclusion of a standard site hoarding along the site boundary has been included in the calculations. The calculations also assume that the equipment will operate for 66% of the working time.

Table 8.9 Indicative Construction Noise Levels at Nearest Noise Sensitive Locations.

| Construction Phase | Item of Plant (BS 5228-1 Ref) | Construction Noise Calculations dB L _{Aeq} at Varying Distances | | | |
|----------------------------|--|--|-----------|-----------|-----------|
| | | 15m | 25m | 50m | 100m |
| Site Clearance | Wheeled Loader Lorry (C2 28) | 66 | 64 | 58 | 52 |
| | Track Excavator (C2 22) | 62 | 60 | 54 | 48 |
| | Dozer (C2.13) | 68 | 66 | 60 | 54 |
| | Dump Truck (C2.30) | 69 | 67 | 61 | 55 |
| | Subtotal Site clearance | 73 | 71 | 65 | 59 |
| General Construction | Dozer (C2.13) | 68 | 66 | 60 | 54 |
| | Track Excavator (C2 22) | 62 | 60 | 54 | 48 |
| | Tower Crane (C4.49) | 67 | 62 | 56 | 50 |
| | Tracked mobile crane (C4.50) | 61 | 56 | 50 | 44 |
| | Subtotal General construction | 71 | 69 | 63 | 57 |
| Piled Foundations | Crane mounted auger (C3.16) | 67 | 63 | 57 | 51 |
| | Tracked excavator (C3.23) | 58 | 53 | 47 | 41 |
| | Concrete pump (C3.25) | 66 | 62 | 56 | 50 |
| | Tracked mobile crane (C3.28) | 57 | 52 | 46 | 40 |
| | Subtotal General construction | 70 | 66 | 60 | 54 |
| Building works and fit out | Hand tools | 71 | 69 | 63 | 57 |
| | Pneumatic Circular Saw (D7.79) | 65 | 60 | 54 | 48 |
| | Internal fit – out | 60 | 55 | 49 | 43 |
| | Subtotal Building fit out | 72 | 70 | 64 | 58 |
| Road Works/Landscaping | Dozer (C2.13) | 68 | 63 | 57 | 51 |
| | Dump Truck (C4.2) | 68 | 63 | 57 | 51 |
| | Surfacing (D8.25) | 58 | 53 | 47 | 41 |
| | Subtotal Landscaping and Road Works | 71 | 66 | 60 | 54 |

On review of the calculated noise levels at the closest distances assessed (15m), construction activities have the potential to exceed the recommended noise criterion of 70dB L_{Aeq} at existing properties along the immediate construction site boundaries during periods when works are occurring along the immediate site boundary in proximity. These are located to the north and in proximity to the infill sites at Ballynakelly, Ballynakelly Rise and Ballynakelly Edge.

Whilst activities occurring along the immediate site boundaries are likely to generate highest noise levels to these properties, this will only occur for limited periods of time during any one phase and can be

controlled through permissible hours of work and liaison with the most sensitive adjacent building occupants.

At further distances beyond 25m from the construction activities, noise levels are expected to be within the recommended criterion. In this instance construction noise levels at properties to the east and the school building to the west of the development site are likely to remain within acceptable limit values during the construction period. Further discussion on mitigation measures are discussed in Section 8.7.

Construction Traffic

Access to the development site for construction vehicles will be via Burgage Crescent to the east and will be routed to the site via the primary road network in the area, (i.e. the M7 and the R120). During the construction phase, heavy good vehicles (HGV's) movements are not expected to exceed 4 vehicles per hour during the busiest period of construction works. There will be light goods vehicles (LGV's) entering and exiting the site also used by construction workers, the volume of which has not been quantified, however, in order to assess a worst-case analysis, this is assumed to be 10 LGV's per hour over a 10hour working period.

Taking account of existing traffic flows along this road as provided within the traffic impact assessment, and adding the number of LGV's and HGV's during worst case operational construction periods, the change in noise level along this road has been calculated using the following formulae:

$$L_{Aeq,T} = L_{AX} + 10\log_{10}(N) - 10\log_{10}(T) \text{ dB}$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds)

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered (dB)

N is the number of events over the course of time period T

The mean value of Sound Exposure Level for truck moving at low to moderate speeds is in the order of 82dB L_{AX} at a distance of 10 metres from the vehicle. The mean value of Sound Exposure Level for car or light good vehicle passing at low to moderate speeds is in the order of 68dB L_{AX} at a distance of 10 metres from the vehicle.

