10.0 NOISE & VIBRATION

10.1 INTRODUCTION

This section of the EIAR has been prepared by Byrne Environmental Consulting Ltd to identify and assess the potential noise and vibrational impacts associated with and on a proposed Clay Farm Phase 2 residential at Ballyogan Road, Dublin 18, during both the Construction and Operational Phases of the development. This chapter was prepared by Ian Byrne MSc. MIOA. Dip Environmental & Planning Law, who has over 20 years' experience as an environmental consultant specialising in Acoustics and Air Quality Monitoring, Impact Assessment and Management.

The development will consist of a residential development of 927 no. residential units, a neighbourhood centre containing a childcare facility with a GFA of 607 sq.m and 2 no. retail units each with a GFA of 85 sq.m, and includes the associated section of the Clay Farm Loop Road from the bridge road link with Phase 1 to the south western site boundary, associated internal roads, pedestrian and cycle paths, open space, and all associated site and infrastructural works. The application site has an overall area of 20.5 hectares.

The development site will include green initiatives including a green cycle way and an Ecopark and landscaped external amenity areas containing playgrounds, external exercise units and sport playing areas.

This document includes a comprehensive description of the receiving ambient noise climate in the vicinity of the subject site; a description of how the construction and operational phases may impact the existing ambient noise climate and finally; the mitigation measures that shall be implemented to control and minimise the impact that the development may have on ambient noise levels on the receiving environment including local residential amenity at Cruagh and Stepaside Park and the Clay Farm Phase 1, the existing Ballyogan Stream Habitat, and Stepaside Golf course.

The mitigation measures designed for the development shall demonstrate how the development shall be constructed and operated in an environmentally sustainable manner in order to ensure its minimal impact on the receiving noise climate and to provide adequate sound insulation in residential units from external sound sources and adjoining residential properties.

10.2 STUDY METHODOLOGY

The general assessment methodology of the potential impact of the proposed development on air quality and climate has been devised in accordance with:

Guidelines on Information to be Contained in an Environmental Impact Statement (EPA 2002).
Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA 2003).
Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003).
Development Management Guidelines (DoEHLG, 2007).
Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoECLG, March 2013).

10.2.1 Noise Assessment Methodology

Baseline Environment

The baseline noise environment in the vicinity of the Clay Farm Phase 2 development has been defined through a field survey and a desktop review of the Dublin Agglomeration Environmental Noise Action Plan 2013-2018.

The existing ambient noise climate in the vicinity of the site has been characterised with information obtained from site specific baseline noise surveys conducted in the vicinity of the closest noise sensitive receptors to the subject site. Baseline noise surveys were conducted generally in accordance with *ISO 1996: 2007*: *Acoustics – Description and measurement of environmental noise*.

Existing noise levels within the vicinity of the proposed development have also been informed from reviewing the Dublin Agglomeration Environmental Noise Action Plan 2013-2018 and associated Strategic Noise Maps, which indicate modelled noise levels as a result of modelled traffic flow on major roads.

Impact Assessment Methodology

The impact of the proposed development has been determined through prediction of future noise levels associated with the scheme using established calculation techniques.

Construction impacts have been assessed in accordance with the National Roads Authority's (NRA) guidance document *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014*). Indicative construction noise calculations have been undertaken using the methodology set out in *BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise 2009+A1 2014.*

Impacts associated with road traffic movements on the development when operational have been assessed with regard to the NRA's *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014*). *UK Department of Transport (Welsh Office) - Calculation of Road Traffic Noise [CRTN]* and the *Highways Agency Design Manual for Roads and Brides Part 7 HD 213/11 – Revision 1 Noise and Vibration.*

The operational phase of the development has been assessed with regard the *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound.* Whilst acoustic consideration is not specifically mentioned within the DLRCC Development Plan 2010-2016 the operational phase of the development has been assessed with cognisance of Chapter 16 of the Development Plan which advises that the quality of residential design must consider *"levels of privacy and amenity [and] the relationship of buildings to one another".*

The ESB Carrickmines Transformer Station located adjacent to the eastern site boundary has been identified as a local noise source during the baseline noise assessment study. It is understood from meetings held between the Applicant and the ESB, that the ESB intend to further develop their facility and are aware that they are obliged to minimise and control noise generated by their site operations so as not to have an adverse noise impact on adjacent lands and properties. For information, Appendix 10.1 of this document includes a copy of the letter dated 8th May 2017 from the ESB to the Applicant regarding this matter. It is understood that the ESB have engaged an acoustic consultant to assist them in designing appropriate and effective noise attenuation measures to reduce the noise generated in particular from existing and future proposed on-site transformers. The acoustic modelling

and design works have commenced and the ESB remains in regular contact with the Applicant and their design team.

Construction Impact Assessment Criteria

The construction noise limits, which are presented in Table 10.1 (NRA Guidelines, 2014) represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable noise level for the nearby residents and other sensitive receptors including amenity space. In addition to the standard workday criterion of 70dB(A) $L_{Aeq,1hr}$, the guidelines specify a reduced limit of 65dB(A) $L_{Aeq,1hr}$, for work on Saturdays, and 60dB(A) $L_{Aeq,1hr}$, for evening periods, and Sundays and Bank holidays. While these criteria were developed for roads projects, they are also applicable to general construction projects and are generally adapted in Ireland for various construction projects.

Table 10.1: Construction Phase Noise Limit Values

Days	Periods	$L_{Aeq\ (1hr)}$ dBA	L_{Amax} dBA
Monday to Friday	07.00 to 19.00	70	80
	19.00 to 22.00	60	65
Saturday	08.00 to 16.30	65	75
Sundays and Bank Holidays	08.00 to 16.30	60	65

It should be noted that the noise criteria quoted in the table above are specific to construction activities only i.e. these levels are not cumulative with the existing noise environment from road traffic and other surrounding sources. Actual construction noise levels are determined by subtracting existing baseline noise levels from the measured total noise including construction activity noise to allow assessment against the limit criteria.

Operational Impact Assessment Criteria

Relative impact assessment criteria associated with road traffic noise is set out in Table 10.2 below.

Table 10.2: Likely impact associated with change in traffic noise level

Change in sound level (L_{10})	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

A change in traffic noise of less than 2dBA is generally not noticeable to the human ear whilst a change of 3dBA is generally considered to be just perceptible. Changes in noise levels of 3 to 5 dBA would however be noticeable and, depending on the final noise level, there may be a slight or moderate noise impact. Changes in noise level in excess of 6dBA would be clearly noticeable, and depending on the final noise level, the impact may be moderate or significant. However, a significant change in traffic volumes or traffic category i.e. increase in the use of a road by HGVs, would be required to result in such increases.

The UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that a change in noise level of 1dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3dB $L_{A10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow.

Traffic noise levels in excess of 60dBA (L_{DEN}) are considered to be potentially intrusive. L_{DEN} is the day-evening-night composite noise indicator for assessing overall noise annoyance. For new roads projects the National Roads Authority design goal is to mitigate when predicted levels exceed 60dB L_{den}. However, for existing roads the Dublin Agglomeration, within the Noise Action Plan, have set a level of 70dB (L_{Day}) and 55dB (L_{Night}) above which mitigation measures should be considered.

The World Health Organisation (WHO) has proposed guidelines for community noise. In this guidance, a L_{Aeq} threshold daytime noise limit of 55dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. Levels of 45dB or less are proposed at night-time, when measured 1m from the external facade of a noise sensitive location such as a residential unit. In the absence of other national standards, these levels are often used as guideline limits in assessing noise impacts.

The operational phase of the development shall be assessed with regard to the WHO guidelines and appropriate acoustic design of residential units to ensure that they comply with the *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound.*

10.2.2 Vibration Assessment Methodology

Impact Assessment Methodology

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

Construction impacts have been assessed in accordance with *BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration and BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014.*

Operational impacts have been assessed in accordance with the Transport Infrastructure Ireland, TII (formerly NRA) Guidelines for the Treatment of Noise & Vibration in National Road Schemes.

Construction Impact Assessment Methodology

Table 10.3 shows the limits above which cosmetic damage could occur for transient vibration. Minor damage is possible at vibration magnitudes which are greater than twice those shown in Table 10.3, and major damage to a building structure would only generally occur at values greater than four times the tabulated values. These values only relate to transient vibration. If there is a continuous vibration, the guide values shown in Table 10.3 might need to be reduced by up to 50%.

This guidance is reproduced from *BS 5228-2:2009+A1 2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 2 – Vibration and BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration.*

Table 10.3: Transient vibration guide values for cosmetic damage

Type of building	PPV (mm/s) in frequency range of predominant pulse	
	4-15Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above.	50mm/s at 4Hz and above.
Unreinforced or light framed structures. Residential or light commercial buildings.	15mm/s at 4Hz increasing to 20mm/s at 15Hz.	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above.

Table 10.4, reproduced from *BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014* outlines the vibration levels (in terms of PPV) from construction activities and their likely effect on humans.

Table 10.4: Guidance on the effect of construction vibration levels on humans

Vibration Level (PPV)	Effect
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30mm/s	Vibration might be just perceptible in residential environments.
1.0mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Operational Impact Assessment Methodology

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes.

Ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Vibration impacts associated with road traffic can therefore be largely avoided by good maintenance of the road surface.

10.3 EXISTING RECEIVING ENVIRONMENT

10.3.1 Description of the baseline environment/ Environmental Noise Context

The site is located off the Ballyogan Road and is set back to the south of the existing Clay Farm Phase 1 development currently under construction. The Ballyogan Stream runs between the Phase 1 and Phase 2 sites. Stepaside Park and Cruagh residential estates are located at the western and southwestern site boundaries respectively. The ESB Carrickmines Electrical Transformer Station is to the north east of the site. The former Ballyogan landfill site is located to the east of the site. This site has been closed as an active landfill for c.10 years. Stepaside golf course borders the southern site boundary.

The Clay Farm Phase 2 site is located within an area where the existing noise climate is influenced by M50 Motorway traffic, road traffic on the Ballyogan Road and local traffic movements within the Cruagh and Stepaside housing estates. The Ballyogan Road is heavily trafficked and exhibits a diurnal pattern with AM and PM peaks

resulting in greater road traffic movements and thus increased ambient noise levels. Traffic volumes decrease between approximately 19:00hrs – 05:00hrs Monday to Sunday resulting in lower night time ambient noise levels.

The principal source of industrial noise is generated by the Carrickmines ESB transformer facility located to the northeast of the site boundary. This facility emits a steady state low frequency noise which is audible and distinguishable within the Clay Farm Phase 2 site. As previously indicated, it is understood that the ESB are currently designing the appropriate noise attenuation measures for this facility, which will reduce the noise emissions.

10.3.2 Baseline environmental noise survey

Baseline noise data in the vicinity of the closest residential receptors to the proposed development site has been obtained from noise monitoring surveys conducted by Byrne Environmental Consulting Ltd during November 2016 The baseline monitoring locations were selected in accordance with *ISO 1996,2, 2007: Acoustics – Description, Measurement and Assessment of environmental noise* and the 2016 EPA publication, *"Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* and included locations in proximity to existing residential dwellings adjacent to the development areas and within the site itself to assess the impact of the ESB transformer facility on the closest proposed Clay Farm Phase 2 residential units.

Measurement Locations

Baseline noise mmeasurements were conducted at four locations in the vicinity of the proposed site. Figure 10.1 below details the approximate locations of the measurement positions. Noise monitoring surveys were conducted under free-field conditions at a height of approximately 1.5m above ground and approximately 3.5m away from reflecting surfaces.

Location NM1:	Measurement location is located in the eastern area of the proposed development site approximately 60m from the ESB transformer facility where the closest residential units will be located
Location NM2:	Measurement location is located at the closest houses to the southern site boundary in the Cruagh residential estate
Location NM3:	Measurement location is located at the closest houses to the southern site boundary in the Stepaside Park residential estate
Location NM4:	Measurement location is located within the proposed Phase 2 area at the closest proposed residential units to the north of the site in proximity to the proposed link bridge.

Figure 10.1: Baseline Noise Monitoring Locations NM1 – NM4

Survey periods

Monitoring was conducted for 3x30 minute periods at the Locations NM1 - NM4 during the daytime, and for 2x30 minute periods during the evening and night-time periods to establish the existing ambient noise levels.
A continuous noise survey was conducted at location NM1 for a continuous 3 day period.

Meteorological conditions during the survey periods were generally dry and wind speeds of less than 5m/s.

Instrumentation

Noise measurements were conducted using calibrated Brüel & Kjær 2250 Type 1 Sound Level Analyser systems fitted with BZ-7132 logging software and B&K UA 1404 outdoor microphone kits.

