

15.0 NOISE AND VIBRATION

15.1 INTRODUCTION

This chapter of the EIAR has been prepared to assess the potential noise and vibration impact of the proposed development in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation. Where relevant, the potential cumulative impact of the development has been assessed.

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15.2 ASSESSMENT METHODOLOGY

The study has been undertaken using the following methodology:

- 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;
- Baseline noise monitoring has been undertaken at the development site in order to characterise the existing noise environment;
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the project at the nearest sensitive locations (NSL's) to the site (NSL's ref. Figure 15.1);
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the development site, and;
- A schedule of mitigation measures has been proposed to reduce, where necessary, the identified potential impacts relating to noise and vibration to and from the proposed development.

In the first instance, the relevant noise & vibration criteria for the development's construction and operational phases, along with the methodology for conducting baseline noise surveys, have been outlined.

15.2.1 Terminology for Potential Impacts

During the construction phase, the range of activities with potential to generate noise and vibration emissions to off-site sensitive receptors will include site preparation works, construction of the proposed development and erection of any temporary buildings/compounds that may be required.

During the operational phase, the potential sources of noise are those associated with additional vehicular traffic on public roads and potential noise from the proposed pumping station.

The relevant impacts associated with the construction and operational phases are addressed in the following sections.

The significance of impacts has been assessed in accordance with the EPA *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR), Draft, August 2017., see Tables 15.1 to 15.3. With regard to the quality of the impact, ratings may have positive, neutral or negative applications where:

Quality of Impact	Definition
Negative/adverse Effects	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Positive Effects	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).

Table 15.1- Quality of Potential Impacts

The significance of an impact on the receiving environment are described as follows:

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

Table 15.2- Significance of Impacts

The duration of impacts as described in the EPA Guidelines are:

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

Table 15.3- Duration of Impacts

Noise and vibration emissions from the development will vary both in terms of duration and magnitude. The following sections analyse the expected construction and operational phase noise and vibration impacts both in terms of the proposed assessment criteria and the expected impacts in terms of the significance effects.

15.2.2 Construction Phase Noise & Vibration Criteria

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. Dún Laoghaire-Rathdown County Council (DLRCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

Noise

Whilst no specific construction noise limits are set by DLRCC with respect to noise, the Dublin Agglomeration Noise Action Plan 2013 to 2018 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 existing 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 locations (NSL's) to the proposed development are the residential dwellings primarily to the north and northwest of the site. The distance between the construction site and nearby NSL's varies, the closest distance between the site and existing dwelling will be approximately 10 metres but generally construction works will occur between 20 and 400 metres from existing dwellings, depending on the location where specific works are occurring.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 15.4 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 15.4- Example Threshold of Significant Effect at Dwellings

- A. Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
- B. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
- C. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
- D. 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 $L_{Aeq,12hr}$** . It is assumed that construction works will take place during normal daytime working hours only.

Vibration

In terms of vibration, BS 5228-2:2009+A1:2014 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 15.5 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
15 mm/s	20 mm/s	50 mm/s

Table 15.5- Recommended Vibration Criteria During Construction Phase

15.2.3 Operational Phase Noise & Vibration Criteria

Noise

Due consideration must be given to the nature of the primary noise sources when setting criteria. Criteria for noise from these sources, with the exception of additional vehicular traffic on public roads, will be set in terms of the $L_{Aeq,T}$ parameter (the equivalent continuous sound level).

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.

Plant Noise Levels

Guidance on noise emissions from mechanical plant items has been taken from British Standard BS4142:2014: *'Methods for Rating and Assessing Industrial and Commercial Sound'*. This document is the industry standard method for analysing building services plant sound emissions to residential receptors.

BS4142:2014 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS4142:2014 assessment it is necessary to compare the measured external background sound level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the plant items, when operational. Where sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS4142:2014 advises that penalties be applied to the specific level to arrive at the rating 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 15.6 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2011).

