8 Noise and Vibration

8.1 Introduction

This chapter assesses the predicted noise and vibration impacts of the proposed power supply development. Potential impacts during the construction and operational phases are considered.

During the construction phase, the potential noise and vibration impacts are associated with site preparation works, foundation construction activities, other construction activities and construction vehicle movements.

During the operational phase, the main potential for noise impact is due to continuous low level noise emissions from the ten transformers which are located on the 220kV substation and the intermittent operation of the emergency diesel generator. There will also be occasional noise from the overhead lines (corona noise), and noise associated with wind interacting with the towers and conductors (aeolian noise). There is no potential for vibration impacts associated with the operation of the development.

The cumulative effects of the proposed power supply development, the development of phase 1 of the proposed data centre, the full build out of the master plan, eight data halls, and the construction of the M17/M18 motorway project are also addressed in this chapter.

8.2 Methodology

8.2.1 Standards and Guidance

The Environmental Protection Agency (EPA) provides guidance on noise assessment for licensed activities in its Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA 2012). Whether or not the proposed development will be subject to licensing by the EPA, planning and licensing authorities tend to have regard to this guidance.

The EPA guidance makes reference to the established international standard ISO 1996: Acoustics Description and Measurement of Environmental Noise (2003 and 2007), and the British Standards BS 4142, and BS 5228 (BS 5228-1:2009+A1:2014).

Environmental noise surveys and reporting have been carried out in general accordance with this EPA guidance.

8.3 Noise Monitoring Methodology

Noise monitoring was carried out at five locations to determine the existing baseline environment.

8.3.1 Selection of Noise Monitoring Locations

The factors considered in selecting the monitoring locations were as follows:

- Position of any noise sources within or adjacent to the site.
- Location of any reflecting structure that may affect 'free-field' conditions.
- Location of objects likely to give rise to wind-derived noises, such as trees and pylons.
- Location of the nearest sensitive receptors.
- Safety and security of the surveyor and equipment.

It is considered to be best practice to select locations aligned between potential noise sources (if identifiable), and the closest sensitive receptors. Site specific constraints are described where relevant.

Following on from this process, five locations were selected for monitoring. These locations are presented in **Figure 8.1.**

Figure 8.1 Noise Survey Locations | Not to Scale [Background mapping © Microsoft Corporation ©2015 Bing Maps]

8.3.2 Survey periods

Daytime and night-time noise measurements were conducted on the 24th September 2014 and 14 July 2015 with evening time measurements undertaken on the 23rd September 2014 and 14 July 2015. All assessments were conducted in accordance with EPA guidance.

Surveys were carried out on a week-day and during time periods which were selected in order to provide a typical snapshot of the existing baseline noise. The primary purpose was to capture a snapshot of the existing noise environment in the area.

8.3.3 Meteorological Conditions

Daytime surveys

The weather conditions during the daytime survey were dry and mild with a slight breeze, with an average wind speed of approximately two metres per second. Temperatures were approximately 17ºC on each day.

Evening time & night-time surveys

The weather conditions during the evening time survey were generally dry and mild, with some drizzle at times. The wind speed averaged approximately 3.5 metres per second. Temperatures were approximately 15ºC, dropping to 11ºC at night time.

8.3.4 Sound Level Meter

A Brüel and Kjær 2250 Light Class 1 Sound Level Meter was used. This meter complies with the International Electrotechnical Commission (IEC) Specification for Sound Level Meters: IEC 61672-1: 2002. The serial number is 2602807. The meter and calibrator were independently calibrated on 29 November 2013, and again on 11 December 2014.

The meter was calibrated before and after monitoring using a Brüel and Kjær 4231 Acoustic Calibrator. Windshield and rain covers were used when required to provide the microphone with effective wind and rain protection.

8.3.5 Monitoring Procedure

Sampling (logging) intervals of 30 minutes were used for daytime and evening, and 15 minutes for night-time environmental noise surveys in line with the EPA Guidance. Daytime is defined as 07:00 to 19:00, evening is 19.00 to 23.00 and night time is defined as 23:00 to 07:00. The sound level meter was attended, and unusual noise events were noted if and when they occurred.