Measurement parameters

The noise parameters used to describe the existing ambient noise climate are described as follows:

L_{Aeq}:	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}:	The sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
L_{A90}:	The sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
L_{Amax}:	The instantaneous maximum sound level measured during the sample period.
1/3 Octave band analysis	The frequency analysis of a sound such that the frequency spectrum is subdivided into bands of one-third of an octave each. Used to determine tonal components of a sound source

Noise levels are measured using a logarithmic noise scale (decibel) and are denoted dBA. The "A" indicates that a frequency weighting has been applied to allow for the variation in the sensitivity of the human ear.

Baseline Noise Measurement Results

Table 10.5: Location NM1: Baseline Noise Survey Results 4th July 2017

Period	Time hrs	Measured sound pressure levels dBA (re 20µPa)			
		L_{Aeq}	L_{A10}	L_{A90}	L_{AMax}
Day	09:51 – 11:51	50.7	51.9	43.9	82.6
Night	23:33 – 00:23	40.4	41.9	38.5	53.0

During the daytime the noise climate was influenced by an audible hum generated by the ESB transformer facility c. 80m from the measurement location, and the distant sound of traffic from the M50 and the Ballyogan Road. Occasional noise from the Ballyogan closed landfill facility was also observed including the tractor mowing of the grass capped landfill. Subjectively, the hum from the ESB facility was clearly audible during both surveys. However a review of the one third octave analysis conducted during the surveys did not identify the presence of a tone during the surveys.

During the night-time period the audible hum generated by the ESB transformer facility was audible. It was observed that traffic noise had receded when compared to the daytime measurement period at this location.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM1.

Table 10.6: Location NM2 Cruagh : Baseline Noise Survey Results

Period	Time	Measured sound pressure levels dBA (re 20µPa)			
		L_{Aeq}	L_{A10}	L_{A90}	L_{AMax}
Day	08:53 – 10:23	53.1	54.4	43.0	86.1
Night	22:44 – 23:44	40.4	38.4	31.6	64.6

Noise levels measured at Location NM2 are consistent with a quiet residential area. Occasional vehicle movements by residents were noted during both the daytime and nightime periods.

No significant source of vibration was observed and vibration was not perceptible during surveys at Location NM2.

Table 10.7: **Location NM3 Stepaside Park: Baseline Noise Survey Results**

Period	Time	Measured sound pressure levels dBA (re 20µPa)			
		L_{Aeq}	L_{A10}	L_{A90}	L_{AMax}
Day	14:13 – 15:43	48.8	49.7	42.8	75.9
Night	00:53 – 01:53	35.4	37.8	32.2	48.0

Noise levels measured at Location NM3 are consistent with a quiet residential area. Occasional vehicle movements by residents and pedestrians were noted during both the daytime and nightime periods.

No significant source of vibration was observed and vibration was not perceptible during surveys at Location NM3.

Table 10.8: Location NM4 Northern Site Boundary: Baseline Noise Survey Results

Period	Time	Measured sound pressure levels dBA (re 20µPa)			
		L_{Aeq}	L_{A10}	L_{A90}	L_{AMax}
Day	12:07 – 13:37	55.8	56.5	49.7	76.8
Night	02:22 – 03:22	41.3	43.2	28.3	67.8

During the daytime the noise climate was influenced and the distant sound of traffic from the M50 and the Ballyogan Road.

During the night-time period It was observed that traffic noise had receded when compared to the daytime measurement period at this location.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM4.

10.3.3 Review of the Dublin Agglomeration Environmental Noise Action Plan 2013-2018 and Strategic Noise Maps

The Dublin Agglomeration Noise Action Plan 2013-2018 was prepared jointly by the four Local Authorities in the Dublin Agglomeration to meet the requirements of the Environmental Noise Directive (2002/49/EC) which is transposed into Irish legislation through the Environmental Noise Regulations (S.I No. 140 of 2006). The key objective of the Directive is to avoid, prevent and reduce, where necessary, on a prioritised basis the harmful effects, including annoyance, due to long term exposure to environmental noise from road traffic, rail and aircraft.

The Environmental Noise Directive requires all European Union Member States to produce strategic noise maps for the main sources of environmental noise, i.e. major roads, major railways, major airports and all sources within agglomerations with a population of more than 100,000 persons in 2012. These strategic noise maps inform the Noise Action Plan. Levels of <55dBA (L_{Day}) and <50dBA (L_{Night}) are considered to be desirably low noise levels within the Noise Action Plan.

The relevant Strategic Noise Maps for the study area have been reviewed and it has been determined that the Castle Court, Glencairn and Glenbourne residential estates are subject to noise levels which range from 50-65dB (L_{DEN}) and 45-55dB (L_{Night}). Higher noise levels are experienced at properties fronting onto the Ballyogan Road. A review of the strategic noise maps also identified that noise levels range from 50-65dB (L_{DEN}) and 45-55dB (L_{Night}) within the proposed development site.

The Strategic Noise Map results are in general agreement with levels recorded during the site specific baseline environmental noise survey.

10.3.4 Significance

Based on the recorded baseline noise surveys conducted in the vicinity of the proposed development site, and a review of the Strategic Noise Maps, it may be concluded that the existing ambient noise levels are low to moderate at the closest existing and proposed receptors.

Traffic movements along the Ballyogan Road and on the M50 and within existing residential estates south of the site dominate the ambient noise levels in the vicinity of the development site. An audible low frequency hum was also emitted from the ESB Transformer Station at a distance of c.80m from the facility. Again to reiterate, it is understood from meetings held between the Applicant and the ESB, that the ESB intend to further develop their facility and are aware that they are obliged to minimise and control noise generated by their site operations so as not to have an adverse noise impact on adjacent lands and properties. It is understood that the ESB have engaged an acoustic consultant to assist them in designing appropriate and effective noise attenuation measures. The ESB remains in regular contact with the Applicant and their design team regarding this matter.

10.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

When considering a development of this nature, the potential impact on noise and vibration must be considered for each distinct stage: the medium term (6-10 years) impact of the construction phase and the longer term impact of the operational phase. It is important that there is no unacceptable increase in ambient noise levels during the construction phases and during the operational phase.

Short term noise exposure during the construction phase must be managed and controlled to acceptable levels. There are a number of existing residential noise sensitive receptors located in proximity to the development site boundaries. It is fundamental that the proposed development or any aspect of the proposed development must not adversely impact the existing noise levels experienced at these receptors over the long term.

