14 NOISE AND VIBRATION

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14 NOISE AND VIBRATION

14.1 Introduction

This chapter of the ES assesses the Noise and Vibration impact of the Proposed Development. The noise impact assessment assesses the likely significant impacts from the construction activities of the Proposed Development on the nearest noise sensitive receptors. The effect of construction noise has been assessed in full. The construction noise targets are set out along with the assessment methodology and results of the construction noise predictions and calculations. Noise mitigation measures are discussed such that noise targets are met throughout the construction phases.

World Health Organisation (WHO) describes environmental noise generically as that emitted by all sources, except sources of occupational noise exposure in workplaces (WHO, 2018). The Environmental Noise Directive (EU, 2002) is more specific in its definition, considering environmental noise as unwanted or harmful outdoor sound created by human activity, such as noise emitted by different means of transport — road traffic, rail traffic, air traffic — and industrial activity.

World Health Organisation (WHO) states that "*Excessive noise seriously harms human health and interferes with people's daily activities at school, at work, at home and during leisure time. It can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour*."

WHO Environmental Noise Guidelines for the European Region provide guidance on protecting human health from harmful exposure to environmental noise. They set health-based recommendations on average environmental noise exposure of five relevant sources of environmental noise. These sources are road traffic noise, railway noise, aircraft noise, wind turbine noise and leisure noise.

European Environment Agency (EEA) claim Environmental noise is a pervasive pollutant that adversely affects the health and well-being of European citizens and wildlife. Although noise is a product of many human activities, the most widespread sources of environmental noise are those related to transport. Long-term exposure to noise can cause a variety of health effects including annoyance, sleep disturbance, negative effects on the cardiovascular and metabolic system, as well as cognitive impairment in children.

The specific objectives of the noise and vibration assessment are to:

- define the assessment methodology and significance criteria used in completing the noise and vibration impact assessment;
- describe the likely significant effects, including indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development,
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

Potential noise and vibration impacts on ecological receptors are considered within ES Chapter 7 Terrestrial Ecology and Ornithology and ES Chapter 8 Fisheries and Aquatic Ecology.

This Noise and Vibration Chapter should be read in conjunction with:

- Chapter 1: Introduction;
- Chapter 2: Project Description and Need (which provides details of the Proposed Development);
- Chapter 8: Fisheries and Aquatic Ecology;
- Chapter 15: Traffic; and
- Volume III, Appendix 2.2 Appendix Outline Construction Environment Management Plan (OCEMP).

This Chapter is supported by the following figures in ES Volume II:

- Figure 14:1 – Figure 14.25 Proposed Development, Construction Noise Receptors and Buffers.

This Chapter is supported by the following appendices in ES Volume III:

- Appendix 14.1: Construction Noise Receptor Data.

14.1.1 Likely Significant Effects Scoped Out

On the basis of the desk-based work undertaken and professional judgement of the author the following areas have been scoped out of the detailed assessment including:

- Construction vibration as the proposed construction activities do not include piling;
- Operational noise has not been included as there is no inclusion of new significant noise sources likely to generate perceptible noise levels when the Proposed Development is operational including the overhead lines or the underground cables. In addition, there are no operational cumulative effects;
- Operational vibration has not been included as there is no inclusion of new significant vibration sources likely to generate perceptible levels of vibration when the Proposed Development is operational.

14.2 Methodology

The noise and vibration assessment has been undertaken on the planning application drawings contained within ES Chapter 2 Project Description and Need, to assess the likely significant noise impact effects on the surrounding area during construction stage.

Construction phase includes:

- Construction noise from on-site activities affecting nearby sensitive receptors; and
- Construction noise from construction traffic affecting nearby sensitive receptors.

14.2.1 Planning Policy Context

The relevant planning policy is listed below:

- Planning Policy Statement (PPS) 21: Sustainable Development in the Countryside;
- The Noise Policy Statement for Northern Ireland (NPSNI); and
- The Strategic Planning Policy Statement (SPPS).

14.2.2 Relevant Guidance

The noise and vibration assessment has considered the following relevant policy and guidance documents:

- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (IEMA, 2014);
- Scottish Government Assessment of Noise Technical Advice Note (TAN, 2011);
- British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites;
- Acoustics and Noise Consultants (ANC) Construction Noise: A Good Practice Guide to the Preparation, Submission and Management of Section 61 Consents Technical Note (March 2021);
- Highways England (2019). Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA111 Noise and Vibration (formerly HD213/11, IAN 185/15) Revision 0. Department for Infrastructure (DfI) Northern Ireland.

14.2.1.1 Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment

IEMA noise impact assessment guidelines address the key principles of noise impact assessment and are applicable to development proposals where noise effects are likely to occur.

The guidelines provide specific support on how noise impact assessment fits within the Environmental Impact Assessment (EIA) process. They cover:

- how to scope a noise assessment;
- issues to be considered when defining the baseline noise environment;
- prediction of changes in noise levels as a result of implementing development proposals; and
- definition and evaluation of the significance of the effect of changes in noise levels (for use only where the assessment is undertaken within an EIA).

The guidelines define core methods and techniques, used within the noise impact assessment process, and endeavour to highlight their limitations, where relevant. They can be applicable to all stages of a project, from construction through operation to restoration and decommissioning.

14.2.1.2 Scottish Government Assessment of Noise Technical Advice Note (TAN)

The Technical Advice Note provides guidance which may assist in the technical evaluation of noise assessment. It has been prepared as a guide for noise professionals, both in the public and private sector, in the preparation and evaluation of noise impact assessments. It does not offer prescriptive guidance on noise assessment nor should it be considered as being exhaustive in extent. It aims to assist in assessing the significance of impact. Advice on the role of the statutory planning system in helping to prevent and limit the adverse effects of noise is set out in Planning Advice Note.

For noise generating developments it may be sufficient to identify the nearest noise sensitive receptors (NSR). However, in general, the distance over which a noise source may have a significant impact on NSRs will depend on the magnitude of the noise source, the existing noise level and the influence of site features on sound propagation. For each NSR, the level of sensitivity associated with the type of NSR needs to be assessed.

14.2.1.3 British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites

BS5228 consists of two parts and covers the need for protection against noise and vibration of persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control in respect of construction operations.

British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise

Table 14.1 outlines the applicable noise threshold limits that apply at the nearest noise sensitive properties. The determination of what category to apply is dependent on the existing baseline ambient (L_{Aeq}) noise level (rounded to the nearest 5dB) at the nearest noise sensitive property in accordance with British Standard BS 5228. Different limits apply based on the existing baseline noise climate, or in simple terms how noisy the baseline noise climate is.

Table 14.1: Noise Threshold Limits at Nearest Sensitive Properties for Construction Activities (Ref BS5228)

	Threshold Limits [dB(A)]		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evening and Weekends (19:00-23:00 Weekdays 13:00-23:00 Saturdays 07:00-23:00 Sundays)	55	60	65
Weekday daytime (07:00-19:00) Saturdays (07:00-13:00)	65	70	75

British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration

Part 2 of the standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry-specific guidance.

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14 mm·s^{-1} to 0.3 mm·s^{-1}. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur. Guidance of effects of vibration levels are illustrated in Table 14.2 below.

Table 14.2: Guidance on Effects of Vibration Levels (Reference BS5228 Part 2, Table B.1)

Vibration Level	Effect
0.14 mm·s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm·s^{-1}	Vibration might be just perceptible in residential environments.
1.0 mm·s^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm·s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 14.3 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 14.3, and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 14.3: Transient Vibration Guide Values for Cosmetic Damage(Reference BS5228 Part 2, Table B.2)

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/S at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

14.2.1.4 Acoustics and Noise Consultants (ANC) Construction Noise : A Good Practice Guide to the Preparation, Submission and Management of Section 61 Consents Technical Note

In England, it is generally accepted for construction sites where works are undertaken in close proximity to environmentally sensitive resources or where management of the construction programme is a key consideration, that seeking prior consent under Section 61 of the Control of Pollution Act 1974 can be an effective way of ensuring that the desired project outcomes are achieved whilst affording the necessary level of protection to those potentially at risk from construction noise and vibration effects. However, demolition and construction can be complex and variable, making reliable predictions and assessments at times challenging, despite, and sometimes because of, the defined process identified in the British Standard 5228, which is the statutory Code of Practice attached to the Control of Pollution Act 1974.

However, the good practice guidance includes an explanation of the legislative framework for Section 61 applications for prior consent and the roles and interactions of those involved in their preparation. It also provides practical advice on: the preparation of the application including noise predictions; engagement with the relevant local authority and other key stakeholders; the application of best practicable means to minimise noise (and vibration); agreeing suitable consent conditions; and the monitoring and management of compliance with consent conditions. Advice is also given on the role and setting of noise and vibration limits or thresholds and the uncertainty associated with noise and vibration predictions. Control of Pollution Act 1974 is not law within NI. However, this technical note acts a reference guide in relation to construction noise assessments.

14.2.1.5 Highways England (2019). Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA111 Noise and Vibration (formerly HD213/11, IAN 185/15) Revision 0. Department for Infrastructure (Dfl) Northern Ireland

LA111 Noise and Vibration Revision 0 (formerly HD 213/11, IAN 185/15) provides guidance on the environmental assessment of noise impacts from road schemes. The Design Manual for Roads and Bridges (DMRB) contains advice and information on transport-related noise and vibration, which has relevance regarding the construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing traffic related noise impacts.

