12 AIR (NOISE & VIBRATION)

12.1 Introduction

Planning permission is being sought for a residential development at Kilcarbery, Co. Dublin. This section of the EIAR has been prepared by AWN to assess the likely noise and vibration impact of the proposed development in the context of current relevant standards and guidance. This assessment has been prepared by Leo Williams BA BAI MAI AMIOA, Acoustic Consultant at AWN Consulting who has over 4 years' experience as an environmental consultant specialising in Acoustics, Impact Assessment and Management.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the subject site and 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. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

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

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), and;
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

12.2 Assessment Methodology

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken across the development site to determine the range of noise levels from road and aircraft at varying locations across the site;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- 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 phase of the development at the most sensitive locations surrounding the development site;
- An inward noise impact from existing road and air noise sources on the proposed 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.

12.3 Receiving Environment

An environmental noise survey was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: Acoustics – Description, Measurement and Assessment of Environmental Noise. Specific details of works carried out are described below.

12.3.1 Survey Details

12.3.1.1 Dates & Times of Surveys

Measurements were undertaken to quantify the existing noise environment in the vicinity of the nearest noise sensitive locations.

Noise measurements were conducted over the following periods:

- Daytime – 4 December 2018; and,
- Night-time – 25 to 26 February 2019.

12.3.1.2 Personnel & Instrumentation

The noise measurements were performed using the following equipment. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

12.3.1.3 Measurement Locations

Three measurement locations were selected and are described in turn below and also shown on Figure 12.1.

Location NM1: was located to the rear of residential properties in the north of the site.

Location NM2: was located inside the west boundary of the site.

L**ocation NM1 proxy**: was located outside the northern site boundary.

Location NM2 proxy: was located set back from the roadside outside the north western site boundary.

Figure 12.1: Noise Survey Locations (Source: Google Earth)

12.3.1.4 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. It is typically used as a descriptor for ambient noise.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

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

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

12.3.1.5 Survey Results and Discussion

The survey results for Location NM1 and NM1 proxy (night) are given in Table 12.1.

Measurement Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A90}
14:09	57	63	52	54
14:24	59	70	54	56
23:03	47	57	39	42
23:42	44	54	39	42

Table 12.1: Summary of Results for Location NM1

The noise environment at the measurement location comprised distant traffic noise, birdsong, aircraft noise and dogs barking. A loud siren to the south was heard during the second measurement. Daytime noise levels were in the range from 57 to 59dB $L_{Aeq,15min}$ and 54 to 56dB $L_{A90,15min}$. Night time noise levels were dominated by distant traffic noise on the R136. An aircraft movement was observed. Measured levels were in the range of 44 to 47dB $L_{Aeq,15min}$ and 42dB $L_{A90,15min}$.

The survey results for Location NM2 and NM2 proxy (night) are given in Table 12.2 below.

Measurement Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A90}
14:50	63	67	56	60
15:06	63	67	56	60
23:23	63	80	44	49
00:03	64	81	44	51

Table 12.2: Summary of Results for Location NM2

The noise environment at the measurement location comprised traffic noise from the R136 and distant traffic noise, birdsong. Daytime noise levels were of the order of 63dB $L_{Aeq,15min}$ and 60dB $L_{A90,15min}$. Night time noise levels were dominated by vehicles on the adjacent R136 road. Measured levels were in the range of 63 to 64dB $L_{Aeq,15min}$ and 49 to 51dB $L_{A90,15min}$.

12.4 Characteristics of the Proposed Development

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.

12.4.1 Proposed Development

The proposed development comprises some 1,034no. residential units, houses and apartments. Full details of the proposed development will be included in Chapter 3: Description of Proposed Development.

12.4.1.1 Construction Stage

During the construction phase the main site activities will include, site clearance, demolition of existing buildings, building construction, road works, and landscaping. This phase has the greatest potential for noise and vibration impacts on the surrounding environment, however this phase will be of short term impact.

Whilst no specific construction noise limits are set by SDCC with respect to noise, the Dublin Agglomeration Noise Action Plan 2018 to 2023 refers to the use of BS 5228:2009+A1: 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites 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.

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

The closest neighbouring noise sensitive properties to the proposed development are the residential dwellings to the north and east of the site, which are located approximately 10m from the site boundary at their closet point.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.3 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors.