Assuming all construction traffic travels exit and enters the site along Burgage Crescent, baseline traffic counts provided by DBFL undertaken as part of this planning application have been used to calculate the change in noise level as a results of additional construction vehicles during this peak phase. A total of 40 HGV's and 100 LGV's have been used for construction traffic volumes over a 10 hour day. Table 8.10 summarises the increase in noise levels associated with the additional HGV traffic assuming 100% of traffic travels either north or south of Main Street (R120) when added to existing traffic flows.

Table 8.10 Construction Traffic Noise Assessment

| Road | Base Traffic Flow (AADT) | Base HGV No's | Construction Traffic / day | Increase in Noise Levels, dB |
|---------------------------|--------------------------|---------------|----------------------------|------------------------------|
| Link F – Burgage Crescent | 356 | 0 | 100 LGV /40 HGV | +1.4 |
| Link G – Main street west | 11,057 | 243 | 100 LGV /40 HGV | +0.1 |
| Link D – Main street east | 11,068 | 243 | 100 LGV /40 HGV | +0.1 |

Reference to Table 8.7 confirms the increase in noise level along the assessed roads is negligible (<1dB) due to the existing volume of traffic along these roads and the relatively low additional HGV and LGV traffic per day forecast. The greatest increase in noise levels is calculated along Burgage Crescent, however the change in noise levels is determined to be not significant.

8.5.2 Construction Phase - Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given the minimal level of ground-breaking and excavations required. There is potential for piling to be used for building and basement foundations. For the purposes of this assessment the expected vibration levels during piling assuming augured or bored piles have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: *Vibration*, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

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

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

In this instance, taking account of the distance to the nearest sensitive off-site buildings, vibration levels at the closest neighbouring buildings are expected to be orders of magnitude below the limits set out in Table 8.6 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants. The potential vibration impact during the construction phase is of short-term, neutral and imperceptible impact.

8.5.3 Operational Phase - Noise

The main potential noise outward noise impact to the surrounding will any changes in traffic flows along the local road network and any operational plant noise associated with development buildings. Potential impacts from these sources are discussed below.

Building Services Plant

It is expected that the principal items of building and mechanical services plant will be associated with the retail units and potentially from the childcare facility. Depending on the operational requirements, plant items will typically be located within dedicated plant rooms with ventilation to atmosphere or will be located externally. Depending on the plant use (e.g. heating/ cooling etc), there may be a requirement for operational items of plant to operate over day and night-time periods.

Given the development is substantially residential, the nearest noise sensitive locations are those within the development itself. The site layout and selection of plant will be designed so that there is no negative impact on noise sensitive locations within the development buildings. Operational plant noise levels at noise sensitive locations within the development will be controlled to ensure the internal noise levels included within Table 8.8 will not be exceeded.

Noise levels associated with services plant at the existing noise sensitive locations outside the development boundary will controlled to ensure compliance with BS 4142 (2014) such that adverse impacts are avoided. The results of baseline surveys of the prevailing background sound level will be used to set appropriate operational limit values. Based on the survey results undertaken at Locations N1 to N4, cumulative noise levels associated with mechanical and electrical services at the nearest noise sensitive locations will be controlled to not exceed a total noise level of 40dB $L_{Aeq, T}$ during both day and night-time periods.

Additional Vehicular Traffic on Surrounding Roads

A traffic impact assessment has been undertaken by DBFL engineers. A number of traffic links were assessed to determine the increase in traffic leading from the site entrance onto the local road network. This information has been reviewed to assess any change in noise levels as a result of increased traffic flows.

The assessment has concluded that once operational, the development will not generate significant traffic volumes onto the surrounding road network. The maximum increase in traffic flows is calculated along Burgage Crescent to the north east of the development where a total of approximately 241 additional vehicles over a 24-hour period is expected. The calculated change in noise levels along this line is 1.9dB(A) during the design year of 2035. A change in noise level of this magnitude is negligible and is Not Significant in accordance with the impact definitions in Table 8.7.