14.3 Likely Significant Effects

In keeping with the typical scope of an Environmental Impact Assessment (EIA), the emphasis of this ES Noise and Vibration Chapter is on the assessment of the potential effects of the Proposed Development upon the surrounding environment (nearest noise sensitive receptors) during the construction phase.

As detailed in IEMA Guidelines for Environmental Noise Impact Assessment the following terminology and definitions are detailed as:

- Noise Impact -The difference in the acoustic environment before and after the implementation of the proposals (also known as the magnitude of change). This includes any change in noise level and in other characteristics/features, and the relationship of the resulting noise level to any standard benchmarks.

- Noise Effect -The consequence of the noise impact. This may be in the form of a change in the annoyance caused, a change in the degree of intrusion or disturbance caused by the acoustic environment, or the potential for the change to alter the character of an area such that there is a perceived change in quality of life. This will be dependent on the receptor and its sensitivity.
- Significance of Effect -The evaluation of the noise effect and, particularly if the noise impact assessment is part of a formal EIA, deciding whether or not that impact is significant.

14.3.1 Receptor Sensitivity Criteria

Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise sensitive commercial premises. This is taken from the Scottish Government's Technical Advice Note on Assessment of Noise, Table 2.1 Level of sensitivity associated with various examples of noise sensitive receptors. Section 2.21 of TAN States

"*The are three levels of sensitivity "high" "medium" and "low". The ranking is primarily based on the relationship between the amenity associated with a NSR and its susceptibility to noise*."

TAN Chapter 2, Table 2.1 Level of Sensitivity Associated with Various Examples of Noise Sensitive Receptors provides sensitivity, description and examples of noise sensitive receptors. There is currently no equivalent refence document in Northern Ireland. Therefore, sensitivity of receptors, as defined in TAN has been used as reference criteria for sensitivity of receptors within this chapter.

Although this is not Northern Irish guidance, the assigned sensitivities are commonly used for Noise Impact Assessments across the UK. The sensitivity of receptors to noise and vibration during construction phase of the Proposed Development is defined below in Table 14.4.

Table 14.4:Criteria to Define Receptor Sensitivity (Ref: TAN Assessment of Noise)

Sensitivity	Description	Examples of NSR
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios Schools during the daytime Hospitals/residential care homes Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive. Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event Night Clubs

There are no non-residential construction noise sensitive receptors identified in the vicinity of the Proposed Development study area. Therefore, all construction noise receptors are classified as having a sensitivity of 'high".

14.3.2 Magnitude of Impact / Level of Significance

Construction noise comprises of both plant noise and site traffic noise. The construction noise 'of effect' for this assessment is based on the '5dB change' method in BS5228 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise' which is summarised in 14.6 below.

The magnitude of construction noise Impacts has been determined in accordance with Annex E of BS 5228-1:2009+A1:2014. The significance criteria for assessing noise impact from construction works have been based on example Method 2 contained within Annex E.3.3 of BS 5228-1:2009+A1:2014, as referred to above. This indicates that:

"Noise levels generated by site activities are deemed to be potentially significant if the total noise (preconstruction ambient plus site noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut off values of 65dB, 55dB and 45dB L_{Aeq} period, from site noise alone, for the daytime, evening, and night-time periods, respectively, and a duration of one months or more, unless works of a shorter duration are likely to result in a significant effect. "

Noise levels generated by construction activities are significant if the total noise (pre-construction baseline plus construction noise) exceeds the pre-construction baseline by more than 5 dBA subject to the lower cut-off value of 65dBA noise from construction activities alone as detailed in BS 5228.This classifies the magnitude of effect based on the sound level difference between the ambient noise level with and without construction. This is calculated by finding the difference between the baseline ambient level and the total level (construction noise plus baseline ambient level) at each noise sensitive receptor location.

For the majority of noise sensitive receptors, pre-construction ambient noise levels are relatively low, resulting in the criteria set within the lower cut-off levels given in Table 14.5 below applying the most stringent limits. As such the lower cut-off levels are used throughout the construction assessment to all noise sensitive receptors.

BS 5228 does not contain any significance criteria equivalent to what is presented in Table 14.1, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are presented.

Table 14.5: Magnitude of Impact: Construction Noise (Ref: BS 5228 Part 1)

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Daytime Noise Level (dB $L_{Aeq, 12h}$) (Ambient and Construction Noise)	Magnitude of Impact
< 0 dB	< 65 dB (lower cut-off level)	No change / Negligible
0 - 5 dB	65 - 70 dB	Minor
5 – 10 dB	70 –75 dB	Moderate
> 10 dB	> 75 dB	Major

On account of the temporary nature of construction activities, higher noise threshold limits apply to construction phase activities as compared to permanent operational phase activities.

14.3.3 Significance Criteria

Following the identification of receptor importance and magnitude of the effect, it is possible to determine the significance of the impact. TAN Chapter 2 Table 2.6 Significance of Effects provides the framework in determining the level of significance relating the magnitude with the sensitivity of the receptor. The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact the receptor is exposed. The significance of effects for receptors of high sensitivity are summarised below in Table 14.6.

Table 14.6: Matrix for Determining Significance of Effect for Receptors of High Sensitivity (Ref: TAN Table 2.6)

Magnitude of Impact (Beneficial or Adverse)	Significance of Effect for Receptors of High Sensitivity
Major	Large or Very Large
Moderate	Moderate or Large
Minor	Slight/ Moderate
Negligible	Slight
No Change	Neutral

In line with the guidance:

- Very Large: These effects represent key factors in the decision-making process. They are generally, but not exclusively associated with impacts where mitigation is not practical or would be ineffective
- Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance
- Moderate: These effects, if adverse, while important, are not likely to be key decision-making issues
- Slight: These effects may be raised but are unlikely to be of importance in the decision-making process
- Neutral: No effect, not significant, noise need not be considered as a determining factor in the decision-making process

Effects are considered to be significant when identified as likely to have a Moderate, Large or Very Large Effect.

14.4 Baseline Environment

14.4.1 Study Area

The location of the Proposed Development is presented in ES Chapter 1: Introduction Plate 1.1: Proposed Development Location.

The proposed 33kV connection is c37.9 km in length, comprising of c26.9 km of overhead line supported by single and double wooden pole sets and 11 km of underground cabling.

The Proposed Development comprises of an underground cable connected from the existing 110/33kV Strabane main substation which extends into an overhead line between Hollyhill and Curlyhill Road from pole 2001. From this point, the overhead line route generally follows a south easterly direction which is undergrounded at various locations, mainly along public roads. The overhead line route terminates at pole 2322 before being undergrounded along Crockanboy Road and connecting into a substation at the Curraghinalt mine.

The detailed route of the Proposed Development including underground cable sections and (numbered) pole locations is shown on drawing nos. 698-1-20 – 698-1-26 Proposed 33kV Powerline Strabane Main to Proposed Curraghinalt Mine Development appended at Appendix 2.1 Project Drawings (not to scale).

The noise and vibration study area encompasses the length of the proposed development, including overhead line and underground cable routes buffered to 320m (both sides of overhead lines and underground cable routes) as presented in Figure 14.1 Noise and Vibration Study area below.