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

Table 12.3: Example Threshold of Significant Effect at Dwellings

Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined and rounded to the nearest 5dB. Baseline monitoring carried out as part of this assessment would indicate that Category A values are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. Taking account of the measured ambient noise levels, the recommended daytime noise level for construction noise is 65dB $L_{Aeq,T.}$

In terms of vibration, British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration 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. Taking the above into consideration the vibration criteria in Table 12.4 are recommended.

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

Table 12.4: Recommended Vibration Criteria During Construction Phase

12.4.1.2 Operational Stage

Section 11.6.3 of the South Dublin County Council Development Plan (2016-2022) provides the following discussion in relation to *Environmental Hazard Management*: -

"(ii) Noise

The Planning Authority will have regard to the Dublin Agglomeration Environmental Noise Action Plan 2013 – 2018, Dublin Local Authorities (2013) when assessing development proposals along major road and rail transport corridors, with a view to reducing noise from new sources and to identify and protect areas of low sound levels.

Development proposals with the potential to give rise to significant noise impacts may require a Noise Impact Assessment and mitigation plan to minimise noise disturbances and protect the amenities of the area.

The Planning Authority will carefully consider the location of noise sensitive developments so as to ensure they are protected from major noise sources where practical. Furthermore, the provision of appropriate mitigation measures for existing areas adjacent to major noise sources is supported and will be considered having regard to the visual amenity and the proper planning and sustainable development of the area."

In summary, this guidance calls for developments to have a good level of sound insulation in accordance with best Irish practice. There is no Irish standard guidance that is directly applicable to this scenario, hence it is proposed to make reference to best practice international guidance (i.e. BS8233:2014, for example) for the purposes of arriving at appropriate design goals.

Section 6.2.1 of the Dublin Noise Action Plan provides some discussion of external noise levels that are considered to be desirably low and undesirably high, as below: -

"6.2.1 Areas with desirable low and undesirable high sound levels

Following a review of existing guidance, as outlined in Chapter 2, and of the levels set the previous noise action plan, the following are the proposed thresholds for desirable low and undesirable high sound levels:

Desirable Low Sound levels

- *< 50 dB(A) Lnight*
- *< 55 dB(A) Lday*

Undesirable High Sound levels

- *> 55 dB(A) Lnight*
- *> 70 dB(A) Lday"*

It should be understood however that the above thresholds are not indicative of external noise levels above which planning permission should not be granted for a development. The Undesirably High Sound Levels do however signify that noise mitigation measures should be provided in order to achieve suitable internal noise levels within dwellings.

BS8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings* sets out recommended internal noise levels for several different building types from external noise sources such as road traffic noise. BS8233:2014 guidance is primarily for use by designers and hence may be used as the basis for an appropriate schedule of noise control measures. The recommended internal noise levels for residential developments are set out below. Note that these values are also referenced within the *SDCC Noise Control Pre Planning Guidance* document published in August 2017.

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

Table 12.5: Indoor Ambient Noise Levels for Dwellings from BS8233:2014

In review, the following daytime and night time internal noise criteria are proposed:

- Daytime (07:00 to 23:00hrs) Living Rooms and bedrooms: 35 to 40dB $L_{Aeq,16hrs}$, and;
- Night-time (23:00 to 07:00hrs) Bedrooms: 30dB $L_{Aeq,8hrs}$.

In relation to noise levels in external amenity areas, BS 8233 provides the following guidance: -

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

As such it is acknowledged that noise levels in external amenity areas would ideally be maintained below 50-55dB L_{Aeq}, however in instances where this is not possible, noise mitigation measures should be provided in order to reduce external noise emissions to the lowest practicable level.

Additional Road Traffic on Public Roads

In order to consider the potential noise impact associated with the proposed development introducing additional traffic onto the existing road networks, and given that vehicle movements on public roads are assessed using a different parameter (the ten percentile noise level; L_{A10}), it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development in terms of the L_{A10} parameter.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 12.6 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2011).

Change in Sound Level (dB LA10)	Subjective Reaction	DMRB magnitude of Impact	EPA Classification Magnitude of Impact
0	Inaudible	No Change	Neutral
0.1 – 2.9	Barely Perceptible	Negligible	Imperceptible
3 – 4.9	Perceptible	Minor	Slight
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate
10+	Doubling of loudness and above	Major	Significant

Table 12.6: Likely Impact Associated with Change in Traffic Noise Level.