Change in Sound Level (dB L_{A10})	Subjective Reaction	Impact
< 3	Inaudible	Imperceptible
3 – 5	Perceptible	Slight
6 – 10	Up to a doubling of loudness	Moderate
11 – 15	Over a doubling of loudness	Significant
> 15		Profound

Table 15.6- Likely impact associated with change in traffic noise level

Table 15.6 has presented 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 Table 15.7 for consistency in wording and terminology for the assessment of impact significance.

Change in Sound Level DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Moderate
10.0 or more	More than a doubling or halving of loudness	Major	Significant, Very Significant, Profound

Table 15.7- Likely impact associated with change in traffic noise level (Updated)

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.

Vibration

No significant sources of vibration are expected to arise during the operational phase of the development. Operational vibration has therefore not been addressed further in this chapter.

15.2.4 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 appointed contractor 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 are expected from 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.

15.2.5 Baseline Noise Survey Methodology

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 1996-2:2017 '*Acoustics – Description, Measurement and Assessment of Environmental Noise*'. Specific details are set out below.

Monitoring Locations

The selected measurement locations are shown in Figure 15.1 and described below.

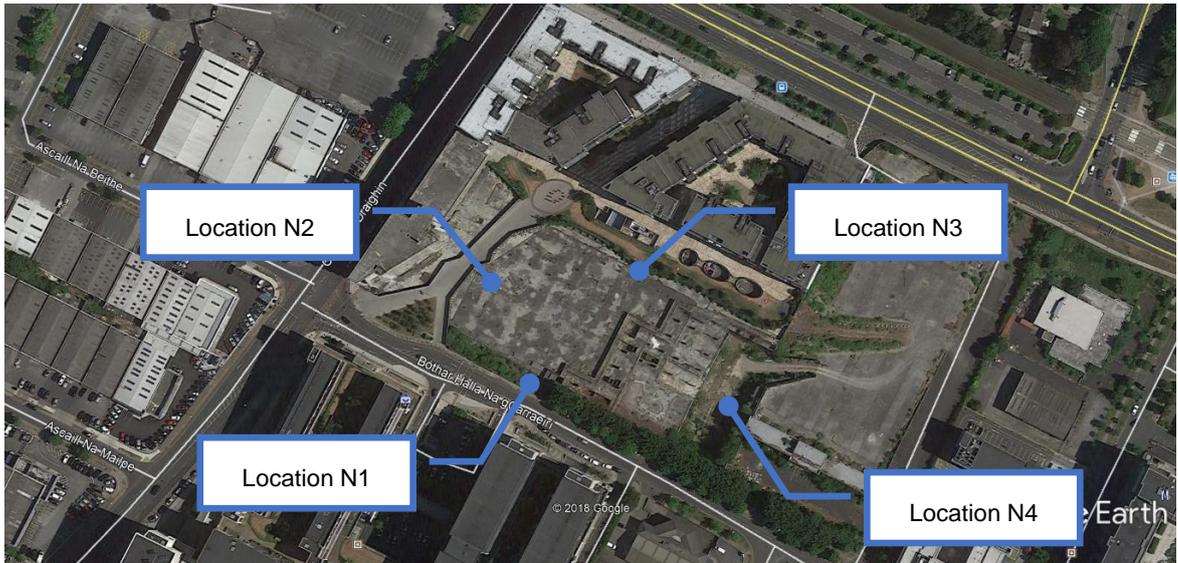


Figure 15.1- Existing Site and Baseline Noise Monitoring Locations (Imagery: Google Earth)

- **Location N1** is located along the southern boundary of development site adjacent to Carmanhill Road. Measurements at this location were conducted at first floor (approx. 3.8m) height and consisted of unattended monitoring for an approx. 10-day period. Figure 15.2 shows the location of the baseline noise monitor installed at this location



Figure 15.2- Noise Monitoring Location N1

- **Location N2** is located along north-western boundary of the development site in proximity to nearby residential apartments. Measurements at this location were attended during daytime hours and were conducted at ground level.
- **Location N3** is located along the northern boundary of the development site in proximity to nearby residential apartments. Measurements at this location were attended during daytime hours and were conducted at ground level.

- **Location N4** is located along the western boundary of the development site. Measurements at this location were attended during daytime hours and were conducted at ground level.