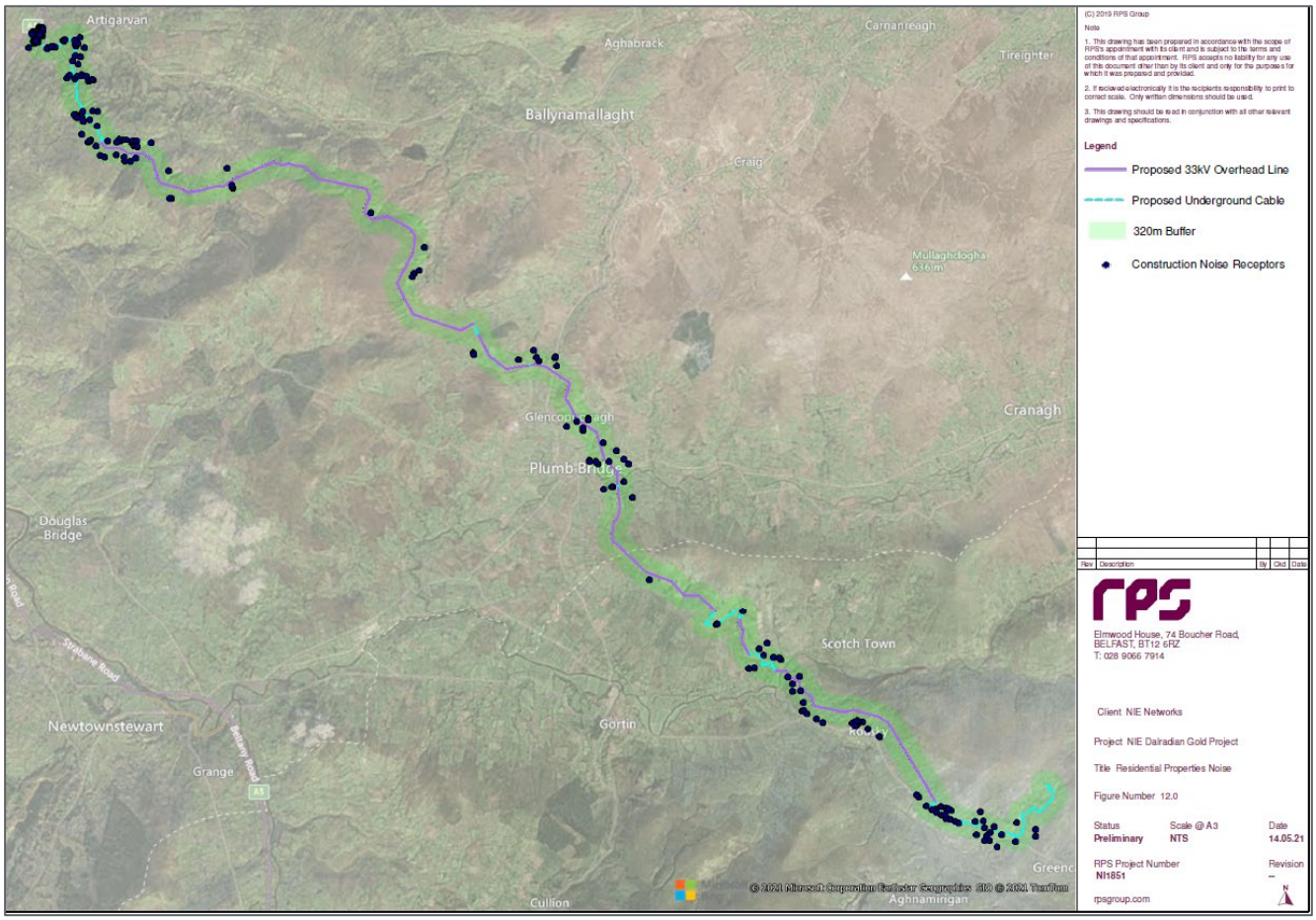

Figure 14.1: Noise and Vibration Study Area

The primary study area for noise is based upon guidance detailed in DMRB:

A construction noise study area shall be defined, where the need for further assessment has been established to include all noise sensitive receptors: 1) that are potentially affected by construction noise; in areas where there is a reasonable stakeholder expectation that a construction noise assessment will be undertaken."

DMRB guidance 2019 suggests that "*a study area of 300m from the closest construction activity is normally sufficient to encompass noise sensitive receptors*."

The study area for the noise and vibration assessment encompasses the entire length of the Proposed Development extended to include noise sensitive receptors within 320m radius.

14.4.2 Baseline Noise Survey

The local noise climate of the Proposed Development is considered likely to comprise of:

- distant road traffic;
- local road traffic;
- natural noise sources (e.g. birds, wind in trees etc.); and
- agricultural activity.

The prevailing noise levels are, therefore, considered to be predominantly low both for ambient and background noise. The assessment methodology from BS 5228 does not require specific quantification of prevailing noise levels to conduct a worst case assessment. The Proposed Development is predominately in a rural location and the baseline sound levels are anticipated to be at least 5 dB below the lowest threshold values in BS 5228-1:2014. Therefore, the lowest threshold values would apply when determining the significance of effects.

As these threshold values have been assumed to apply, it was determined that baseline monitoring surveys were not required. Therefore, a baseline noise monitoring survey has not been undertaken along the route of the

Proposed Development. The application of the lowest construction limit of 65 dB, as detailed within BS 5228, has been applied for assessment of magnitude of impact.

14.4.3 Construction Noise Receptors

Noise sensitive receptor locations, referenced as construction noise receptors, were obtained from the following data sources:

- Aerial mapping included Google and Bing aerial maps;
- Search of Planning NI planning portal for planning applications for residential properties.

The construction noise receptors locations are shown on Figures 14.1 – Figure 14.25 with a list of their identification references (ID's), and location coordinates summarised in Appendix 14.1 Construction Noise Receptors.

(N. B. Addresses of the construction noise receptors have not been included due to General Data Protection Regulations and publication of personal data).

Construction noise receptors include all residential properties within 320m either side of the Proposed Development proposed 33kV power line route. All construction noise receptors identified within the noise and vibration study area are residential properties.

14.4.4 Construction Noise Data Sources

The construction noise data source of proposed plant and equipment used for the construction noise assessment was BS 5228. In addition, construction information was provided by Northern Ireland Electricity Networks (NIEN) on the type of construction machinery to be adopted during the construction of the Proposed Development. Proposed construction vehicle usage of the proposed construction activities detailed in ES Appendix 2.2 OCEMP.

14.4.5 Consultation

A summary of all consultation with stakeholders or consultees (such as local planning authority) that is relevant to this chapter is provided in Table 14.7.

Table 14.7: Consultation Responses

Date	Consultee and Issue raised	How and Where Addressed in the ES
01/05/2020	Environmental Health Service (EHS) of Fermanagh and Omagh District Council (FODC). "*The proposed 33kV power line has the potential to generate noise and dust during construction activities associated with the installation, which has the potential to have an adverse impact on the occupants of any nearby commercial and residential properties.*"	Potential noise from the construction activites of the Proposed Development has been assessed, as detailed in Section 14.5 Impact Assessment on construction noise receptors All construction noise receptors identified within the noise and vibration study area are residential properties.There are no commerical receptors within 320m buffers of the proposed 33kV power line route. All construction noise receptors identified within the noise and vibration study area are residential properties. Dust assessment is contained within ES Chapter 12 Air Quality
19/01/2021	Environmental Health Service of Derry City and Strabane District Council..."*The proposed 33kV power line has the potential to generate noise and dust during activities associated with its installation which has the potential to have an adverse impact*	Potential noise from the construction activites of the Proposed Development has been assessed, as detailed in Section 14.5 Impact Assessment on construction noise receptors

Date	Consultee and Issue raised	How and Where Addressed in the ES
	on the occupants of any nearby commercial and residential properties."	All construction noise receptors identified within the noise and vibration study area are residential properties.There are no commerical receptors within 320m buffers of the proposed 33kV power line route. Dust assessment is contained within ES Chapter 12 Air Quality
19/05/2020	Environmental Health Service of Derry City and Strabane District Council..."*The proposed 33kV power line has the potential to generate noise and dust during activities associated with its installation which has the potential to have an adverse impact on the occupants of any nearby commercial and residential properties."*	Potential noise from the construction activites of the Proposed Development has been assessed, as detailed in Section 14.5 Impact Assessment on construction noise receptors All construction noise receptors identified within the noise and vibration study area are residential properties.There are no commerical receptors within 320m buffers of the proposed 33kV power line route. Dust assessment is contained within ES Chapter 12 Air Quality

14.5 Impact Assessment

14.5.1 Assessment of Construction Effects

Construction noise is likely to give rise to temporary, adverse effects at the construction noise receptors.

The construction noise assessment has been undertaken primarily as a desk based assessment but specifically references and assesses the construction plant to be used during the construction phase of the Proposed Development. .

Based on the Proposed Development, presented in ES Chapter 2 Project Description and Need, the likely significant impacts associated with noise are considered for the Construction Phase only. The construction noise assessment is undertaken using noise data sources contained within BS 5228 for construction plant. In addition, Northern Ireland Electricity Networks (NIEN) has detailed the type of construction machinery to be adopted on the site, and vehicle usage of the proposed construction activities as detailed in ES Appendix 2.2 oCEMP.

14.5.1.1 Construction Durations and Hours

It is envisaged that the total time to complete construction will be in the region of 12-18 months. Construction works will only take place between the hours of 07.00 - 19.00 hours on Monday to Friday, 07.30 - 17.00 hours on Saturday with no such work on Sunday.

If necessary, rock breaking will only take place between 09:00 – 17:00 hours on Monday to Saturday with no such work on Sunday.

Outside these hours, work on site will be limited to emergency works. The working day will be between 07:00 to 19:00 hours, assuming one hour break, therefore 11 hours typical working day assumed. Saturday working hours will be lower.

BS 5228 defines the day-time period is defined as 07:00 to 19:00 hrs; the evening period as 19:00 to 23:00 hrs and the night-time period as 23:00 to 07:00 hrs. Therefore, there will be no evening or night time construction works with the construction of the Proposed Development.

14.5.1.2 Construction Noise Receptors

As previously detailed, there are residential properties adjacent to and in close proximity to the Proposed Development 33kV power line route. Construction Noise Receptor locations are detailed in Figures 14.1 – Figure 14.25 Construction Noise Receptors (Please refer to ES Volume II).

14.5.1.3 Construction Phase- Overhead Line

ES Chapter 2: Project Description and Need, Section 2.2: Overhead Line describes the proposed overhead line. The Proposed Development comprises of an underground cable connected from the existing 110/33kV Strabane main substation which extends into an overhead line between Hollyhill and Curlyhill Road from pole 2001. From this point, the overhead line route generally follows a south easterly direction which is undergrounded at various locations, mainly along public roads. The overhead line route terminates at pole 2322 before being undergrounded along Crockanboy Road and connecting into a substation at the Curraghinalt mine.