It is also critical that adequate sound insulation is provided within residential units to be constructed from both external sound sources and adjoining residential properties.

10.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

10.5.1 Potential Impact

Various elements of both the construction and operational phases of the proposed development have the potential to impact on the receiving on the local receiving noise environment, on adjacent residential properties and on human health. The likely potential impacts for both construction and operation of the proposed scheme prior to mitigation are described in this section of the EIA Report. The mitigation measures are described in Section 10.7 and the predicted impacts with the development in place and the mitigation measures incorporated in Section 10.9.

Construction Impacts

The development of the site will be conducted in the following phased stages:

- Enabling works - Site set up and Site clearance
- Construction works including infrastructure and building construction and landscaping

Enabling works - Site Set Up and Clearance

Works activities associated with the 'Site set up' will be undertaken prior to construction works commencing. The setting up of the site shall involve the construction of site security hoarding and site compounds, site offices, materials and waste storage areas and staff welfare facilities. These short term activities will have a minimal potential to generate excessive noise levels.

The proposed development involves the ground clearance of the existing site to facilitate the proposed development including buildings, internal roads and hard standing areas, services and landscaped areas.

Site clearance, levelling and an element of ground excavation shall also occur at this stage. A variety of items of plant will be in use during site clearance and ground excavation. These will include excavators, dump trucks, compressors and generators. The operation of these items of plant does have the potential to generate short term elevated noise levels.

During the 'Site Clearance' works Construction and Demolition (C&D) waste shall be segregated as per the requirements of the Construction, Demolition and Operational Waste Management Plan for the site and shall be exported off-site by an appropriately permitted waste contractor. The movement of these trucks to and from the site shall result in an increase in the volume HGV's within the immediate area and along the proposed haul routes which will generate additional noise levels.

Construction Works

The development of c.20.57 hectares relates to the construction of 927 no. residential units in a mix of houses and apartments, a 622m^2 crèche, 2 No. retail units with a ground floor area of 192m^2 together with associated open space, car parking and a bridged link road between the Phase 2 and Phase 1 development currently under construction. It is proposed that 795 No. surface car parking spaces and 512 No. basement car parking spaces will be provided within the development.

During the construction phase there will be extensive site works, involving construction machinery, construction activities on site, and construction traffic, which will all generate noise. The highest noise levels will be generated during the general construction activities. The construction noise levels will be of relatively short term duration and will only occur during daytime hours which will serve to minimise the noise impacts at local existing receptors.

It is predicted that the construction phases shall result in a short term increase in noise levels in the area as well as introducing tonal and impulsive noise as a result of construction activities such as pneumatic breaking, cutting, excavating, vehicle movements and general manual construction activities.

Due to the phased nature of the development which will occur over an approximate 10 year period, there will be slight to moderate impacts on existing residents in Cruagh and Stepaside Park and on the the future residents of Clay Farm Phase 1 and Phase 2 properties constructed in the early phases of the development. However, the proposed construction phase noise mitigation measures as detailed in Section 10.7 shall ensure that all construction activities are controlled and managed and audited by an independent acoustic consultant to confirm that the mitigation measures are implemented throughout the construction phase.

Construction noise predictions

As set out in Section 10.2.1 the predicted noise levels that will be experienced at the nearest residences as a result of construction activities have been calculated using the activity L_{Aeq} method outlined in *BS 5228 1:2009+A1 2014 – Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise.*

Tables 10.9 to 10.10 set out assumed plant items during the key phases of construction with the associated source reference from BS 5228: 2009+A1 2014. The closest residential properties to the proposed development site are located at distances ranging from approximately 50-150m. Construction noise calculations have therefore been conducted at distances of 50 to 150m from the works for the Site Clearance and Main Construction phases, representing the nearest properties to the works.

Table 10.9 Indicative construction noise predictions associated with Enabling works

Plant Item	**BS 5228 Reference**	**Calculated sound pressure levels L_{Aeq} dB at distance from the proposed development**			
		10	**50**	**100**	**150**
Generator (enclosed)	C.4 Ref 84	68.2	54.2	48.2	44.7
Compressor(enclosed)	D.6 Ref 19	71.2	57.2	51.2	47.7
Tracked Excavator	C.2 Ref 3	76.2	62.2	56.2	52.7
Wheeled Excavator	C.2 Ref 26	77.2	63.2	57.2	53.7
HGV	C.4 Ref 19	75.2	61.2	55.2	51.7
Combined $L_{Aeq,period}$		**81.7**	**67.7**	**61.7**	**58.1**

Table 10.10 Indicative construction noise predictions associated with Construction works

Plant Item	**BS 5228 Reference**	**Calculated sound pressure levels L_{Aeq} dB at distance from the proposed development**			
		10	**50**	**100**	**150**
Generator (enclosed)	C.4 Ref 84	68.2	54.2	48.2	44.7
Compressor(enclosed)	D.6 Ref 19	71.2	57.2	51.2	47.7
Tracked Excavator	C.2 Ref 3	76.2	62.2	56.2	52.7
Wheeled Excavator	C.2 Ref 26	77.2	63.2	57.2	53.7
HGV	C.4 Ref 19	75.2	61.2	55.2	51.7
Concrete / Steel Cutting Equipment	Various	82.2	68.2	62.2	58.7
Dump truck	C.2 Ref 30	77.2	63.2	57.2	53.7
Combined $L_{Aeq,period}$		**85.6**	**71.6**	**65.6**	**62.1**

The results of the assessment has indicated that, in general, at distances of greater than 50m-100m from the works sites, the construction day time noise limit of 70dB L_{Aeq} can typically be complied with for during both enabling and construction works. It is also important to note that the impact due to construction activities will be transient in nature.

The proposed construction phase noise mitigation measures as detailed in Section 10.7 shall ensure that all construction activities are controlled and managed and audited by an independent acoustic consultant to confirm that the mitigation measures are implemented throughout the construction phase.

Construction Traffic Noise

Based on the assumption of up to 16 HGV movements per day on the haul routes to and from the site along public roads, the resulting average predicted traffic noise level at the closest receptors is calculated as follows:

The predicted noise levels at any receptor located within 5m of the haul route road has been calculated using a standard international acoustical formula as described below.