Survey Periods

Noise measurements were conducted at Location N1 between 10:30hrs on 5 October to 01:15hrs on 15 October 2018. The weather during the survey period was generally dry and calm with the exception of periods between 7th and 9th October and the night of 11/12 October, during which time there were elevated periods of wind. For the purposed of data analysis, the periods of elevated wind have been omitted.

Instrumentation

AWN Consulting installed and removed the sound level meter. Measurements were made using a Larson Davis 831 Sound Level Meter and a Larson Davis EPS2116 Environmental Monitoring Kit. Sample periods were 5-minute during the survey period. Before and after the survey the instrument was check calibrated using a Brüel and 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_{AFmax}	is the instantaneous maximum sound level measured during the sample period.
L_{AFmin}	is the instantaneous minimum sound level measured during the sample period.
L_{AF10}	is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
L_{AF90}	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 2×10^{-5} Pa.

15.3 RECEIVING ENVIRONMENT

15.3.1 Location N1

Table 15.8 presents a summary of the average daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels measured at Location N1.

ISO 1996-2:2017 requires general dry, calm weather conditions for measurements to be considered valid. Any periods of adverse weather have therefore been identified and omitted from the study, in accordance with best practice.

Day / Date	Period	Measured Noise Levels (dB re. 2×10^{-5} Pa)				
		L _{Aeq} ¹	L _{Amax} ²	L _{Amin} ³	L _{A10} ⁴	L _{A90} ⁵
Fri 05 Oct	Day / Evening	55	88	38	57	49
Fri/Sat 05-06 Oct	Night-time	46	69	33	48	38
Sat 06 Oct	Day / Evening	54	80	39	56	48
Sat/Sun 06-07 Oct	Night-time	45	64	34	48	40
Sun 07 Oct	Day / Evening	Data omitted due to adverse weather				
Sun/Mon 07-08 Oct	Night-time					
Mon 08 Oct	Day / Evening					
Mon/Tue 08-09 Oct	Night-time					
Tue 09 Oct	Day / Evening	56	85	37	57	51
Tue/Wed 09-10 Oct	Night-time	46	65	31	45	38
Wed 10 Oct	Day / Evening	55	78	43	57	52
Wed/Thu 10-11 Oct	Night-time	47	65	34	48	41
Thu 11 Oct	Day / Evening	56	81	44	58	52
Thu/Fri 11-12 Oct	Night-time	Data omitted due to adverse weather				
Fri 12 Oct	Day / Evening	57	85	43	58	53
Fri/Sat 12-13 Oct	Night-time	46	66	32	48	41
Sat 13 Oct	Day / Evening	55	78	41	57	50
Sat/Sun 13-14 Oct	Night-time	46	64	35	48	40
Sun 14 Oct	Day / Evening	52	76	37	54	47
Sun/Mon 14-15 Oct	Night-time	45	63	33	47	38

Table 15.8- Baseline Noise Levels at Location N1

During the survey period, the dominant intermittent noise source was road traffic and birdsong. Other sources of intermittent noise included road traffic on the adjacent road network and occasional distant aircraft.

¹ Represents the logarithmic average of the 15-minute noise measurements over the sample period.

² Represents the highest measured L_{AFmax} noise measurement over the sample period.

³ Represents the lowest measured L_{AFmin} noise measurement over the sample period.

⁴ Represents the arithmetic average of the 15-minute noise measurements over the sample period.

⁵ Represents the arithmetic average of the 15-minute noise measurements over the sample period.

During the daytime/evening period, the average measured ambient noise level was 55dB $L_{Aeq,T}$ and the average measured background noise level was 50dB $L_{A90,T}$.

During the night-time period, the average measured ambient noise level was 46dB $L_{Aeq,T}$ and the average measured background noise level was 39dB $L_{A90,T}$.

15.3.2 Location N2

Table 15.9 presents a summary of measured daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels measured at Location N2.