The detailed route of the Proposed Development including underground cable sections and (numbered) pole locations is shown on *Drawing numbers 698-1-20 - 698-1-25 Proposed 33kV Powerline Strabane Main to Proposed Curraghinalt Mine Development* submitted in support of the planning applications and provided in Volume II (not to scale). The working area of the Proposed Development is defined by the red line boundary as shown on the aforementioned drawings.

The proposed sequence of construction works for the overhead line will include:

- Tree cutting,
- Pre-construction site access and engagement with third parties;
- Material machinery and equipment arrival;
- Pole erection including removal and set aside of topsoil, excavating foundation, lifting pole into place, and backfill and compact foundations. (Where rock breaking is required during excavation, a rock breaker attachment will be used on the tracked excavator. Due to the small footprint of the excavation required, use of a rock breaker will be limited to a short duration for a maximum of 3 days).;
- Overhead line stringing;
- Site demobilisation and restoration; and
- Construction and access audit.

Construction plant operation is proposed with the pole erection construction activities including proposed operation of excavators for pole erection and saw for tree cutting. ES Appendix 2.2 OCEMP, Table 1.1 Summary of Overhead Line Construction Vehicles and Plant, details the proposed vehicle type and construction activity description. Due to the nature of construction of overhead electricity lines, the Proposed Development will be constructed progressively along the proposed route in a sequential fashion, with the Active Work Section progressively moving along the route as the installation is completed. Each Active Work Section will have one Overhead Line Construction Work Team and will consist of a maximum of 50 poles (typically 30-40 poles).

The maximum duration of works at an Active Work Location expected to be:

- 1 day for Tree cutting
- ½ day for Access and Landowner Engagement
- ½ day for Material Delivery
- 1 - 3 days for Pole Erection (typically <1 day)
- 10 days for stringing (typically 5 days)
- ½ days for Audit.

BS 5228 contains a database of the noise emission from individual items of equipment and activities, and includes routines to predict noise from demolition and construction activities at identified receptors. The prediction method provides guidance on the effects of different types of ground conditions, barrier attenuation and how to assess

the impact of fixed and mobile plant. Noise levels for construction plant and equipment have been assigned based upon the reference levels provided in Annex C of BS 5228-1(2009+A1:2014).

Typical Anticipated operational noise levels of various construction plant proposed for tree cutting and pole erection are summarised below Table14.9 (obtained from BS 5228). The plant shown in Table 14.8 is representative of the type of plant that will be in use for the construction phase of the overhead lines.

Table 14.8: Noise Levels for Overhead Line Construction Plant (Ref: BS5228:2009+A1:2014)

Activity/ Plant		Sound Pressure Level LAeq at 10m (dB)	Reference from Tables C2, C4 & C9 D2, Annex C, BS5228:2009+A1:2014
Tree Cutting	Saw	86	D.2 14
Pole Erection Removal and set aside of topsoil Excavating Foundation (Lifting Pole into Place use an attachment on the tracked excavator) Backfill and Compact Foundation	Excavator	71	C2, Ref 21
Pole Erection Lifting Pole into Place	Use of an attachment on excavator	67	C2, Ref 21
Pole Erection Rockbreaking	Excavator mounted rock breaker	93	C.9 Ref 11
Overhead Line Stringing	Mobile Elevated Work Platform	67	C4, Ref 57

As stated above, tree cutting and rock breaking (if required), is not anticipated to occur over a full working day. Therefore, a further adjustment has then been applied both tree cutting and rock breaking sound pressure levels to correct the noise level for the percentage on time using the term +10.log10 (percentage on time / 100) as detailed in F.2.3.2 BS 5228 (See Figure F.5) to be representative of half day duration.

Table 14.9: Time Correction Adjustment Noise Levels for Overhead Line Construction Plant (Ref: BS5228:2009))

Activity/ Plant	Construction Time	% On Time Correction	Adjusted Sound Pressure Level
Tree Cutting	½ day	-3 (50)	83
Pole Erection Rockbreaking	½ day	-3 (50)	90

14.5.1.4 Construction Phase-Underground Cable

ES Chapter 2: Project Description and Need, Section 2.3: Underground Cable summarises the description of proposed Underground Cabling.

The location of underground cable sections is shown on drawing nos. 698-1-20 – 698-1-26 *Proposed 33kV Powerline Strabane Main to Proposed Curraghinalt Mine Development* appended at Volume II Appendix 2.1 Proposed Development Drawings (not to scale). The working area of the Proposed Development is defined by the red line boundary as shown on the aforementioned drawings.

For underground cable installation, the installation and therefore the Active Work Location will typically progress at a rate of 1km per month and no more than 2km per month. The majority of the proposed underground cable will be installed in public carriageway.

The proposed sequence of construction works for the underground cable will include:

- Site Access and Engagement with Third Parties;
- Intrusive Ground Investigation - Intrusive ground investigation works will consist of approximately 2m2 trial holes which are used to determine ground conditions and the precise location of existing services and structures. There will be approximately 1 trial hole per 100m of underground cable (c85 total) and the duration of investigation works will be approximately 15 (potentially non-consecutive) working days for a single 2 person digging team with a 13 tonne excavator;
- Machinery, Vehicle and Equipment Mobilisation;
- Excavation - A cable track of 1000mm deep by 500mm wide will be excavated along the proposed route as shown in drawing number CW33-1D (ES Appendix 2.2 OCEMP Appendix A). All spoil generated during excavation is expected to be unsuitable for reuse as backfill and will be removed using a dumper and/or grab lorry. Excavated material will be drawn to a registered disposal site. For excavation on agricultural lands, top soil will be stripped and stockpiled adjacent to the works and will be re-used when re-instating the trench. Other excavated material will be stockpiled separately, within the identified working area and will be re-used as back fill. Alternative construction methodologies may be required where there are specific existing features (e.g. watercourse, pipes, culverts) in the ground.
- Duct Installation - 6m long, 100mm diameter, red, class 1, PVC ducts will be installed in the excavated trench. All ducts will be as per NIE Networks specification 204-12 included in Appendix A. Installation will be as per drawing number CW33-1D included in ES Appendix 2.2 oCEMP Appendix A.
- Reinstatement - For cable installation in the public carriageway reinstatement will be to finished ground level.. For cable installation in agricultural lands, top soil will be re-instated to finish the trench to ground level. This will be re-seeded.
- Excavation of Cable Pulling Pits, Cable Installation and Jointing - Reinstatement of Cable Pulling Pits - Following the installation of the ducts and the reinstatement of the cable track, cable pulling pits will then be excavated along the cable track in order to pull the cable through the ducts and joint the sections of cable together. Following pull through of the cable, the pulling pits will then be reinstated as per the methods above; and
- Material, Machinery and Equipment Demobilisation.

Typical noise levels from various construction plant associated with underground cable construction are summarised in Table 14.10 obtained from BS 5228.

Table 14.10: Noise Levels for Underground Cable Construction Plant (Ref: BS5228:2009+A1:2014)

Activity	Plant	Activity Equivalent Continuous Sound Pressure Level L_{Aeq} at 10m (dB)	Reference from Tables C2 & C4, Annex C, BS5228:2009+A1:2014
Instrusive Ground Works	13 ton wheeled excavator	66	Table C4, Ref 10
Excavation	6 ton dumper	79	Table C4, Ref 6
	13 ton wheeled excavator	66	Table C4, Ref 10
	Road saw	91	Table C4, Ref 70
	Agricultural tractor and dump trailer	79	Table C4, Ref 75
Duct Installation	Cable winch	74	Table C2, Ref 43
Reinstatement	Vibrating plate	80	Table C2, Ref 41
Directional Drilling	Directional drilling rig	77	Table C2, Ref 44

A further adjustment has been applied to road saw, cable winch and vibrating plate as these construction activities will not occur for the duration of a full working day. The sound pressure level has been time corrected representative of a half day working day as detailed below in Table 14.11.

Table 14.11: Time Correction Adjustment Noise Levels for Underground Cable Construction Plant (Ref: BS5228:2009))

Activity/ Plant	Construction Time	% On Time Correction	Adjusted Sound Pressure Level
Road saw	½ day	-3 (50)	89
Cable winch	½ day	-3 (50)	71
Vibrating plate	½ day	-3 (50)	77

14.5.1.5 Predicted Impact of Construction Noise

The precise construction strategy to be adopted will be a matter for the contractor, but it is likely that construction noise levels experienced during the construction phase of the overhead line will be similar to the typical construction noise levels indicated in Table 14.8 and Table 14.10 for the various plant.

Construction noise predictions have been undertaken of the potential construction noise levels for the proposed construction activities associated with the Proposed Development 33kV power line route to include both overhead line and underground cable.

The calculation method adopted is the ‘Stationary plant – Plant sound power method’ of BS 5228.

Construction plant/machinery operating in the proposed construction areas will vary in distance from a closest point to a furthest point to the construction noise receptors assessed. This is because the working location will change as the construction work progresses and due to various pole locations.

As there are numerous construction noise receptors along the length of both the overhead line and underground cable routes, construction noise predictions have been calculated at the following distances, as prescribed within the Noise and Vibration study area, from the Proposed Development 33kV power line route:

- 0 - 10m;
- 10 - 20m;
- 20 - 40m;
- 40 - 80m;
- 80 - 160m; and
- 160 - 320m.