$L_{Aeq, T} = SEL + 10\log_{10}(N) - 10\log_{10}(T) + 20\log_{10}(^{r1}/_{r2})$ dB

where $L_{Aeq, T}$ is the equivalent continuous sound level over time period (T) (3600 sec);
SEL is the A weighted Sound Exposure Level of the noise event (77dB);
N is the number of events over the time period T (16);
r1 is the distance at which SEL is assessed (5m)
r2 is the closest distance to the receptor from the road (5m)

The calculations assumed a typical scenario of 2 truck movements per hour based on an 8 hour working day a maximum Sound Exposure Level of 77dBA for the trucks and the minimum distance between the local road passing by each of the nearest noise sensitive receptors to the public road (5m). No attenuation, above geometric spreading, has been considered within these calculations may be considered the worst case scenario.

The maximum predicted $L_{Aeq, period}$ values as a result of the HGV traffic movements at the nearest noise sensitive receptors located along the haul route roads is predicted to be 53 dBA, $L_{Aeq, period}$.

It is not expected that the predicted short-term increase in HGV movements associated with the construction phase of the development will have an adverse impact on the existing noise climate of the wider area or on local receptors and would not significantly increase the L_{den} at any receptor location in the area.

Vibration

The most significant potential sources of ground borne vibrations that may be generated during the construction phase of the development will be generated by the following practices:

- Ground preparation excavation activities that require the use of pneumatic rock breakers
- Concrete pile breakdown activities
- Link bridge pier piling

Vibration impacts have been considered from any particular plant items that have the potential to generate perceptible levels of vibration.

The nearest off-site residential receptors are located at Cruagh and Stepaside Park residential estates which are approximately 100-150m from the construction works site. Depending on the methods of construction, there is the possibility of construction related vibration impacts on human beings as a result of ground preparation and concrete foundation excavation activities. However, such sources of vibration shall be temporary and intermittent. Based on experience from similar construction projects it is highly unlikely that any construction vibration impacts on humans would be either measurable or perceptible beyond a distance of 50m.

It is highly unlikely that any construction vibration impacts on buildings beyond a distance of 50m from the proposed development would result in cosmetic damage. Experience of similar construction projects has shown that beyond this distance there is no risk of cosmetic damage occurring within buildings.

Operational Phase

The noise aspects to be considered for the completed development can be divided into two categories:

- Noise impacts on neighbouring residential receptors
- Inward noise impacts on the development from traffic and construction works

Noise Impacts on Neighbouring Residential Receptors

The main potential for altering the noise environment once the development is operational, and thus impacting neighbouring residential receptors, is road traffic noise associated with the development.

The Traffic and Transportation Report submitted with this application includes a detailed assessment of the traffic impact associated with the proposed development, and the cumulative development of the Phase 1 & 2 developments based on the proposals in the Scheme masterplan. As part of this assessment, detailed traffic flow information has been derived for the existing road network for the Do-Minimum and Do-Something scenarios in place for Year 1 (2019), Year 5 and Year 15 (2034). The 2034 Traffic Network Impact scenario predicts that the traffic associated with the development will increase traffic at the 6 local junctions by 3.2% at the Leopardstown Rd/M50 slip Roads roundabout - 29.5% at the Site Access/Ballyogan Road/Leopardstown Valley junction during the AM peak and by 3.1% at the Leopardstown Rd/M50 slip Roads roundabout – 34.4% at the Site Access/Ballyogan Road/Leopardstown Valley junction during the PM peak. These maximum predicted values will result in a less than 3dB increase in existing ambient noise levels.

The Traffic and Transport Assessment for the Clay Farm Phase 2 scheme has predicted that there will be 381 AM vehicle trips and 422 PM vehicle trips.

The UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that it takes a 25% increase or a 20% decrease in traffic flows in order to get a 1dBA change in traffic noise levels. On this basis, the traffic flow increases associated with the development for all year scenarios will result in a traffic noise increase of between less than 1dBA to 3dBA. There will be an imperceptible to slightimpact on existing ambient noise levels at the existing roads and junctions within the surrounding area as a result of road traffic alterations associated with the proposed development.

The subject development includes the provision of surface and undercroft car parking spaces for 927 residential units. Vehicles using car parking areas generally travel at speeds <20kmph which result in relatively low noise levels. On site car parking within the proposed development will have no impact on adjacent residential developments.

Within the proposed development, sounds generated by everyday domestic activities including waste facilities, pedestrians, children, and use of open spaces, are part of everyday living, and are not considered “noise” in the sense of a potential nuisance. This activity noise would not have any potential for impact beyond the boundaries of the site. In particular, the design of the proposed development has ensured that waste management facilities will not result in impacts on adjacent sensitive receptors

Inward Noise Impacts on the Proposed Development

Regarding noise aspects within the proposed development itself, the aspects to be considered are:

- Suitability for residential development, in terms of the existing noise climate
- Avoidance of potential conflict in terms of activity noise within the development itself

Properties to the north of the site, and closest to Ballyogan Road, will be subjected to higher noise levels than properties located to the south of the site. Existing noise levels, associated with road traffic movements on the Ballyogan Road range from 50-65dB (L_{DEN}) and 45-55dB (L_{Night}) within the northern boundary of the Phase 1 site currently under construction..

The main potential noise impact on existing receptors associated with the proposed development relates to additional traffic flows on the surrounding road network. Given that traffic from the development will make use of existing and new road infrastructure, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development using the L_{A10} parameter which is typically used to describe traffic noise.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 10.11 offers guidance as to the likely impact associated with any particular change in traffic noise level.

Table 10.11: Likely Impact Associated with Change in Traffic Noise Level

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

A traffic impact assessment relating to the proposed development has been prepared by DBFL Consulting Engineers as part of this application. Information from this report has been used to determine the predicted change in noise levels in the vicinity of the area surrounding the proposed development, for the opening year 2019 and the 2034 scenarios.

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 internal roads and internal site junctions with and without the development. Traffic data has been assessed and the calculated change in noise levels associated with both the Phase 1 and Phase 2 developments is predicted to be <3dB – 3dB which is considered an imperceptible to slight impact.

For existing roads the Dublin Agglomeration Noise Action Plan 2013-2018, prepared jointly by the four Local Authorities in the Dublin Agglomeration, has set a level of 70dB (L_{Day}) and 55dB (L_{Night}) above which mitigation measures should be considered. Similar to noise impacts on neighbouring residential receptors, there will be no significant impacts associated with road traffic and domestic activities on future residents of the proposed development.