The following parameters were recorded and reported:

- $L_{Aeq\ 15min,\ or\ 30min}$ – this is the continuous steady sound level during the sample period, and effectively represents an average value.
- $L_{A10\ 15min\ or\ 30min}$ – this is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
- $L_{A90\ 15min\ or\ 30min}$ – this is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

Meteorological conditions for each survey were noted, with particular reference to any wind and rain which could affect the representativeness of the surveys.

Following completion of the surveys, the logged data was downloaded onto a computer and specialised software was then used to analyse the data. Any identified tonal or impulsive components were also assessed.

8.4 Modelling Methodology

The following methods were used to assess the impact of the proposed development on sensitive receptors:

- SoundPlan modelling software – this method was used to assess the construction and operational plant noise impact at sensitive receptors surrounding the site.
- Calculation of Road Traffic Noise (CoRTN) – the formulae outlined in this document were used to calculate construction traffic noise levels at sensitive receptors along affected link roads.

8.4.1 SoundPlan (V7.3)

CoRTN is used to calculate road traffic noise at receptors that are located in close proximity to the road with little variation in topography. The noise levels are calculated based on the following inputs;

- Details of ground conditions.
- Location of boundary receptors.
- Proposed buildings and structures.
- Sound power levels of each individual plant source (for both the construction and operational phase).

Noise predictions for both the construction and operational phase were made using this software according to guidelines specified in 'ISO 9613-2: Attenuation of Sound Propagation Outdoors: General Method of Calculation' (ISO, 1996).

8.4.2 Calculation of Road Traffic Noise

CoRTN is used to calculate road traffic noise in the city centre as receptors are located in proximity to the road with little or no variation in topography. The noise levels are calculated based on the following inputs;

- Traffic volumes, AADT (annual average daily traffic), percentage HGVs / LGVs (values outlined in Chapter 7, Traffic and Transportation used in the assessment).
- Vehicle speeds and road gradient.
- Angle of view of road (degrees).
- Location of receptors.
- Road surface.
- Any obstacles, such as screens or barriers.

The CoRTN approach is used to assess the impact of construction traffic noise on local roads. No significant increase in traffic is expected during the operational phase of the development, refer to Chapter 7, Traffic and Transportation.

8.5 Noise and Vibration Impact Assessment Criteria

8.5.1 Construction Phase

8.5.1.1 Noise

There are no mandatory noise limits for construction noise in Ireland or in the UK. In setting criteria for construction noise, account has to be taken of the technical feasibility of the proposed criteria, and also the trade-off between the noise level and the duration of the noise exposure.

The TII (formerly National Roads Authority) proposed construction noise limits in its document *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (TII 2014). These limits, which are presented in **Table 8.1**, represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable ambient noise level for the residents. While they have been developed for road projects, it is also considered reasonable to apply them for other construction projects, as the limits are similar to typical construction noise project limits that have been widely applied in Ireland.

Table 8.1 Maximum permissible noise levels at the façade of dwellings during construction (TII Guidelines)

Days & times	$L_{Aeq\ (1\ hr)}$ dB	L_{Amax} dB
Monday to Friday 07.00 to 19.00	70	80
Monday to Friday 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

In relation to traffic, the DMRB provides a classification of magnitude of noise impacts over short and long terms. The short term classification is outlined in **Table 8.2** below.

Table 8.2 Short term classification of noise impact

Noise change, $L_{A10,18h}$, dB	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5 +	Major

8.5.1.2 Vibration

The TII guidelines in relation to vibration set a threshold of 2.5 millimetres per second as a velocity limit which if exceeded, is considered a significant impact, in terms of vibration annoyance. Any vibration that gives rise to cosmetic structural damage is also considered to be a significant impact. The relevant limits to ensure protection of buildings are 8 millimetres per second for vibrations with frequencies of below 10 Hertz, 12.5 millimetres per second for vibrations with frequencies of between 10 and 50 Hertz, and 20 millimetres per second for vibrations with frequencies in excess of 50 Hertz.