Construction noise receptors and calculation distance buffers to proposed overhead line and underground cable routes are included in ES Vol II Figures 14 .1– 14.25.

In order to assess the worst-case construction noise level from the Proposed Development, the noise level for each of the construction activities detailed in Table 14.8 and Table 14.10 at a distance of 10m will be used for the purpose of the construction noise assessment. BS 5228 provides construction plant noise levels referenced to 10m.

Underground cable excavation activity includes the cumulative operation of dumper, excavator and agricultural tractor and dump trailer.

The construction noise predictions and calculations assumes a direct line of sight from the construction noise source to the construction noise receptors without a barrier being considered, which is a worst case scenario, and subsequently a robust assessment.

Table 14.12 – Table 14:20 below details predicted worst-case construction noise levels at varying distances from 10m to 320m from construction noise activities associated with proposed development 33kV power line route to include overhead line construction and underground cabling construction together with the resulting magnitude of effect.

The construction noise predictions detailed within this assessment are deemed to be worst case based on the following:

- Full power operation of each construction activity throughout the daytime period;
- Free field conditions are assumed, and ground effects are ignored.
- Construction plant is assumed to be operational at closest point at either each pole location or underground cable locations to construction noise receptors;
- Predictions are based on the construction plant simultaneously operational, where applicable; and
- No barrier effects have been applied (building barrier and associated building mitigations not included).

14.5.1.5.1 Overhead Line - Tree Cutting

Table 14.12 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development tree cutting.

Table 14.12: Predicted Daytime Construction Noise Levels at Overhead Line Tree Cutting and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Overhead Line Tree Cutting	83	71	65	59	53	47
Magnitude of Effect	Major	Moderate	Negligible	Negligible	Negligible	Negligible

The requirement for tree cutting for the purposes of accommodating the construction and placement of the Proposed Development, has been identified through completion of detailed field surveys. The locations of woodlands, scrub and hedgerows in respect of the working corridor have been identified in Volume II, Figures 7.3.1 – 7.3.18.

The Overhead Line Tree-cutting team will complete works taking direction from the Ecological Clerk of Works (ECoW) in respect of mitigation measures outlined in the Volume III, Appendix 2.2 OCEMP. The tree-cutting activities will be complete on an Active Work Section prior to the Overhead Line Construction Team commencing works.

14.5.1.5.2 Overhead Line - Pole Erection

Table 14.13 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - tree cutting.

Table 14.13: Predicted Daytime Construction Noise Levels at Overhead Line Pole Erection and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Overhead Line Pole Erection	71	65	59	53	47	41
Magnitude of Effect	Moderate	Negligible	Negligible	Negligible	Negligible	Negligible

14.5.1.5.3 Overhead Line – Rock breaking

Table 14.14 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - rock breaking.

Table 14.14: Predicted Daytime Construction Noise Levels at Overhead Line Rockbreaking and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Overhead Line Rockbreaking	90	84	78	72	66	60
Magnitude of Effect	Major	Major	Major	Moderate	Minor	Negligible

14.5.1.5.4 Overhead Line - Line Stringing

Table 14.15 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - line stringing.

Table 14.15: Predicted Daytime Construction Noise Levels at Overhead Line Line Stringing and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Overhead Line Stringing	67	61	55	49	43	37
Magnitude of Effect	Minor	Negligible	Negligible	Negligible	Negligible	Negligible

14.5.1.5.5 Underground cabling - Intrusive Ground works

Table 14.16 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - intrusive ground works.

Table 14.16: Predicted Daytime Construction Noise Levels at Underground Cabling Intrusive Ground Works and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Underground Cabling Intrusive Ground Works	66	60	54	48	42	36
Magnitude of Effect	Minor	Negligible	Negligible	Negligible	Negligible	Negligible

14.5.1.5.6 Underground Cabling - Excavation

Table 14.17 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - underground cabling excavation works.

Table 14.17: Predicted Daytime Construction Noise Levels at Underground Cabling Excavation and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Underground Cabling Excavation	80	74	68	62	56	50
Magnitude of Effect	Major	Moderate	Minor	Negligible	Negligible	Negligible

14.5.1.5.7 Underground - Duct Installation

Table 14.18 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - duct installation.

Table 14.18: Predicted Daytime Construction Noise Levels at Underground Cabling Duct Installation and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Underground Cabling Duct Installation	71	65	59	53	47	41
Magnitude of Effect	Minor	Negligible	Negligible	Negligible	Negligible	Negligible

Construction noise receptor ID 177 is the only receptor location within 0-10m from proposed underground cable construction. Construction noise predictions 20m to 320m are 65 dB or less from cabling duct installation.

14.5.1.5.8 Underground Cabling - Reinstatement

Table 14.19 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - reinstatement

Table 14.19: Predicted Daytime Construction Noise Levels at Underground Cabling Reinstatement and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Underground Cabling Reinstatement	77	71	65	59	53	47
Magnitude of Effect	Major	Moderate	Negligible	Negligible	Negligible	Negligible

Construction noise receptor ID 177 is the only receptor location within 0-10m from proposed underground cable construction. Construction noise receptors ID 17,21,114 178 and 179 within 10 - 20m

14.5.1.5.9 Underground Cabling - Road Saw

Table 14.20 predicts the construction noise levels at construction noise receptors and subsequent assessment at varying distances from the Proposed Development - road saw.

Table 14.20: Predicted Daytime Construction Noise Levels at Underground Cabling - Road Saw and Assessment of Effect Due to Increased Distance

Construction Noise Level	Distance (m)					
	L_{Aeq} dB at 10m	L_{Aeq} dB at 20m	L_{Aeq} at 40m	L_{Aeq} at 80m	L_{Aeq} at 160m	L_{Aeq} at 320m
Underground Cabling (Road saw only)	91	85	79	73	67	61
Magnitude of Effect	Major	Major	Major	Moderate	Minor	Negligible

Construction noise predictions exceed BS 5228 65 dB noise limit for the following construction noise activities at the following distances from construction activity to construction noise receptor:

- Overhead line – Tree Cutting between at construction noise receptors 0 -40m;
- Overhead line – Pole Erection between at construction noise receptors 0 -20m;
- Overhead line – Rockbreaking between at construction noise receptors 0 -160m;
- Overhead line – Stringing between at construction noise receptors 0 -10m;
- Underground cabling – Excavation between at construction noise receptors 0 -60m;
- Underground cabling – Duct Installation between at construction noise receptors 0 -20m;
- Underground cabling – Reinstatement between at construction noise receptors 0 -40m;
- Underground cabling – Roadsaw between at construction noise receptors 0 -160m.

There are no construction predictions 65 dB or greater at construction noise receptors between 160 – 320m of Proposed Development.

Construction noise receptors 160m or less from either overhead line or underground cable located within each figure detailed in ES Volume II Figure 14.1 – Figure 14.25 are summarised below in Table 14:21. .

Table 14.21: Construction Noise Receptors and IDs within 160m of Underground Cable and Overhead Line

Figure (Please Refer to Volume II)	Overhead Line	Underground Cable	Comment
Figure 14.1 Construction Noise Receptors	No construction noise receptors	ID 177 within 10m ID 17,21, 114,178, 179 within 10 – 20m ID 16,19,23,184,180,182 within 20 – 40m ID 298, 297,15, 20,22,24,5,4,2 within 40 – 80m ID 3,6,183,181,186, 25, 289,302,288,287,286,300,285, 221,222,228,229,230,231,232,233,234,235,236,237,238,285 within 80-160m	Underground Cable only
Figure 14.2 Construction Noise Receptors	ID 73, 76, 82,118 and 120 within 80m – 160m	ID 116 within 10– 20m ID 117,214 within 20 – 40m ID 213, 115,215 within 80-160	Underground Cable & Pole Locations 2001 to 2008
Figure 14.3 Construction Noise Receptors	ID 73,118,120,82,76,81,135,131, within 80m – 160m	No construction noise receptors within 160m	Undeground & Pole Pole Locations 2001 - 2024
Figure 14.4 Construction Noise Receptors	ID 139 between 40m – 80m ID 136 and 137 between 80 -160m	No construction noise receptors	Pole Locations 2024 to 2042
Figure 14.5 Construction Noise Receptors	ID 139 between 40m – 80m ID 136 and 137 between 80 -160m	No construction noise receptors	Pole Locations 2039 to 2062
Figure 14.6 Construction Noise Receptors	No construction noise receptors within 160m	No construction noise receptors	Pole Locations 2064 to 2086
Figure 14.7 Construction Noise Receptors	ID 175 between 40 – 80m	No construction noise receptors	Pole Locations 2081 to 2105