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

Mechanical Plant

Taking into consideration the internal criteria noted previously in Table 12.5, it is necessary to set an external noise level. This is done by factoring in the degree of noise reduction afforded by a partially open window, which is typically in the range of 10 to 15dB. Using the lower value as a conservative basis, and taking into account the pre-existing background noise environment measured at the nearest noise sensitive locations, external noise levels of 55 and 45dB $L_{Aeq,T}$ are considered appropriate for day and night-time periods respectively. The time period for day-time noise levels has been set over a 1-hour period to provide a robust criterion. Given the higher sensitivity of people to noise at night, the time period for night-time levels is set as 15mins. In this instance, the following criteria relate to the nearest noise sensitive properties external to the site.

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

12.5 Potential Impact of the Proposed Development

12.5.1 Proposed Development

12.5.1.1 Construction Stage

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators.

Typical general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays.

Construction Activity Onsite

A variety of items of plant will be in use for the purposes site clearance/groundworks and construction. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

During the construction phase, it is anticipated that there will be a number of HGV's to/from site. Excavators will be employed to move existing ground and then standard construction tools and methods will be employed for general construction and landscaping. It is possible to predict indicative noise levels using guidance set out in BS 5228-1:2009+A1:2014 for the main phases of the proposed construction works. Table 12.7 summarises the construction noise prediction calculations at some nominal distance (i.e. 60m and 100m distances). While the site boundary is at its closest point some 10m from neighbouring noise sensitive locations, the majority of the site works will take place at greater distances due to the size of the development site.

Construction Phase	Item of Plant (*BS 5228-1:2009+A1:2014* Ref)	BS5228 Reference Noise Level dB L_{Aeq} at 10m	Predicted at Receiver (60m distance) dB L_{Aeq}	Predicted at Receiver (100m distance) dB L_{Aeq}
Site Clearance/ Groundworks	Tracked excavator (C2.21)	71	49	44
	Dump Truck (C2.30)	79	57	52
	Telescopic Handler (C4.54)	79	57	52
	Tracked Mobile Crane (C4.50)	71	54	49
	Diesel Generator (C4.76)	61	39	34
	Total Site Clearance		**60**	**57**
General Construction	Dump Truck (D2.30)	79	57	52
	Tracked excavator (D2.21)	71	49	44
	Compressor (D7.08)	70	48	43
	Telescopic Handler (D4.54)	79	57	52
	Hand Held Circular Saw (D4.72)	79	57	52
	Diesel Generator (D4.76)	61	39	34
	Internal Fit out	70	53	48
	Total General Construction		**62**	**58**
Road Works/ Landscaping	Asphalt Paver & Tipping Lorry (D5.30)	75	53	48
	Electric Water Pump (D5.40)	68	46	41
	Vibratory Roller (D5.20)	75	53	48
	Total Landscaping and Road Works		**56**	**52**

Table 12.7: Typical Noise Levels Associated with Construction Plant Items.

The predicted noise levels detailed in the above table indicate that for the likely range of the works, construction activities can operate within the limits outlined in Section 12.4.1.1.

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

Construction Traffic Offsite

Access routes to and from the site, delivery times and off-loading proposals will be formally agreed with the Local Authority. Peak traffic flows during the construction phase will occur during the excavation phase. During the busiest period, a maximum of 200 lorries into and out of the site per day are anticipated. Vehicle movements will be planned to ensure arrival and departure times are maintained inside the agreed working hours.

Assuming all construction traffic travels along the R136 to the North or to the South, this would add an additional 400 HGV movements per day along this road.

Baseline traffic counts 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. Table 12.8 summarises the increase in noise levels associated with the additional HGV traffic assuming 100% of traffic travels either east or west of the site entrance.

Road	Base Traffic Flow (AADT)	Base HGV No's	Construction Traffic / day	Increase in Noise Levels, dB
R136	30,403	1,064	400	<1.0

Table 12.8: Construction Traffic Noise Assessment

Reference to Table 12.6 confirms that the addition of construction traffic to the existing traffic volumes are less than 1dB(A) which is just perceptible and of negligible impact. During the remaining construction periods, HGV volumes will be further reduced and hence no additional noise impacts are predicted.

Vibration

With consideration of the distance from site boundaries to nearby sensitive receptors, and the anticipated methods for constructing building foundations and for general construction, it is expected that vibration emissions to nearby receptors will not be significant.