Date	Period	Measured Noise Levels (dB re. 2×10^{-5} Pa)				
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
15 Oct 2018	14:52 – 15:08	52	58	47	54	49
	15:43 – 15:58	52	66	47	54	49
	16:33 – 16:48	53	62	48	55	51

Table 15.9- Baseline Noise Levels at Location N2

During the survey period, the dominant intermittent noise source was road traffic and birdsong. Other sources of intermittent noise included road traffic on the adjacent road network and occasional distant aircraft.

During the daytime period, ambient noise levels were in the range 52 to 53dB $L_{Aeq,15min}$, with background noise levels in the range 49 to 51dB $L_{A90,15min}$.

15.3.3 Location N3

Table 15.10 presents a summary of measured daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels measured at Location N3.

Date	Period	Measured Noise Levels (dB re. 2×10^{-5} Pa)				
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
15 Oct 2018	14:35 – 14:50	52	59	47	54	49
	15:27 – 15:42	52	65	47	54	50
	16:18 – 16:33	53	71	49	55	51

Table 15.10- Baseline Noise Levels at Location N3

During the survey period, the dominant intermittent noise source was road traffic and birdsong. Other sources of intermittent noise included road traffic on the adjacent road network and occasional distant aircraft.

During the daytime period, ambient noise levels were in the range 52 to 53dB $L_{Aeq,15min}$, with background noise levels in the range 49 to 51dB $L_{A90,15min}$.

15.3.4 Location N4

Table 15.11 presents a summary of measured daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels measured at Location N4.

Date	Period	Measured Noise Levels (dB re. 2×10^{-5} Pa)				
		L _{Aeq}	L _{Amax}	L _{Amin}	L _{A10}	L _{A90}
15 Oct 2018	14:18 – 14:33	54	62	46	57	50
	15:10 – 15:25	54	72	48	56	50
	16:01 – 16:16	55	67	50	58	52

Table 15.11- Baseline Noise Levels at Location N4

During the survey period, the dominant intermittent noise source was road traffic and birdsong. Other sources of intermittent noise included road traffic on the adjacent road network and occasional distant aircraft.

During the daytime period, ambient noise levels were in the range 54 to 55dB L_{Aeq,15min}, with background noise levels in the range 50 to 52dB L_{A90,15min}.

15.3.5 Summary of Measured Noise Levels

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) L_{night}
- < 55 dB(A) L_{day}

Undesirable High Sound levels

- > 55 dB(A) L_{night}
- > 70 dB(A) L_{day}

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 residential 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.

Irrespective of this, it is noted that the measured noise levels across the site are equivalent to or lower than the thresholds outlined in the Dublin Noise Action Plan as being **Desirable Low Sound levels**. As such it is considered that inward noise (i.e. the noise impact of the existing environment of the amenity of the proposed dwellings) is not a major consideration in terms of planning.

15.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

During the construction phase the main site activities will include, site clearance, groundworks, building construction, internal road construction and landscaping. Potential impacts arising during the construction phase will be short term in duration.

During the operational phase of the development, no significant sources of noise or vibration associated with the development are anticipated. The primary source of outward noise in the operational context relates to any changes in traffic flows along the local road network and any noise emissions associated with mechanical services plant. Potential impacts arising during the operational phase will be long term in duration.

15.5 CONSTRUCTION IMPACTS, MITIGATION AND MONITORING MEASURES

15.5.1 Construction Impacts

Noise

A variety of items of plant will be in use for the purposes site clearance 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. Excavator mounted Breakers will be employed to remove existing concrete and rock 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 for the main phases of the proposed construction works. The nearest third-party noise sensitive locations to the proposed construction works are the properties to the north and south of the site boundary although there is also potential for the incomplete apartments to the west of the site to become developed prior to the commencement of construction works on this site. The closest works area is approximately 30m from the nearest properties with the remainder of works taking place across the site at varying distances. In order to assess a worst-case scenario, construction noise levels at distances of 30m and 100m have been used although a prediction to 10m distance is also provided as a reference. The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard site hoarding, typically 2.4m height will be erected around the perimeter of the construction site for the duration of works. Table 15.12 summarises the construction noise prediction calculations at the nearest residences using the assumptions