Figure (Please Refer to Volume II)	Overhead Line	Underground Cable	Comment
Figure 14.8 Construction Noise Receptors	No construction noise receptors between 0 -160m	No construction noise receptors	Pole Locations 2090B to 2112
Figure 14.9 Construction Noise Receptors	No construction noise receptors between 0 -160m	No construction noise receptors	Pole Locations 2111 to 2127
Figure 14.10 Construction Noise Receptors	No construction noise receptors between 0 – 160m	No construction noise receptors between 0 – 160m	Underground Cable & Pole Locations 2124 to 2145
Figure 14.11 Construction Noise Receptors	ID 160,94,93,95,96 within 80-160m	ID 160,94,93,95,96 within 80-160m	Underground Cable & Pole Locations 2141 to 2164
Figure 14.12 Construction Noise Receptors	ID 162 between 20m – 40m ID 160, 165, 166 between 80m – 160m	No construction noise receptors	Pole Locations 2157 to 2180
Figure 14.13 Construction Noise Receptors	ID 103 and 162 between 20m – 40m ID 100 40m – 80m ID 163, 164, 165 and 166 between 80m – 160m.	No construction noise receptors	Pole Locations 2172 to 2193
Figure 14.14 Construction Noise Receptors	ID 103between 20m – 40m ID 100 between 40m – 80m ID 140,142,144 between 80 – 160m	ID 103between 20m – 40m ID 100 between 40m – 80m ID 140,142,144 between 80 – 160m	Underground Cable & Pole Locations 2184 to 2204

Figure (Please Refer to Volume II)	Overhead Line	Underground Cable	Comment
Figure 14.15 Construction Noise Receptors	ID 140, 142 between 80m – 160m.	ID 140, 142 between 80m – 160m.	Underground Cable & Pole Locations 2202 to 2219
Figure 14.16 Construction Noise Receptors	ID 169 between 80m – 160m	No construction noise receptors	Pole Locations 2216 to 2234
Figure 14.17 Construction Noise Receptors	ID 170 and 171 within 20 – 40m	ID 170 and 171 within 20 – 40m	Underground Cable & Pole Locations 2229 to 2248
Figure 14.18 Construction Noise Receptors	ID 172 within 0-10 m ID 107 wihtin 40 – 80m ID 112,108m wihtin 80 – 160m	No construction noise receptors within 160m	Underground Cable & Pole Locations 2251 to 2261
Figure 14.19 Construction Noise Receptors	ID 90, 92, 107 between 20m – 40m ID 87, 89, 112,108 between 80m – 160m	ID 90, 92, 107 between 20m – 40m ID 87, 89, 112,108 between 80m – 160m	Underground Cable & Pole Locations 2260 to 2276
Figure 14.20 Construction Noise Receptors	ID 92 wihtin 40m – 80m	No construction noise receptors	Pole Locations 2272 to 2293
Figure 14.21 Construction Noise Receptors	No construction noise receptors within 160m	No construction noise receptors	Pole Locations 2292 to 2309

Figure (Please Refer to Volume II)	Overhead Line	Underground Cable	Comment
Figure 14.22 Construction Noise Receptors	ID 37 within 40 – 80m ID 38 within 80-160m	ID 37 within 40 – 80m ID 38 within 80-160m	Underground Cable & Pole Locations 2304 to 2322
Figure 14.23 Construction Noise Receptors	ID 41,43, 54 within 10-20m ID 39,40,48, 49, 50, 58 within 20-40m ID 37,47, 51, 52 within 40 – 80m ID 38, 67, 46, 56, 57 within 80-160m	ID 41,43, 54 within 10-20m ID 39,40,48, 49, 50, 58 within 20-40m ID 37, 47, 51, 52 within 40 – 80m ID 38, 67, 46, 56, 57 within 80-160m	Underground Cable & Pole Locations 2315 to 2322
Figure 14.24 Construction Noise Receptors	No construction noise receptors	ID 54 within 10m – 20 m ID 58 and 61 within 20 – 40m ID 52 within 40 – 80 m ID 68, 56,57, 63, 62 within 80 – 160 m	Underground Cable only
Figure 14.25 Construction Noise Receptors	No construction noise receptors	ID 62 within 80-160m	Underground Cable only

14.5.1.6 Decommissioning of the Overhead Line

Once operational, the overhead line will become a network asset and form part of the wider network. Decommissioning is not envisaged, however should the overhead line be required to be decommissioned, all associated structures and materials would be recovered and items recycled with the site returned to its original use. Decommissioning impacts will be the same or lesser than the impact of construction.

14.5.1.7 Decommissioning of the Underground Cable

Decommissioning is not envisaged, however should the underground cable be required to be decommissioned, it would be disconnected from the circuit breakers or poles to which it is connected, safely insulated using pot end joints and cable will be recovered. As a result, the impact of decommissioning the underground cable would be significantly less that the impact of installation.

14.5.1.8 Construction Traffic

Conservative 'worst-case' estimates of cumulative traffic for the construction phase traffic are provided in Table 14.22 below; it is envisaged that the total traffic will be significantly less than the figures stated.

Table 14. 22: Estimated Construction Phase Traffic

Estimated Construction Phase Traffic - On Public Carriageways			
Vehicle Type	**Estimated maximum total number of trips through duration of construction phase**	**Estimated Average trips per week through duration of construction phase (12-18 months)**	**Estimated Average trips per day through duration of construction phase (12-18 months)**
Light commercial (e.g. van or linespersons 4x4)	7120	148 - 99	27 - 22
Heavy goods (e.g. 16T grab lorry, Road Tractor with low loader, 14-26T Flatbed lorry with crane arm)	2440	51 - 34	9 - 6
Estimated Construction Phase Traffic - On Agricultural Access Way			
Vehicle Type	**Estimated maximum total number of trips through duration of construction phase**	**Estimated Average trips per week through duration of construction phase (12-18 months)**	**Estimated Average trips per day through duration of construction phase (12-18 months)**
Light commercial (e.g. van or linespersons 4x4)	3000	63 - 42	11 – 8
Agricultural Tractor	150	3 - 2	<1
Tracked Excavator	640	13 - 9	3 - 2

For a 12 hour working day (07:00 – 19:00 hrs) the increase of:

- Light commercial vehicles (LGV) would be approximately 2 movements per hour (maximum 27 LGV movements per day) on public carriageway;
- Heavy Goods Vehicles HGVs would be equivalent to one or less movement per hour (maximum 9 HGV movements per day) on public carriageway;
- Light commercial vehicles (LGV) would be approximately 1 movement per hour (maximum 11 LGV movements per day) on agricultural access way;
- Heavy Goods Vehicles HGVs would be equivalent to 1 or less movement per hour (maximum <1 agricultural tractor and 3 tracked excavator movements per day) on agricultural access way.

Operational traffic 'magnitude of effect' is quantified by the long-term change in traffic noise level based on the guidance in the 'Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, HD213/11-Revision 1, Noise and Vibration'. Changes of 25% increase in traffic flows to result in 1 dBA increase in noise level. It is

generally accepted that changes in noise levels of 1 dB(A) or less are imperceptible, and changes of 3 dB(A) are perceptible to the average human ear.

Therefore, construction traffic noise will be less than 1 dBA on public carriageway and agricultural access way equating to “negligible magnitude of impact” and negligible significant impact.

14.5.2 Operational Phase

Operational noise has not been included as there is no inclusion of new significant noise sources likely to generate perceptible noise levels when the Proposed Development is operational including the overhead lines or the underground cables. The Proposed Development will not result in any significant permanent adverse effects on the noise environment within the study area.

Operational vibration has not been included as there is no inclusion of new significant vibration sources likely to generate perceptible levels of vibration when the Proposed Development is operational.

There are a number of ways in which noise can be generated from electricity infrastructure. Generally, these fall within four categories of noise, namely:

- audible noise associated with corona discharge from high voltage transmission lines;
- audible noise associated with dirty, damaged or cracked insulators;
- audible noise associated substation equipment such as transformers, quadrature boosters and mechanically switched capacitors;
- audible noise associated with wind blowing through electricity infrastructure (i.e. Aeolian Noise).

As the Proposed Development will result in the installation of new equipment, there is not likely to be any significant noise impact from dirty, damaged or cracked insulators associated with the Proposed Development. Likely significant noise effects associated with the other categories listed above are discussed under separate headings below.

14.5.2.1 Corona Noise

Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. Corona discharges are perceivable as a broadband crackling and hissing noise in the frequency range of one to several kilohertz (Straumann and Fan, 2009).

Corona noise can be characterised as broadband ‘crackling’ or ‘buzzing’, but it is generally only a feature during fog or rain where the water droplets collecting on the surface of the conductor initiate the discharge activity. The audible noise levels experienced are directly related to the level of rainfall, the higher the rainfall the higher the noise level. Fog will also give rise to corona noise, however the noise levels are generally lower than those experienced during rainfall.

The build-up of contamination or surface grease on conductors or insulators can give rise to or exacerbate corona discharge noise. Conductors are designed to operate below the inception level for corona discharge, however surface contamination or accidental damage to the conductor can cause local enhancement of electrical stress, leading to the discharge activity and subsequent generation of noise.

Build-up of contamination on insulator sets is unlikely on 33kV construction, as intermediate post insulators are arranged vertically, with the conductors atop the post (110kV has a glass cap and pin insulator string, with the conductor attachment at the bottom of the arrangement that is more prone to build up of contamination) This arrangement will be exposed to hundreds of wetting events (rain showers) per annum which continually wash the insulator post. Tension insulators at 33kV (located at section/angle/terminal positions) are a composite unit, which are cased in a silicone rubber housing. Silicone housing has a higher hydrophobicity property than glass or porcelain, which repels contaminants, in addition to this the horizontal orientation of tension insulators is ideal to benefit from washing from rainfall.