8.5.2 Operational Phase

In operation, the relevant standard that the development should meet is Galway County Council's DM Standard 9 which requires that '*Noise levels shall not exceed 55 dB (a) Leq when measured at the boundary of the site*' (Galway County Development Plan 2015-2021 p218). No limit is provided for nighttime. As the proposed power supply development will be operational 24 hours per day, a night time limit should be complied with. On this basis, the EPA noise guidance limit of 45dBL_{Aeq} is applied.

8.6 Existing Environment

The existing noise environment is characterised by local traffic noise, relatively steady traffic noise from the M6 Motorway, and typical rural noise sources such as bird calls, dog barking, and distant movements of farm machinery.

8.7 Survey Results

A summary of the monitoring results for the five monitoring locations is shown in **Table 8.3** below.

8.7.1 Daytime

Daytime noise surveys were undertaken at five locations along the boundary of the site, refer to **Figure 8.1**. The relevant parameters recorded are presented in **Table 8.3** below and a description of noise sources is also provided.

Table 8.3 Daytime monitoring results

Monitoring location	Survey time	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	Notes
N1	14:42 – 15:12	45	47	39	Traffic along the M6 motorway was constant throughout the survey and was noted as the main noise source. Other noise sources included trees rustling, occasional pedestrian conversation and local traffic on the nearby local road.
N2	13:25 – 13:55	44	47	39	Traffic along the M6 motorway was constant throughout the survey and was noted as the main noise source. Other noise sources included a PE class in the nearby school, a distant industrial low frequency noise, birdsong and rustling of leaves.
N3	11:20 – 11:50	40	40	33	Traffic along the M6 motorway was constant throughout the survey and was noted as the main noise source. Other noise sources included birdsong and occasional local traffic to the south.
N4	16:55 – 17:25	50	51	47	Traffic along the M6 motorway was constant throughout the survey and was noted as the main noise source. Other noise sources included the rustling of leaves, and intermittent distant sounds of construction activity.
N5	18:00 – 18:30 And 18:31 – 19:01	53	54	40	Traffic along the M6 motorway was constant throughout the survey and was noted as the main noise source. There was intermittent distant construction noise (hammering and occasional track machine), and intermittent sheep bleating.

8.7.2 Evening time

Evening time noise surveys were undertaken at five locations along the site boundary, refer to **Figure 8.1**. The relevant parameters recorded are presented in **Table 8.4** below and a description of noise sources is also provided.

Table 8.4 Evening time monitoring results

Monitoring location	Survey time	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	Notes
N1	21:45 – 22:15	39	39	34	Traffic along the M6 motorway was a constant distant noise source at this location along with intermittent dog barking.
N2	20:55 – 21:25	43	45	39	Traffic along the M6 motorway was a constant distant noise source at this location. Other noise sources included dog barking.
N3	22:30 – 23:00	35	37	30	Traffic along the M6 motorway was the main noise source at this location. Other noise sources included intermittent local traffic and some dog barking.
N4	19:39 – 20:09	46	48	41	Traffic along the M6 motorway was the main noise source at this location. Other noise sources included some distant construction noise, and some birdsong.
N5	19:01 – 19:31	50	53	39	Traffic along the M6 motorway was the main noise source at this location. Other noise sources included distant construction (tracked machine, beeping, excavation), and sheep bleating.

8.7.3 Night-time

Night-time noise surveys were undertaken at five locations along the site boundary, refer to **Figure 8.1**. The relevant parameters recorded are presented in **Table 8.5** below and a description of noise sources is also provided.