set	out	above.
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Construction Phase	Item of Plant (BS 5228-1 Ref)	BS5228-1 Reference dB LAeq at 10m	Predicted dB LAeq at 30m	Predicted dB LAeq at 100m
Site Clearance/ Groundworks	Tracked excavator (C2.21)	71	55	44
	Dump Truck (C2.30)	79	63	52
	Tracked Excavator fitted with Breaker. Breaking concrete foundation (D2.4)	91	75	64
	Breaking Concrete Below Ground Level. Pneumatic Breaker (D2.2)	81	65	54
	Tracked Mobile Crane (C4.50)	71	60	49
	Diesel Generator (C4.76)	61	45	34
	Total site clearance / groundworks		76	65
General Construction	Dump Truck (D2.30)	79	63	52
	Tracked excavator (D2.21)	71	55	44
	Compressor (D7.08)	70	54	43
	Telescopic Handler (D4.54)	79	63	52
	Hand Held Circular Saw (D4.72)	79	63	52
	Diesel Generator (D4.76)	61	45	34
	Internal Fit out	70	59	48
Total General Construction		68	58	
Road Works/ Landscaping	Asphalt Paver & Tipping Lorry (D5.30)	75	59	48
	Electric Water Pump (D5.40)	68	52	41
	Vibratory Roller (D5.20)	75	59	48
	Total Landscaping and Road Works		62	52

Table 15.12- Indicative Construction Noise Levels at Nearest Noise Sensitive Locations.

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 adopted from BS 5228 for the majority of periods.

Where certain works (i.e. concrete breaking) occur at the site boundary adjoining the neighbouring dwellings noise predictions indicate that the BS5288-1:2014 construction noise limits may be exceeded.

The use of construction noise and vibration mitigation measured will therefore be required and will be employed during the construction phase with a view to minimising noise impacts.

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 measured will be employed during the construction phase with a view to minimising noise impacts and achieving the adopted noise limit values.

Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given the works proposed and distances to nearby buildings. Rock Breakers will be required however to remove existing concrete and rock at various locations across the site and the potential vibration impact of Rock/Concrete breaking is discussed below.

AWN have previously conducted vibration measurements under controlled conditions, during trial construction works, on a sample site where concrete slab breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- 3 tonne hydraulic breaker on small CAT tracked excavator, and;
- 6 tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances. Results for each activity at each location are presented below.

Table 15.13 summarises the range of peak levels at various distances.

Distance from Source to Measurement Location (metres)	Measured Peak Vibration level PPV (mm/s)
10 - 19	0.13 – 0.25
20 – 29	0.11 – 0.21
30 – 39	0.10 – 0.14
40 - 49	0.13 – 0.48
>50	0.13 – 0.25

Table 15.13- Results Summary at various distances (3T Breaker)

Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.10 to 0.48 PPV (mm/s).

Table 15.14 summarises the range of peak levels at various distances.

Distance from Source to Measurement Location (metres)	Measured Peak Vibration level PPV (mm/s)
10 - 19	0.48 – 1.49
20 – 29	0.64 – 0.84
30 - 39	0.79
40 - 49	0.24 – 0.68
>50	0.24 – 0.25

Table 15.14-Results Summary at various distances (6T Breaker)

Peak vibration levels during the various staged activities using the 6 Tonne Breaker ranged from 0.24 to 1.49 PPV (mm/s).

Table 15.15 is provided in order to give some context as to the magnitude of the measured PPV levels in respect of typical sensitive laboratory equipment, human perception and also thresholds for the typical onset of cosmetic (i.e. non-structural) damage to industrial/commercial buildings.

Type of Vibration Effect		Vibration level, PPV (mm/s)
Increasing Magnitude of Vibration in Terms of PPV (mm/s) (Not to Scale)	Cosmetic (i.e. non-structural) Damage to Buildings	50 (at 40Hz and above for Residential or light commercial buildings) ↑ 20 (at 15Hz Freq. for Residential or light commercial buildings) ↑ 15 (at 4Hz Freq. for Residential or light commercial buildings)
		↑
	Disturbance (annoyance) of occupants and users of buildings	10 (Intolerable) ↑ 1.0 (Complaints Likely) ↑ 0.14 – 0.3 (Threshold of Human Perception)
		↑
Disturbance of particularly vibration-sensitive equipment and processes	0.05 (Bench microscopes up to 400x magnification) ↑ 0.003 (Class E Microelectronics manufacturing equipment)	

Table 15.15- Summary of Typical Vibration Thresholds

Considering the relatively low vibration levels that are expected from the concrete breakers (ref Tables 15.13 and 15.14), 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, although vibration emissions may be perceptible at nearby properties.