12.5.1.2 Operational Stage

Outward Noise Impact

A traffic impact assessment relating to the proposed development has been prepared by DBFL as part of this EIAR. Information from this report has been used to determine the predicted change in noise levels in the vicinity of a number of roads in the area surrounding the proposed development, for the opening and design years.

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development. Traffic flow data in terms of the AADT figures has been assessed and the calculated change in noise levels during these two periods are summarised in Tables 12.9 and 12.10.

Road	Opening Year (2020) AADT		Change in Noise Level dB (A)
	Without Development	With Development	
R136 (North of junction)	31,262	31,368	0.0
R136 (South of junction))	35,849	35,999	0.0
Old Nangor Road (East)	1,762	1,941	+0.4
Old Nangor Road (West)	463	463	0
R134/Nagor Rd Connector Rd	2242	2554	+0.6

Table 12.9: Change in Traffic Noise Levels with Proposed Development – Opening Year.

Road	Design Year (2035) AADT		Change in Noise Level dB (A)
	Without Development	With Development	
R136 (North of junction)	36,046	36,603	0.1
R136 (South of junction))	41,324	42,124	0.1
Old Nangor Road (East)	2,007	2,961	+1.7
Old Nangor Road (West)	534	534	0
R134/Nagor Rd Connector Rd	2527	4196	+2.2

Table 12.10: Change in Traffic Noise Levels with Proposed Development - Design Year

The predicted increase in traffic noise levels associated with the development is less than 3dB in the vicinity of the majority of roads for both the opening and design years. Making reference to Table 12.6 confirms that this increase is barely perceptible and the resultant impact is negligible.

In summary, the predicted increase in noise levels associated with vehicles at road junctions in the vicinity of the proposed development is of ***long-term***, ***imperceptible*** impact.

During the operational phase, there will be a variety of mechanical plant that will be required to service the community centre and creche within the development, some of which will have the possibility of emitting noise to the surroundings. It is assumed noise emission levels from the development will be linked to the hours of occupancy of the various buildings meaning that noise emissions will reduce to minimal levels during the most sensitive periods (i.e. at night time).

The selection of mechanical plant emitting to atmosphere will be selected and controlled during the detailed design such that it does not exceed the criteria discussed in Section 12.4.1.2 at noise sensitive receivers within the development itself, therefore it is expected that there will be no impact at noise sensitive receivers offsite, that are further away.

Inward Noise Impact

The development lands in question are located in proximity to the R136 main road which runs along the western boundary of the site. The site is also located some 1.3km north east of Casement Air Base. Noise from road traffic and aircraft movements has the potential to impact on residential within the proposed development.

Existing Noise Climate

The existing noise climate within the development lands have been surveyed and the results summarised in Section 12.3.1.4. The survey indicated that road traffic noise contributes significantly to the prevailing noise environment across the development site.

Road Traffic Noise

In order to determine the inward noise impact for noise sensitive properties proposed as part of the development, it is necessary to determine the internal noise levels within the proposed buildings. These can then be compared against appropriate internal noise criteria from BS 8233, as summarised in Section 12.4.1.2 (Table 12.5).

It is possible to calculate internal noise levels within the residential properties proposed within the site, taking account of the existing noise environment, proposed constructions and the relevant sound insulation provided by the building elements (i.e. walls, roof, glazing etc.).

Aircraft Noise

Due to the proximity of the proposed site to Casement Aerodrome and various associated flight paths, the potential for inward impact of aircraft noise has been considered here.

The airfield is in operation 24 hours a day, 365 day a year and subject to operational requirements. Aircraft types range from rotary light aircraft, heavy and fixed wing and heavy weight aircraft.

Detailed information on the current operation of Casement Aerodrome was not available, however, based on information in the public domain it is understood that over 21,000 movements are recorded annually. AWN understand that typically 10-15% of aircraft movements took place during the more sensitive night time period (23:00hrs to 07:00hrs), which amounts to numbers of the order of 9 aircraft movements per night per day.

The figure below illustrates Runway 05 and Runway 23 which are orientated in the direction of the proposed site. It is understood that aircraft using these runways amount to some 50% of aircraft movements annually to Casement Aerodrome.