ESB Facility East of Site

Notwithstanding the ESB's proposals to provide appropriate noise attenuation measures to mitigate the noise impact from their transformer facility, i.e. at source in accordance with best practice, the Clay Farm Phase 2 residential units (similar to the Clay Farm Phase 1 development) have been designed to ensure a high degree of acoustic insulation from external sources to reduce the significance of external noise intrusion into the residential buildings. The mitigation measures which will be incorporated into the construction of the units and the scheme are set out in Section 10.7.

Phase 1 & Phase 2 Bridge Link – Ballyogan Stream and Habitat

The movement of vehicles over the bridge link between the Phase 1 and Phase 2 developments will generate vehicle borne noise from both vehicle engines and from noise from wheel movement over the bridge road surface. Although noise from this source is not predicted to be unacceptably high, given the elevated nature of the bridge, which will not benefit from screening provided by buildings in the development to reduce the propagation of internal road noise, the bridge road surface will be constructed using a low noise asphalt material which shall reduce wheel generated noise by c. 2.5dB(A) as compared to standard asphalt road surfaces and will further serve to reduce the propagation of vehicle noise within the development and shall reduce the noise impact on the Ballyogan stream and habitat over which the bridge structure spans.

Vibration

The only source of vibration predicted, once the development has been constructed and is operational, is vibration associated with road traffic movements.

As a vehicle travels along a road, vibration can be generated in the road and subsequently propagate towards nearby buildings. Such vibration is generated by the interaction of a vehicle's wheels and the road surface and by direct transmission through the air of energy waves. Some of these waves arise as a function of the size, shape and speed of the vehicle, and others from pressure fluctuations due to engine, exhaust and other noises generated by the vehicle.

Ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Vibration impacts associated with road traffic can therefore be largely avoided by good maintenance of the road surface.

It has been assessed that vibration levels related to road traffic movements, including those additional movements due to the proposed development would be significantly lower than those levels required to lead to disturbance of occupiers or to cause cosmetic or structural damage to buildings.

10.6 CUMULATIVE NOISE IMPACTS

In accordance with *Schedule 6, Part 2(c) of the Planning and Development Regulations 2001*, this section has considered the cumulative impact of the proposed development in conjunction with future development in the vicinity of the subject site. This section relates to the cumulative impact on the subject site itself and on surrounding sites.

The European Commissions report of May 1999 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' defines cumulative impact as follows:

"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project".

The potential and predicted impacts of the operational phases of both Phase 1 and Phase 2 Clay Farm developments have been individually assessed. The noise and vibrational impacts of the Phase 1 development has been previously determined and it was determined that it would not have an adverse noise or vibrational impact on the receiving environment. Similarly, this document has assessed the potential impacts of the Phase 2 development which has been designed and will be managed during the construction phase in a manner that will not have an adverse or unacceptable noise or vibrational impact on either the Phase 1 development or on any other residential areas that border the Phase 2 site, in particular, the Cruagh and Stepaside Park estates, on the Stepaside Golf course or on the Ballyogan Stream and Habitat area that traverses the Phase 1 and Phase 2 sites.

It is considered that there will be short to medium term moderate negative cumulative impacts associated with the construction phase of the project over all phases of the development. However, it is considered that there will be a long term positive cumulative impacts as a result of the proposed development, due to the modern residential facilities and significant public open spaces and civil amenity areas that are being provided.

10.7 INWARD NOISE IMPACT ASSESSMENT

To mitigate the traffic noise impacts on the proposed residential units within the scheme, mitigation measures will be incorporated into the design of the proposed residential units (mitigation by design).

External noise can enter rooms within dwellings through windows, ventilators, walls, roof and doors. In most cases, however, windows provide the main path and therefore, mitigation by design has focussed on this building element to ensure that their insulation is adequate. All northern and northeastern facing external windows shall be triple glazed to prevent the breakthrough of external noise. There shall be no passive air vents on external walls to reduce the breakthrough of external noise. The apartments shall include ducted Heat Recovery and Ventilation Systems. At the earliest stage during the construction phase, residential test units shall be constructed to their finished level and shall be tested by a suitably qualified independent Acoustic Engineer to ensure that they comply with *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound.* Table 10.12 provides detail on the recommended sound insulation values that shall be achieved to ensure acoustic privacy between adjoin residential units.

Table 10.12: Recommended sound insulation values for internal party walls / floors

Dwellings	Airborne Sound Insulation D_{nTw} (dB)	Impact Sound Insulation L_{nTw} (dB)
Floors and Stairs	53	58
Walls	53	N/A

The main potential noise impact on existing receptors associated with the proposed development relates to additional traffic flows on the surrounding road network. Given that traffic from the development will make use of existing and new road infrastructure, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development using the L_{A10} parameter which is typically used to describe traffic noise.

For other non-traffic related sources appropriate guidance on internal noise levels for dwellings is contained within *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings.* This British

Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as detailed in Table 10.13

Table 10.13: Recommended Indoor Ambient Noise Levels From BS 8233: 2014

Typical situations	Design Range, $L_{Aeq,T}$ dB	
	Daytime $L_{Aeq,16hr}$ (07:00 to 23:00hrs)	Night-time $L_{Aeq,\ 8hr}$ (23:00 to 07:00hrs)
Living / Dining Rooms	35 / 40	n/a
Bedrooms	35	30

As outlined in Section 10.9, noise mitigation measures for the development will be specified to ensure that the following internal ambient noise criteria will be achieved:

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

With regard to the existing ambient noise climate of the area, the site layout and the internal noise criteria, the sound insulation requirements of the residential units have been assessed to ensure that external noise from traffic movements along Ballyogan Road, M50 traffic, traffic movements within the development, Luas tram movements along Ballyogan Road and from noise generated at the ESB facility located to the east of the site do not have an adverse impact on internal noise levels.

10.8 DO NOTHING IMPACT

If the site remains undeveloped it shall continue to have no impact on the receiving noise environment. Based on the projected increase in traffic up to the reference year of 2034 the increase in traffic noise levels based on projected Traffic Impact Assessment figures without the subject development would be <3dB. This increase above the existing situation would be minor and would not result in a perceptible change in the existing noise climate at any local receptor.