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 15.5 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants. Notwithstanding this, standard good-practice vibration mitigation measures are discussed in the relevant sections of this document.

15.5.2 Construction Phase Mitigation

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2*. Whilst construction noise and vibration impacts are expected to be within the criteria set out in this document for the majority of the time, the contractor 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 minimised. This will be particularly important during concrete/rock breaking which is the activity forecast to have the highest potential noise impact.

In this regard, various mitigation measures can be considered and applied during the construction of the proposed development, such as:

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Maintaining site access roads even so as to mitigate the potential for vibration from lorries;
- Establishing channels of communication between the contractor/developer, Local Authority and residents, and;
- Appointing a site representative responsible for matters relating to noise and vibration.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of barriers as necessary around items such as generators or high duty compressors;
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.

15.5.3 Monitoring Measures

The appointed contractor will be required to monitor levels of noise and vibration during critical construction periods at nearby sensitive locations and/or development site boundaries.

15.5.4 Construction Phase Cumulative Impacts

The phasing/commencement of any other permitted developments in the locality could potentially result in the scenario where a number of other construction sites are in operation at the same time as the proposed development. However, the location of the proposed development site in relation to nearby noise sensitive locations and the distance from the proposed development site in relation to other nearby lands means that there is minimal risk of cumulative construction noise emissions resulting in an exceedance of the relevant criteria. No additional mitigation measures are therefore required.

15.6 OPERATIONAL IMPACTS, MITIGATION AND MONITORING MEASURES

15.6.1 Operational Impacts

Building and Mechanical Services Plant

During the operational phase of the proposed development there will be mechanical and electrical services plant required to service the buildings which may operate over both day and night-time periods.

Making reference to the background noise levels measured during the baseline noise survey and reference to the guidance from BS 4142, the cumulative noise levels associated with mechanical plant items at the façade of the nearest noise sensitive buildings both within and external to the development site will be designed to not exceed the following level:

- 50dB $L_{Aeq,1hr}$ (daytime), and;
- 39dB $L_{Aeq,15mins}$ (night-time).

Noise emissions shall not contain any tonal characteristics. These limits have been set in order to preserve the existing noise environment and to set appropriate limits at noise sensitive buildings within the development site itself.

Plant information provided by McElroy Associates state 3 No. ASHP Heat Pumps to be located at roof level of the 12-storey block. Noise data for the heat pumps has been provided by the preferred supplier (Plant ref LHA/4504/HE/XL/HH/P2U) and a sound power level of 86dB(A) per unit is stated. A louvred screen surrounds the rooftop plant area and there is a distance of approximately 35 metres between the plant and the nearby South-Central Apartments. Noise predictions are also made to the proposed Rockbrook Apartments at façade of 11th Floor, which are closer in distance (i.e. approx. 10 metres from plant) but benefit from additional acoustic screening from the building roof.

Noise calculations have estimated the resultant noise level at the nearby apartments comply with the daytime criterion but do not comply with the design target for night-time operation. Noise mitigation measures are therefore required to reduce plant noise emissions to nearby dwellings. Recommendations for mitigation are provided in Section 15.6.2.

Car Parking on Site

In this instance the car parking facility on the site will be provided by means of a basement car park. The car park is accessed from Carmanhall Road and parking is provided at Basement-1, -2 and -3 level.

The enclosed nature of the car park will ensure that the impact at noise-sensitive residences both within the development and in the surrounding areas is negligible. In summary, the likely noise impact of car parking on the local environment is not significant.