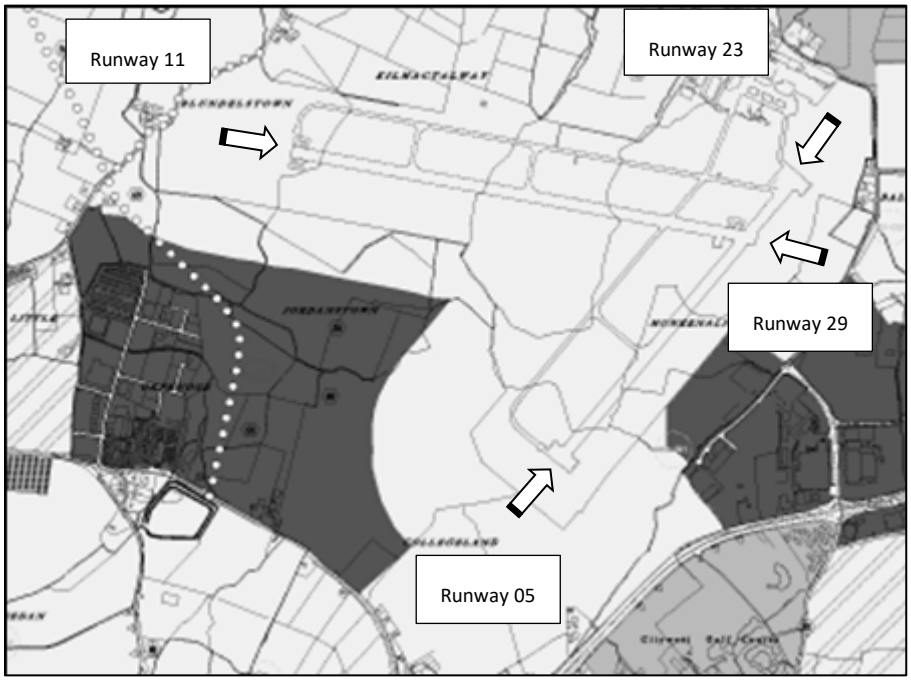

Figure 12.2: Casement Aerodrome

During the attended daytime noise surveys one aircraft movement was observed. It was faintly audible and was not the dominant noise source at the time. It is likely that other aircraft movements occurred but were not readily discernible.

Similarly during the night time survey no aircraft movements were discerned. Again it is possible that aircraft movements were taking place but these were not contributing such a noise level as to be audible in the existing noise environment. As such it is considered that standard building constructions would provide adequate sound insulation to the intrusion of any aircraft noise, without the need for mitigation measures.

Predicted Façade Noise Levels

The noise level incident on the closest proposed building façade has been predicted based on the baseline measured noise levels, for daytime and night time periods. Taking into account the measured noise levels and the attenuation of sound over distance the following noise levels have been predicted at the nearest proposed façade: -

Location	Period	Predicted Noise Level (dB L_{Aeq})
Nearest Proposed Façade – Western Boundary	Daytime	67
	Night time	51

Table 12.11: Predicted Facade Noise Levels

12.5.1.3 Do-Nothing Impact

The existing noise climate will remain unchanged on site and at nearby noise sensitive locations.

12.6 Ameliorative, Remedial or Reductive Measures

12.6.1 Proposed Development

12.6.1.1 Construction Stage

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

- selection of quiet plant;
- noise control at source;
- screening, and;
- liaison with the public.

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise and vibration monitoring. This will specifically be required to protect neighbouring sensitive location during the demolition works.

Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

Noise Control at Source

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

Referring to the key noise generating sources during the construction phases, the following best practice migration measures should be considered:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, maintaining enclosure panels closed during operation can reduce noise levels over normal operation. Mobile plant should be switched off when not in use and not left idling.

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

Screening

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

Liaison with the Public

A designated noise liaison officer will be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, prior to particularly noisy construction activity, e.g. demolition, breaking, piling, etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

12.6.1.2 Operational Stage

Outward Noise Impact

The noise impacts on the surrounding area as a result of the operation of the proposed development are minor and no mitigation is required.

Inward Noise Impact

The facades highlighted in Figure 12.3 and Figure 12.4 overleaf will be provided with upgraded glazing that achieves the minimum sound insulation performance as set out in the Table 12.12 below.