Along all other surrounding roads assessed, the increase in traffic noise is below 1dB(A). In terms of noise impacts, the magnitude of change in traffic flows would result in a negligible increase. The noise impact of traffic volumes accessing the site onto the surrounding network is determined to be long term, not significant.

There are no significant vibration sources associated with the operational phase.

8.6 Do Nothing Scenario

Should the development not proceed, the existing noise climate will remain nominally unchanged. The baseline noise survey results discussed within Section 8.3 are representative of noise levels in the surrounding environment and are considered representative of the Do Nothing Scenario.

8.7 Mitigation Measures

8.7.1 Construction Phase

With regard to construction activities, best practice control measures from construction sites within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2 will be used to control noise and vibration impacts. The developer will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during site preparation works and piling works.

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling or breaking works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to ensure noise limits are not exceeded due to cumulative activities.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include but are not limited to the following

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the developer will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise*;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;

- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Establishing channels of communication between the developer, South Dublin County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration, and;
- The developer appointing a Site Environmental Manager (SEM) responsible for matters relating to noise and vibration.

8.7.2 Operational Phase

At the detailed design stage, the plant items associated with any of the retail units, childcare facility or other ancillary areas with mechanical or electrical service requirements shall be selected to ensure that the noise criteria are not exceeded either at the residential dwellings within the development itself and at the nearest noise sensitive locations external to the site. Noise mitigation measures shall be provided (where required) to ensure that noise impacts are acceptable. These will typically include:

- selecting plant items with low noise operational levels;
- siting items of plant away from noise sensitive boundaries, and;
- screening and acoustic attenuation measures.

Noise mitigation measures with respect to the traffic from the development are not deemed necessary.

8.8 Residual Impacts

8.8.1 Construction Phase

During the construction phase of the project there is the potential for moderate impacts on nearby noise sensitive properties due to noise emissions from site activities at the immediate site boundaries. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact will have a **negative, moderate** to and **short-term** impact on the surrounding environment.

8.8.2 Operational Phase

The predicted change noise levels associated with additional traffic is predicted to be of imperceptible impact along the existing road network. In the context of the existing noise environment, the overall contribution of induced traffic is considered to be of **neutral, imperceptible** and **long-term** impact to nearby residential locations.

Noise levels associated with operational plant are expected to be well within the adopted day and night-time noise limits at the nearest noise sensitive properties taking into account the site layout and development type which is largely residential. Any plant associated with retail units will be controlled to ensure a neutral noise impact in accordance with BS 4142. Assuming the operational noise levels do not exceed the adopted design goals, the resultant residual noise impact from this source will be of **neutral, minor, long term** impact.

8.9 Interactions Arising

With consideration of the proposed noise and vibration mitigation measures, there are no significant noise or vibration impacts anticipated as a result of the operational phases of the proposed development.

There may be some significant impacts in terms of construction noise to residences located at distances of less than 25m from site works, however noise mitigation measures have been proposed in order to reduce impacts as far as is reasonably practical.

There is the potential for Noise and Vibration arising from the subject scheme to interact with other aspects of the environment, particularly Traffic and Transportation and Population and Human Health. It is considered, however, that the implementation of the mitigation measures described above will neutralise the potential for interactions between these aspects of the environment.

8.10 Monitoring

8.10.1 Construction Phase

The developer will be required to ensure construction activities operate within the noise limits set out within Table 8.5. The developer will be required to undertake regular noise monitoring at locations representative of the closest sensitive locations to ensure the relevant criteria are not exceeded.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise*.

8.10.2 Operational Phase

Noise and vibration monitoring is not deemed necessary during the operational phase of the development

8.11 References

- EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (EPA, 2003);
- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017);
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015);
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1 – Noise.

- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2 – Vibration.
- BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration;
- BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound;
- DMRB, volume 11 environmental assessment section 3 environmental assessment techniques Part 7 hD 213/11 – revision 1 noise and vibration
- ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.
- ISO 9613-2: 1996: Acoustics – Attenuation of sound during propagation outdoors.