Additional Vehicular traffic on Public Roads

A traffic impact assessment relating to the proposed development has been prepared as part of this EIAR has been submitted with the application documentation. Information from this report has been used to determine the predicted change in noise levels in the vicinity of the adjacent road network along which traffic will travel to and from the site, namely Carmanhall Road.

Traffic data for two years have been assessed i.e. 2021 and 2031. The annual average daily traffic (AADT) has been used to assess the potential change in noise levels along the adjacent roads. The development traffic takes account of the proposed development. Table 15.16 below summarises the calculated change in road traffic noise level for the assessment years.

Year	AADT (%HGV)		Predicted Change in noise Level, dB (L _{A10})
	No Development i.e. Do Nothing	With Development i.e. Do Something	
Baseline 2018	6,800 (1.2)	-	-
Opening 2021	7,700 (1.1)	10,700 (1.0)	+1.4
Design 2031	8,600 (1.1)	11,600 (1.0)	+1.3

Table 15.16- Summary of calculated change in noise level for the Opening and Design years.

The calculated increase in noise level is less than 1dB, referring to Table 15.7 confirms that the calculated change in noise level is ‘Barely Perceptible’ and the associated impact is ‘Not Significant’.

15.6.2 Operational Phase Mitigation

Building and Mechanical Services Plant

During the detailed design stage, the selection of plant with the appropriate attenuation (where required) will ensure that the operational noise limits set in Section 15.6.1 will be achieved at the nearest noise sensitive locations both within and outside of the development site.

Calculations indicate that noise mitigation will be required to the 12th floor external plant area, to reduce noise emissions during night-time plant operation. An acoustic louvre is therefore proposed for the 12th Floor external plant, with a minimum Insertion Loss as specified in Table 15.17.

Item	Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Louvre	6	7	10	12	18	18	14	13

Table 15.17 Minimum performance requirements for Acoustic Louvre (12th Floor Plant).

The calculated residual noise level at the nearby apartments comply with both the daytime and night-time design targets.

Car Parking on Site

During the operational phase of the development, noise mitigation measures with respect to car parking on site are not deemed necessary.

Additional Vehicular traffic on Public Roads

During the operational phase of the development, noise mitigation measures with respect to the traffic from the development are not deemed necessary.

15.6.3 Monitoring Measures

No additional monitoring is proposed for the operational phase of the proposed development.

15.6.4 Operational Phase Cumulative Impacts

There are no anticipated cumulative impacts in relation to the operational phase of the proposed development.

15.7 RESIDUAL IMPACTS

15.7.1 Construction Phase

During the construction phase of the project there will be some 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.

The resultant residual noise impact from this source will be of negative, moderate to significant, short-term impact.

Quality	Significance	Duration
Negative	Moderate to Significant	Short-term

Table 15.17- Description of Construction Phase Effects

15.7.2 Operational Phase

The probability of effects from the operational phase of the developments are likely and a description of effects are summarised in Table 15.18.

Quality	Significance	Duration
Negative	Not Significant	Permanent

Table 15.18- Description of Operational Phase Effects

15.8 DO NOTHING SCENARIO

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

15.9 SIGNIFICANT IMPACTS AND INTERACTIONS

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 nearby residences, when works (particularly ground works) are occurring adjacent to the site boundary. 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.

15.10 REFERENCE LIST

In preparing the noise and vibration chapter of this Environmental Report, reference is made to the following documents and Standards:

- Dublin Agglomeration Noise Action Plan 2013 to 2018
- Urban Design Manual and the Design Manual for Urban Roads and Streets 2013, Department of Transport, Tourism and Sport and the Department of Environment, Community and Local Government
- ISO 1996-2:2017 Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of sound pressure levels
- BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
- BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration
- BS8233:2014 Guidance on sound insulation and noise reduction for buildings
- BS4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound'
- Design Manual for Roads and Bridges (DMRB), Highways England Company Limited, Transport Scotland, The Welsh Government and The Department for Regional Development (Northern Ireland)
- Calculation of Road Traffic Noise (CRTN), 1998, Department of Transport, Welsh Office (UK)
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, Transport Infrastructure Ireland (TII), March 2014
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007)