10.9 REMEDIAL AND MITIGATION MEASURES

10.9.1 General Construction Site Management

The following noise management measures shall be implemented at the site from the outset of site activities to control and manage noise levels during the construction phase of the proposed development:

- An independent acoustic consultant shall be engaged by the contractor prior to the commencement of site activities to ensure that all noise mitigation measures as specified in this Section of the EIA Report are implemented and to prepare a site specific *Construction Phase Noise Management Plan.* The Plan shall include all relevant noise and vibration control measures as specified in this document The Plan shall be submitted to Dun Laoghaire Rathdown Council for approval.
- The nominated contractor shall appoint a designated person to manage all environmental complaints including noise and vibration.
- A noise complaint procedure shall be implemented in which the details of any noise related complaint are logged, investigated and where required, measures are taken to ameliorate the source of the noise complaint.

- Appropriate signage shall be erected on all access roads in the vicinity of the site to inform HGV drivers that engines shall not be left idling for prolonged periods and that the use of horns shall be banned at all times.
- HGV's queuing on any local or public road shall not be permitted and it shall be the responsibility of site management to ensure this policy is enforced.
- The hours of operation for the site shall be limited to the following hours:
    - 08:00hrs – 19:00hrs Monday to Friday
    - 08:00hrs – 16:00hrs Saturday
    - Closed on Sundays and Bank/Public Holidays
- All onsite generator units (if required) used to supply electricity to the site shall be super silenced or enclosed and located away from any receptor.

10.9.2 Construction Phase Noise Mitigation

The following shall be implemented to mitigate construction noise impacts in order to ensure that the construction phase of the development does not have an unacceptable impact on sensitive receptors:

- A strictly enforced noise management programme shall be implemented at the site from the outset of construction activities.
- The Developer shall appoint an acoustic consultant independent of the Contractor to conduct routine noise audit surveys which shall be conducted at the baseline noise monitoring locations throughout the construction phase of the Phase 2 development to assess compliance with the construction noise limit criteria detailed in this document and to assess the effectiveness and implementation of the specific Construction Phase noise mitigation measures detailed in this document.
- The principal of controlling noise at source shall be implemented at the site. Best practice mitigation techniques as specified in *BS 5228:2009+A1 2014 – Noise and Vibration Control on Construction and Open Sites* shall be implemented during the construction phase and are detailed in this Section.
    - All plant where possible shall be low noise rated.
    - High noise activities such as pneumatic hammering / rock breaking shall not occur before 09:00hrs and not after 17:00hrs Mondays to Fridays.
    - Where necessary the use of enclosures and noise screens shall be used to control noise from plant.
    - Plant shall be located away from the closest noise sensitive receptors where practicable.
    - All site vehicles shall either be turned off when not in use or throttled down when idle.
    - Site plant and vehicles shall be maintained to ensure they are not excessively noisy.
    - Vibration sources such as compressors, pumps or generators shall be isolated and placed on anti-vibration pads to minimise ground vibrations and vibrational noise.
    - Site offices / cabins shall be grouped together in a manner that forms an additional noise barrier relative to the closest receptors to the site boundaries.

10.9.3 Construction Phase Vibration Mitigation

In order to ensure that site construction activities are conducted to minimise the vibration impacts on the receiving environment, structural vibration monitoring shall be conducted during the course of the project works as and if required. It is proposed that vibration monitoring will be conducted at adjacent properties as required using calibrated vibration monitors and geophones and that audible and visual alarm units may be installed to ensure that if vibration levels approach or exceed specified warning and limit values, site personnel will be alerted to

cease at the earliest instance and appropriate mitigation measures may then be implemented to minimise the vibrational impacts of protected structures.

As detailed in Section 10.2.2 the transient vibration guide values for cosmetic damage as specified in British Standard BS 7385:, Evaluation and measurement for vibration in buildings, Part 2 1993 Guide to damage levels arising from ground borne vibration is 15 mm/sec Peak Component Particle Velocity at 4 Hz increasing to 20 mm/sec at 15 Hz. This limit value rises to 50 mm/sec at frequencies of 40 Hz and greater. The applied conservative limit of 12.5 mm/sec PPV (peak particle velocity) applied for this assessment is significantly lower than these levels.

Having regard to the above we suggest the inclusion of the following mitigation measure for ease of reference:

N&V Const 1: In order to protect the amenities enjoyed by nearby residents, premises and employees a full Construction Management Plan (including traffic management) should be put in place prior to the commencement of development. This will need to have regard to the mitigation measures set out in Section 10.8.3 of the EIA Report.

10.9.4 Operational Phase Noise Mitigation

To mitigate the impacts associated with noise emissions from the ESB Transformer Facility to the residential properties located in the eastern area of the development site, the following mitigation measures have been incorporated into the design of the proposed residential units (mitigation by design).

N&V Opera 1: External noise can enter rooms within dwellings through windows, ventilators, walls, roof and doors. In most cases, however, windows provide the main path and therefore, mitigation by design has focussed on this building element to ensure that their insulation is adequate. All external windows shall be triple glazed acoustically rated window and frames or equivalent double glazing reaching the same level to prevent breakthrough of external noise. In addition, passive air vents on all external walls shall be acoustically rated baffle filters to reduce the breakthrough of external noise.

Acoustic Design requirements for residential buildings

Windows

In order to ensure a sufficient level of sound insulation is provided for all dwellings within the development, the following lists the minimum sound insulation performance of windows and window frame sets in terms of the weighted sound reduction index (R_W):

40dB R_W for Living rooms & Bedrooms

37dB R_W for Kitchen – Dining Rooms.

The acoustic performance specifications detailed are the minimum requirements which shall apply to the overall glazing system when installed on site. 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. All exterior wall and door frames should be sealed tight to the exterior wall construction.

Ventilation Systems

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations and will be finalised at the detailed design stage. BS 8233 notes that where openable windows cannot be relied upon for ventilation, sound attenuating trickle ventilators or attenuated acoustic ventilation units are available for insertion in external walls. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Options which will be considered in order to achieve compliance with background ventilation requirements will be adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively.

Wall Constructions

The wall construction typically provides the highest level of sound insulation performance to a residential building. The residential dwellings will be built using either masonry or a timber framed construction. The minimum sound insulation performance of the chosen wall construction will be 55dB Rw.

Roof Construction

The insulated roof constructions proposed across the site will provide an adequate level of sound insulation to the properties within the development site. A minimum sound insulation value of 40dB Rw should be used for roof spaces. This can nominally be achieved using tiled pitched roof with 100mm acoustic insulation and plasterboard ceiling.