Corona discharge occurs on all types of transmission lines, but it becomes more noticeable at higher voltage (approximately 350kV and higher). Under fair weather conditions, audible noise (AN) from corona is minor and rarely noticed (Wordpress, 2011). On account of the fact that AN from corona discharge is more of an issue at

higher voltage, much of the evidence base relates to measurement data from AC transmission lines at higher voltages (e.g. Zhang et al, 2009; Al-Faraj et al, 1997; Straumann and Fan, 2009; Task Force of the Radio Noise and Corona Subcommittee of the Transmission and Distribution Committee, 1975). There is however, literature that explores the measurement of AN from corona discharge at voltage levels between approximately 170 and 350kV (e.g. Chartier et al, 1995; Muhr et al, 2004).,

From reviewing the literature, it is clear that the level of impact likely from electricity transmission lines increases with the increase of the voltage strength of the line. Much of the literature indicates that corona noise only becomes a significant issue from 350-500kV and above. In terms of the Proposed Development, this would suggest that significant corona noise impacts are highly unlikely for 33kV lines.

The proposed Curraghinalt 33kV connection will operate at less than 1/10 of this voltage (350kV), and employs a completely different and proven insulation technology. These arrangements can be found on the majority of NIE Networks' 47,000 km of distribution network without issue, to the point that if noise is emanating from an insulator, it is an indicator of a crack in porcelain, which will be replaced as a priority when identified by a line patroller.

14.5.2.2 Aeolian Noise

The effect of wind blowing through electricity plant and its supporting structures can result in two types of noise, a general broadband turbulence noise and Aeolian noise. The general turbulence noise is no different for electricity infrastructure than it is for a wide range of physical structures in the environment and therefore this type of noise is not considered a nuisance. Aeolian noise, characterised by a series of tones and whistles that vary in frequency with the wind speed, is caused by vortex shedding (regular air fluctuations) across the surface of the item of infrastructure. This form of noise is independent of the infrastructure being energised or not.

Aeolian noise may become problematic at wind speeds higher than 10m/s, however it is often masked by the noise of the rain, if any, or by the wind itself (Cigre, 1999). Aeolian noise effects can be reduced by a range of infrastructure design techniques such as reducing the number of sub-conductors, increasing the spacing between sub-conductors, spiral wire wrapping and using composite insulators instead of glass or porcelain ones. However Aeolian noise/vibration is a phenomenon associated solely with transmission lines, where the span lengths (between structures) and line tensions employed, are vastly greater than of that encountered on 33kV wood pole applications. Since the mid-1980s new-build transmission lines have had conductor dampers fitted to counteract the vibration element while existing lines have had damping studies carried out and dampers fitted retrospectively.

In general, Aeolian noise is not as noticeable as corona noise as the conditions that give rise to it (i.e. high winds) also help to mask the effects of this noise. It is also not as common as corona noise as the conditions required to give rise to Aeolian noise (i.e. high winds at a specific angle of incidence) do not occur regularly.

14.5.3 Cumulative Effects

14.5.3.1 Cumulative Construction Effects

The inter-project cumulative effects have been assessed based on the current information available and a number of assumptions. There is the potential for cumulative and in-combination effects during construction, should there be an overlap between different construction activities in the wider area.

Any such cumulative impacts would reduce with distance away from a neighbouring site so that beyond 1km the cumulative impacts will be negligible regardless of the performance of the construction phase mitigation that will be implemented for a Proposed Development.

ES Appendix 1 Cumulative details the cumulative projects associated with the Proposed Development. A 1km search radius was applied to the Proposed Development with the following cumulative summarised below in Figure 14.2 and Table 14.23.

Figure 14:2 Cumulative Applications 1km from Proposed Development

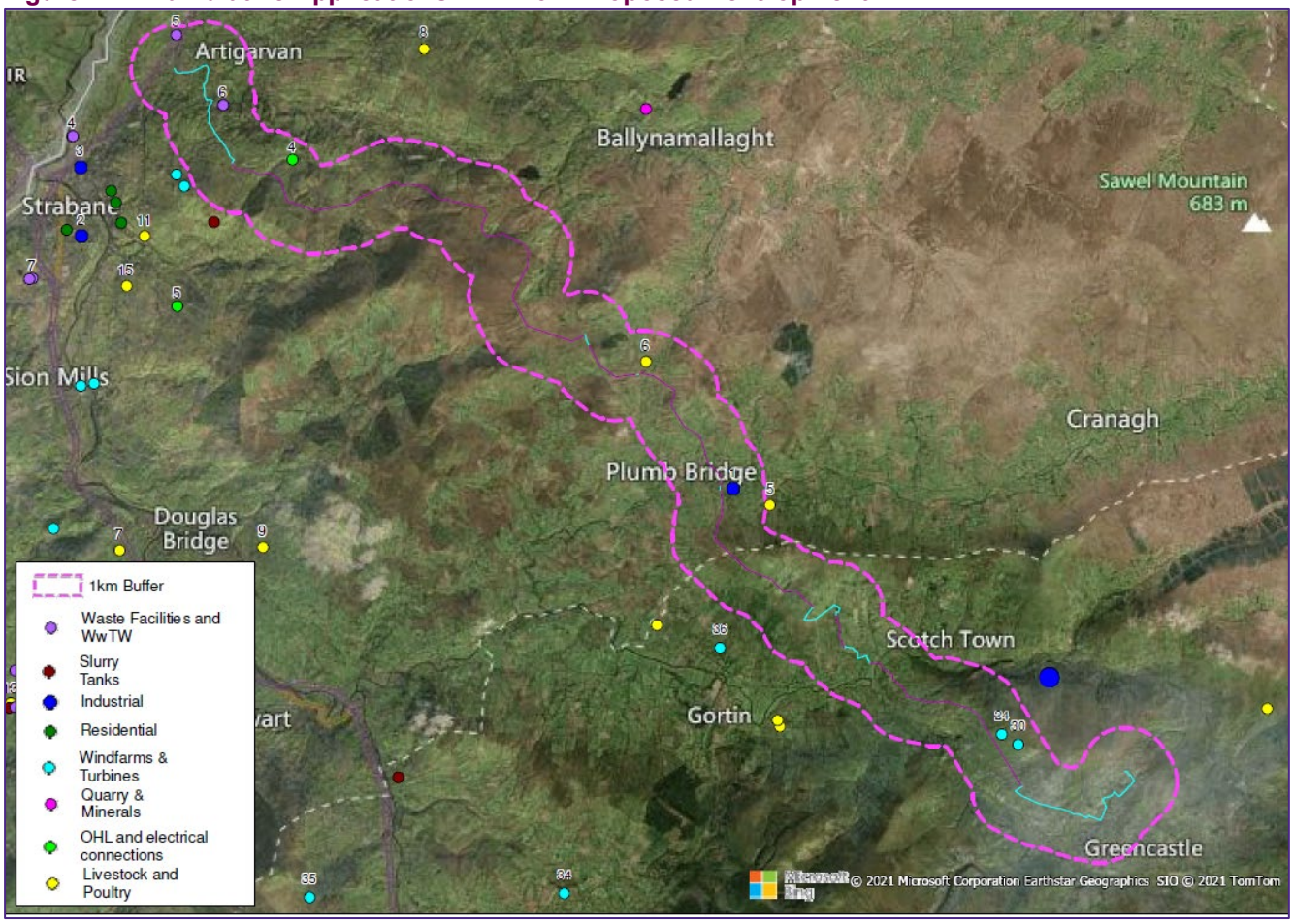

Table 14:23 Summary of Cumulative Applications 1km from Proposed Development

Application Type	ID Reference	Planning Reference	Project Status	Potential Application Impact
Waste facilities and WwTW	6	LA11/2018/0469	Constructed	No
Residential	4	LA11/2016/0444/F	Constructed	No
Livestock and poultry	6	LA11/2017/0993/F	Constructed	No
Industrial	1	LA11/2018/0250/F	Constructed	No
Livestock and poultry	5	LA11/2018/0966/F	Constructed	No
Windfarms and Turbines	24	LA10/2020/0512/F	Constructed	No
Windfarms and Turbines	30	LA10/2018/0673/F	Constructed	No

Cumulative projects summarised above have all been constructed therefore there are no cumulative construction noise impacts associated with construction of Proposed Development. This would result in negligible effect and significant negligible impact.

Cumulative projects summarised above have been constructed therefore there are no cumulative construction vibration impacts associated with construction of Proposed Development. This would result in negligible effect and significant negligible impact.

14.5.4 Inter-relationships

There are interrelations with several chapters as detailed below:

- Chapter 7 Terrestrial Ecology and Ornithology
- Chapter 8 Fisheries and Aquatic Ecology and,
- Chapter 15 Traffic Construction Phase Mitigation

14.5.5 Construction Mitigation

Worst case construction noise predictions can be reduced through use of appropriate mitigations as detailed below in Section 14.5 Construction Mitigation.

BS 5228-1 states that "*if the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect*." These factors have therefore been considered to determine the effect significance.

Construction mitigation measures will be put in place to ensure construction noise levels are attenuated and reduced where necessary.

14.5.5.1 Construction Phase Mitigation

As outlined in Section 14.5, there is potential for short-term noise impacts at the nearest construction noise receptors if worst-case construction noise levels occur.