Glazing Specification	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
Red	26	28	38	47	43	51	40
Elsewhere	22	20	26	34	46	39	32

Table 12.12: Sound Insulation Performance Requirements for Glazing, SRI (dB)

The upgraded glazing and ventilation is specified for the most exposed facades, i.e. those facing the R136 road. These facades are highlighted red in the figure below. All other facades require standard glazing. Upgraded ventilators are specified for these highlighted facades.

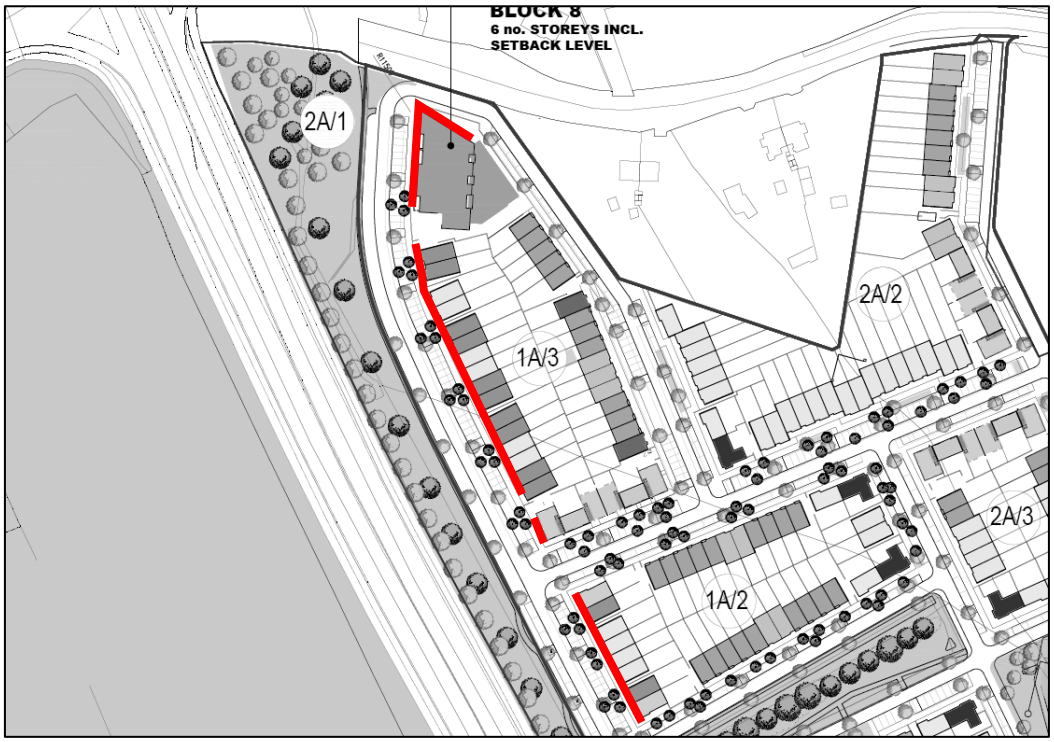

Figure 12.3: Northern Sector of Site

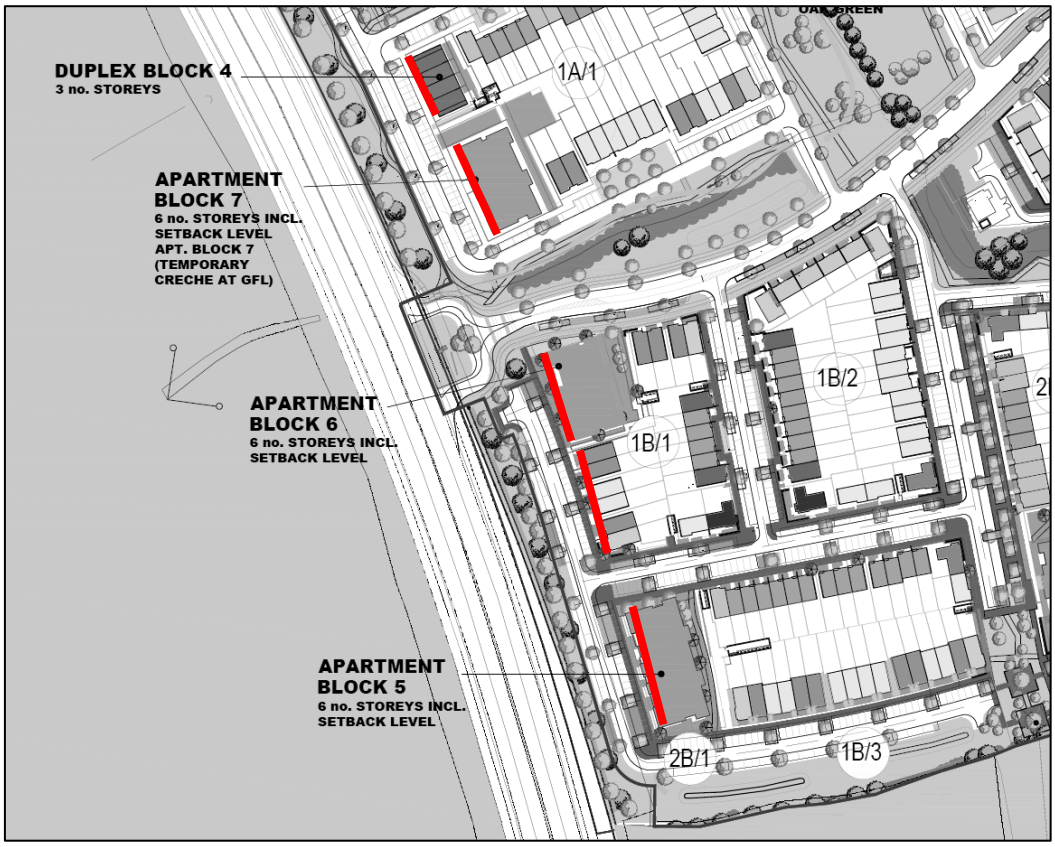

Figure 12.4: Southern Sector of Site

The overall R_w outlined above are provided for information purposes only. The over-riding requirement is the Octave Band sound insulation performance values which may also be achieved using alternative glazing configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 8.12 or greater.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

In addition, any background ventilators through the façade, e.g. trickle vents, will be selected to achieve an acoustic performance of at least 36dB $D_{ne,w}$ when in the open position for those facades identified in Figure 12.3 and 12.4.

With these measures in place the internal noise levels within those proposed buildings most exposed to environmental noise from the R136 will achieve the criteria outlined in Table 8.5 when the windows are closed and the ventilators are open.

12.7 Residual Impact of the Proposed Development

12.7.1 Proposed Development

12.7.1.1 Construction Stage

During the construction phase of the project there will be some small impact on nearby residential properties due to noise emissions from site traffic and other activities. The application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum.

12.7.1.2 Worst Case Impact

The construction noise calculations have been carried out with worst case scenarios considered, such as extended on times and combinations of plat items operating simultaneously.

12.7.2 Operational Stage