At the earliest stage during the construction phase, residential test units shall be constructed to their finished level and shall be tested by a suitably qualified independent Acoustic Engineer to ensure that they comply with *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound.* Table 10.12 above provides detail on the recommended sound insulation values that shall be achieved to ensure acoustic privacy between adjoining residential units and to assess compliance with external noise intrusion criteria as defined in *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings.*

As set out in Section 10.5.1 the operational phase of the development is unlikely to have an adverse noise impact on the receiving environment or on existing residential developments adjacent to the site during the operational phase of the scheme. Therefore, no mitigation measures additional to those set out above are proposed.

10.10 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

Outward Noise Impact

Construction phase

During the construction phase there is the potential for some minor impact on nearby noise sensitive properties due to noise generated by construction site activities. The implementation of the construction phase noise and vibration mitigation and monitoring programme as detailed in Section 10.8 above and Section 10.10 below, will minimise the potential noise and vibration impact on the receiving environment including existing residential receptors..

Operational Phase

The predicted noise impact generated by additional traffic movements associated with the Phase 2 development is predicted to be of a imperceptible to slight impact on existing ambient noise levels at the Cruagh and Stepaside Park Estates, the Clay Farm Phase 1 development site, the residential development along the Ballyogan Road or on the Stepside Golf course.

Inward Noise Impact

It may be concluded that during daytime and night-time periods, acceptable internal noise levels can be achieved across the site as defined in *BS 8233* with windows closed using the recommended triple glazing, wall and roof constructions as proposed in Section 10.8 above.

The installation of Heat Recovery and Ventilation systems in the apartments will negate the requirement for external wall vents, thus maintaining the sound insulation integrity of external wall structures.

With regard to the recommended mitigation by design measures as specified above, it may be concluded that residential properties located within the proposed development can be appropriately designed and constructed to achieve acceptable internal noise levels.

10.11 MONITORING

This section describes the noise and vibration monitoring methodologies that shall be implemented at the site to ensure that construction site activities do not cause excessive nuisance or cause cosmetic or structural damage to properties in the vicinity of the site.

10.11.1 Proposed Noise Monitoring Programme During Site Construction

On commencement of the site construction activities, routine noise monitoring shall be conducted in the vicinity of the site to assess the impact that site activities may have on local external noise levels and on ambient noise levels on local receptors.

It is proposed to conduct routine noise monitoring surveys to establish the noise impacts of site activities at the closest receptors to the site (baseline monitoring locations) and to ensure that control measures are implemented if elevated noise levels are recorded.

All noise monitoring data will be compiled into a technical monitoring report which will include a full assessment of the potential noise impacts arising from site construction activities.

The environmental noise measurements will be completed in accordance with the requirements of *ISO 1996: Acoustics – description and measurement of environmental noise*. The measurement parameters to be recorded include wind speed, temperature, L_{Aeq}, L_{A90}, L_{A10} and $L_{Amax.}$

Noise Monitoring Locations

The monitoring locations selected for the noise monitoring survey will be at residential noise sensitive receptors adjacent to the site boundaries and as identified in the baseline noise assessment..

10.11.2 Proposed Vibration Monitoring Programme During Site Construction

In order to ensure that site construction activities are conducted to minimise the vibration impacts on the receiving environment, it is proposed that structural vibration monitoring may be implemented during the course of the construction phase if and as required.. It is proposed that vibration monitoring will be conducted at adjacent properties opposite the site boundaries as required using calibrated vibration monitors and geophones and that audible and visual alarm units may be installed to ensure that if vibration levels approach or exceed specified warning and limit values, site personnel will be alerted to cease at the earliest instance and appropriate mitigation measures may then be implemented to minimise the vibrational impacts of protected structures.

Vibration Monitoring Locations

The monitoring points chosen for locating the geophone of the vibration measuring instrument will be chosen according to the guidelines in British Standard *BS 7385:, Evaluation and measurement for vibration in buildings, Part1 1990 Guide for measurement of vibrations and evaluation of their effects on buildings* and *Part 2 1993 Guide to damage levels arising from groundborne vibration.*

10.12 REINSTATEMENT

Reinstatement issues are not relevant to this Section of the EIAR.

10.13 INTERACTIONS

The principal interactions between Noise & Vibration impacts and Human Beings have been addressed in Section 10.7 of this report which describes in detail the mitigation measures that shall be implemented to ensure that human health and residential amenity are not adversely impacted by any aspect of the construction or operational phases of the development.

10.14 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered in compiling this section of the EIAR**.**

10.15 REFERENCES

Department of Environment, Heritage and Local Government 2003 Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development
Department of Environment, Heritage and Local Government 2007 Development Management Guidelines
Department of Environment, Community and Local Government March 2013 Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment
Environmental Protection Agency, 2002. Guidelines on the Information to be Contained in Environmental Impact Statements
Environmental Protection Agency, 2003. Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)
ISO 1996: 2007: Acoustics – Description and measurement and assessment of environmental noise.
NRA (TII) Guidance for the Treatment of Noise and Vibration in National Road Schemes (2014).
BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise 2009+A1 2014.
UK Department of Transport (Welsh Office) - Calculation of Road Traffic Noise [CRTN] and
UK Highways Agency Design Manual for Roads and Brides Part 7 HD 213/11 – Revision 1 Noise and Vibration.
BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014
BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration.
Department of the Environment, Building Regulations 2014, Draft Technical Guidance Document E – Sound.

APPENDIX 10.1

Copy of letter dated 8th May 2017 from ESB to Applicant regarding ESB site noise

NETWORKS

esbnetworks.ie

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8th May 2017

Mr Dick Cuddihy,

Park Development Group,

The Herbert Building,

The Park,

Carrickmines ,

Dublin 18.

Ref: Existing ESB 220kV Substation at Ballyogan Road, Carrickmines, Dublin 18.

Dear Mr. Cuddihy,

In relation to your recent enquiry in respect of possible noise impacts from the existing ESB substation at Ballyogan Road and your adjacent developments at Clay Farm. I can confirm that as part of ESB's original planning applications submitted in 2009 for the substation (Planning Ref: D09A/0065), ESB provided details to Dun Laoghaire Rathdown County Council for a noise abatement enclosure which would be installed in front of the transformers.

It is ESB's intention that as the substation developments progress and plant becomes operational, the appropriate noise abatement solution will be deployed within a reasonable timeframe and subject to planning requirements previously granted.

I trust the above is satisfactory, should you require any clarifications on the above please contact me.

Yours sincerely,

Conor Garrigan

HV Station Manager, Dublin,

HV Delivery and Contracting,

ESB Networks.