Worst case construction noise predictions exceed the 65 dB BS 5228 noise limit at a number of construction noise receptors during daytime hours only (i.e. construction works are proposed 07:00 – 19:00 hours on Monday to Friday, 07:30 – 17:00 hours on Saturday with no such work on Sunday). Rock breaking, if required, will only take place between 09:00 – 17:00 hours on Monday to Saturday with no such work on Sunday, to ensure that any noise impact is short term, localised and within working hours.

The construction works will be undertaken between 07:00 – 19:00hrs Monday to Friday and 07:00 – 17:00 hours on Saturday. Proposed construction works will not be undertaken outside these hours. Therefore, there will be no construction noise during evenings or during night time, unless for emergency works.

Table 14.12 – Table 14.20 outlines predicted construction noise levels at varying distances from the construction noise source indicate that there is potential for noise impacts at the nearest construction noise properties, in some instances. It must be noted that these worst-case predicted noise levels are very much an overestimation of the likely construction phase noise levels as they assume that all plant will be active simultaneously.

As a summary of proposed Construction works:

- Construction works will be temporary and limited in duration;
- Construction plant and machinery will not be fully operational during the working day;
- Construction works are not proposed to occur during night time or on Sundays, unless for emergency works. Therefore, there will be no associated construction noise impact during these times at construction noise receptors.

The OCEMP provides a framework within which a final CEMP will be developed and will be adhered to by the appointed contractor. A range of measures will be taken to ensure that the quietest machinery is used or that the use of machinery is such as to be sensitive to the residents at the nearest properties as detailed below.

ANC Construction guide states "*Mitigation of construction noise and vibration is implemented through Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974. This will serve to minimise the noise and vibration effects at receptors in the vicinity of the construction works.*"

Typical BPM measures which comprise of both physical and management measures will include:

- restrictions on working hours;
- scheduling of noisy works to the least sensitive working hours;
- use of plant conforming with the relevant EU directives relating to noise and vibration;
- ensuring that all plant is properly maintained, (mechanisms properly lubricated, faulty silencers replaced, worn bearings replaced, cutting tools sharpened etc.);
- closing acoustic covers to engines when in use or idling;
- locating plant as far away from noise and vibration sensitive receptors as practicable;
- avoiding the unnecessary revving of engines and switch off equipment when not in use;
- starting-up plant and vehicles sequentially rather than at the same time.

BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures will be applied by the contractor where appropriate during the construction phase of the Proposed Development. Construction best practice measures which will be implemented included below:

- ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- careful selection of quiet plant and machinery to undertake the required work where available;
- machines in intermittent use will be shut down in the intervening periods between work;
- ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment;
- Handling of all materials will take place in a manner which minimises noise emissions;
- Audible warning systems will be switched to the minimum setting required by the Health & Safety Executive.

The use of the proposed construction noise mitigation measures will ensure that construction noise levels are controlled to the lowest levels practicable.

14.5.5.2 Consultation and Communication

Mitigation in the form of timely and effective stakeholder consultation is outlined within the environmental OCEMP. This would ensure that residents are kept informed of on-going and future operations. For example, local residents would be informed by letter drop of proposed works, particularly where these are due to occur outside standard working hours. The letter would include details of proposed cause, start dates and duration of works to be carried out

14.5.5.3 Construction Noise Monitoring

The need for monitoring of construction noise during key periods of the construction programme would be discussed in consultation with Fermanagh and Omagh District Council and Derry City and Strabane District Council. There will be no requirement for post-construction surveys or monitoring for operational noise.

14.5.5.4 Construction Traffic

No construction traffic noise impacts are anticipated from the construction of the Proposed Development. Therefore, no specific construction traffic noise mitigations are proposed during the construction of the Proposed Development.

14.5.5.5 Construction Vibration

No construction vibration impacts are anticipated from the construction of the Proposed Development. Therefore, no specific vibration mitigations are proposed during the construction of the Proposed Development.

14.5.6 Operational Phase Mitigation

14.5.6.1 Operational Noise

No operational noise impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

14.5.6.2. Operational Vibration

No operational vibration impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

14.5.7 Limitations of Noise and Vibration Assessment

The calculations have been based on specific construction plant noise levels provided as guidance in BS 5228. BS 5228 states: "*Values of the sound power levels for a particular type and size of machine and the equivalent continuous sound pressure levels for the site activities … will apply in the majority of cases, but can be lower or higher due to the make and maintenance of the machines, their operation and the procedures adopted when work is carried out.*" Therefore, there could be potential for a variation gap in the source noise levels.

It is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant noise effects.

14.6 Summary of Effects

In order to identify the potential construction noise and vibration impacts upon construction noise receptors 320m either side of the Proposed Development defined as noise and vibration study area. A construction noise assessment has been performed according to the method and guidance provided in BS 5228.

Construction noise levels have been predicted from proposed construction activities associated with overhead line and underground cable.

Construction vibration is not proposed during construction of Proposed Development.

Pre-mitigation, the predicted construction noise impacts are anticipated to result in effects ranging from negligible to major significance at all construction noise receptors.

Mitigation in the form of restrictions on timing of activities and best practicable means have been recommended such that the significance of effects are as low as possible. In addition, it has been recommended that residents are informed when activities that may produce high noise for a short period of time are to be undertaken. Elevated levels can be tolerated if prior notification and explanation is given.

14.6.1 Residual Effects

14.6.1.1 Construction Phase

The construction noise predictions are assessed in accordance with Table 14.1: Noise Threshold Limits at Nearest Sensitive Properties for Construction Activities (Ref BS5228) and Table 14.6: Magnitude of Impact: Construction Noise (Reference BS 5228 Part 1).

Construction noise predictions conclude that there is no exceedance of 65 dB BS 5228 noise limit at the majority of construction noise receptors. Construction noise predictions, which do not exceed the BS 5228 construction noise limit, would conclude “negligible magnitude of effect” at construction noise receptors. Therefore, these construction noise receptors are likely to experience a negligible effect.

Construction noise receptors are deemed as High Sensitivity. The resulting significance of effect based on Table 14.12 – 14.20 and the sensitivity of the receptor are summarised below in Table 14.23.

Table 14.23: Significance of Effect on Construction Noise Receptors

Construction Noise Level	Construction Noise Receptors					
	10m	20m	40m	80m	160m	320m
Overhead Line Tree Cutting	Major	Moderate	Negligible	Negligible	Negligible	Negligible
Overhead Line Pole Erection	Moderate	Negligible r	Negligible	Negligible	Negligible	Negligible
Overhead Line Rockbreaking	Major	Major	Major	Moderate	Moderate	Negligible
Overhead Line Stringing	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Underground Cabling Instrusive Ground Works	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Underground Cabling Excavation	Major	Moderate	Minor	Negligible	Negligible	Negligible
Underground Cabling Duct Installation	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Underground Cabling Reinstatement	Major	Moderate	Negligible	Negligible	Negligible	Negligible
Underground Cabling (Road saw only)	Major	Major	Major	Moderate	Minor	Negligible

Construction noise predictions conclude that there is no exceedance of 65 dB BS 5228 noise limit at the majority of construction noise receptors. Construction noise predictions, which do not exceed the BS 5228 construction noise limit, would conclude “negligible magnitude of effect at construction noise receptors. Therefore, these construction noise receptors are likely to experience a negligible impact.

Construction noise predictions, which do exceed the BS 5228 construction noise limit between 5-10 dB, would conclude “moderate magnitude of effect” at construction noise receptors.

Construction noise predictions, which do exceed the BS 5228 construction noise limit between 10 -15 dB, would conclude “major magnitude of effect” at construction noise receptors.

Major magnitude of effect is predicted due to tree cutting. Tree cutting is proposed at limited locations along Proposed Development occurring over a half day.

Major magnitude of effect is predicted due to rockbreaking. Rock breaking will not occur at every pole location.

Major magnitude of effect is predicted at construction noise receptors 0 -10m due to underground cabling excavation and reinstatement. There is one construction noise property located within 10m of Proposed Development, therefore this will be insignificant impact.

The proposed construction works will occur in close proximity to construction noise receptors for a limited number of days. Therefore, impact will be temporary and not significant.

No permanent residual noise and vibration impacts are predicted as a during construction of the Proposed Development. However, some short term residual impacts during the construction stage of the Proposed Development are predicted.

14.6.1.2 Operational Phase

No residual impacts or residual significant effects are predicted for the operational stage of the Proposed Development.

14.6.1.3 Transboundary

The Proposed Development is not located close to any international boundaries and there will be no transboundary effects in relation to noise and vibration.

Table 14:25 Summary of Likely Environmental Effects on Noise and Vibration

Receptor	Sensitivity of receptor	Description of Effect	Duration	Magnitude	Significance	Significant / Not significant
Construction Phase						
Construction Noise Receptors	High	Construction Noise	Short term	Negigible - Major	Moderate adverse	Not Significant
Construction Noise Receptors	High	Construction Traffic Noise	Short term	Negligible	Negligible	Not Significant
Construction Noise Receptors	High	Construction Vibration	Short term	Negligible	Negligible	Not Significant
Operational Phase						
Construction Noise Receptors	High	Operational Noise	Long Term	Negligible	Negligible	Not Significant
Construction Noise Receptors	High	Operational Vibration	Long Term	Negligible	Negligible	Not Significant