The predicted noise level associated with additional traffic is predicted to be of insignificant impact along the existing road network. In the context of the existing noise environment, the overall contribution of traffic is not considered to pose any significant impact to nearby residential locations. It can be concluded that, once operational, noise levels associated with the proposed development will not contribute any significant noise impact to its surrounding environment.

Furthermore, the internal noise environment within the proposed residential units and the corresponding external amenity space will be, once mitigation is implemented, within the recommended levels for good residential amenity.

The resulting impact is of neutral, long-term and not-significant.

12.7.2.1 Worst Case Impact

A worst case scenario has been considered during the traffic noise assessment since future traffic flows have been used which includes other developments and future growth.

It is expected that plant items will operate during the operational hours of the community facilities however in the case that these operate at night time a criterion has been set for the night time period. Plant items will be designed and controlled in order to meet the relevant criteria.

12.7.3 Cumulative Impact

If additional large scale developments are proposed in the future, in the vicinity of the proposed development, this has the potential to add further additional vehicles to the local road network. However, it is unlikely that other future developments of similar scale would give rise to a significant impact during the construction and operational stages of those projects.

Future projects of a large scale would need to conduct an EIAR to ensure that no significant impacts associated with noise and vibration will occur as a result of those developments.

12.8 Monitoring

12.8.1 Proposed Development

12.8.1.1 Construction Stage

The contractor will be required to ensure construction activities operate within the noise limits set out within Table 12.3. The contractor 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: 2017: Acoustics – Description, measurement and assessment of environmental noise.

12.8.1.2 Operational Stage

Noise or vibration monitoring is not required once the development is operational.

12.9 Reinstatement

Not Applicable.

12.10 Difficulties Encountered

No difficulties were encountered during the preparation of this Chapter.