Table 8.5 Night-time monitoring results

Monitoring location	Survey time	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	Notes
N1	00:17 – 00:32	32	33	25	The main source of noise at this location was distant intermittent traffic from the M6 motorway. Other noise sources noted included an industrial hum from the north of the location.
N2	23:47 – 00:02	36	38	31	The main source of noise at this location was distant traffic from the M6 motorway. Other noise sources noted included some activity in nearby pitches along with conversation.
N3	23:05 – 23:20	39	39	30	The main source of noise noted at this location was distant traffic from the M6 motorway along with intermittent dog barking.
N4	23:00 – 23:15	46	48	40	The main source of noise noted was intermittent noise from traffic on the M6 motorway. Other noises noted were intermittent cattle noise, a train passing on the nearby train line, unidentified distant impulsive (banging) noise, and occasional dog barking.
N5	00:08 – 00:23	38	41	33	The main source of noise at this location was intermittent distant traffic, occasional sheep bleating, and distant noise from a train.

8.8 Noise and Vibration Characteristics of Proposed Development

8.8.1 Construction Noise and Vibration

8.8.1.1 Construction Activities

Construction activities are described in **Chapter 4**. Construction noise will be variable throughout the construction period, depending on the activities underway and the distance from the main construction activities to the receptors.

The highest noise levels will be generated during the site preparation, excavation and foundation stage. There is potential for vibration impacts to occur during the construction phase.

Construction vehicles will generate noise which will be similar to the current forestry harvesting activity which is ongoing on the data centre site, in which the 220kv substation will be located.

During the construction phase, a number of activities will be carried out concurrently across the site. These activities include, the felling/mulching of trees and the blasting, drilling and breaking of rock for foundation construction. The blasting, drilling and breaking of rock will be required under the footprint of the 220kV substation, and also to construct the foundations of seven towers, the MV switchrooms and the other elements of the power supply project. Based on the ground investigation information available, it is predicted that no blasting will be required to construct the cable trenches.

Table 8.6 details the construction noise sources included in the modelling assessment. These noise sources are included as they will be the noisiest activities during construction. Because it is likely that the construction of the power supply project will be concurrent with the construction of Phase 1 of the proposed data centre, the indicative construction phase noise modelling has included the predicted noise associated with construction activities for both projects.

Table 8.6 Sound power input data in noise model – construction phase (power supply project and phase 1 of the data centre)

Plant	Quantity	Sound power level dB(A)	Operational times	Location
Chainsaw	4	101.0	Monday to Friday 07:00-19:00 (70% of the time)	Site entrance x2, Substation, data centre
Red Giant primary shredder	3	103.0		Site entrance, data centre, substation
Rigid dump truck	3	94.9		Substation, data centre (x2)
Digger	2	106.0		Substation, data centre

Plant	Quantity	Sound power level dB(A)	Operational times	Location
Excavator, mounted rock breaker	8	91.1	Saturday 08:00 to 16:30 (70% of the time)	Substation, data centre, Pylon towers
Table circular saw	2	85.0		Site entrance, substation
Tracked mobile drilling rig	1	90.5		Data centre
Lorry	1	85.4		Data centre

8.8.1.2 Construction Related Traffic

In relation to traffic noise during the construction phase of the development, the noise impact has been assessed at locations which are predicted to experience a greater than 25% increase in annual average daily traffic (AADT), including the AADT associated with the construction of the proposed data centre Phase 1 which will be constructed at the same time.

There are two locations R01a (west of site access along R348) and R01b (east of site access along R348), along the R348, where a greater than 25% increase is predicted to occur. There are two locations R01a and R01b, along the R348, where a greater than 25% increase is predicted to occur. Traffic noise is predicted to increase from 55dB(A) to 59.5dB(A) at R01a and from 55dB(A) to 58B(A) at R01b. These impacts are categorised as a moderate, short term impacts, refer to **Table 8.2**.

The traffic volumes used in the above assessment are based on the highest monthly construction values. For the power supply project, month 6 of the 14 month construction period is predicted to have the highest construction volumes on the local road network. This peak is predicted to last two months. The construction traffic volumes will drop significantly after month 6. Further details are contained in **Chapter 7**. A flat profile is assumed for the construction volumes associated with Phase 1 of the data hall and subsequent data halls

8.8.2 Operational Noise and Vibration

The two principle sources of noise from the proposed development will be from the operation of the 220kV substation, and from the overhead conductors and towers.

Ten transformers will be located within the 220kV substation. These will have a maximum sound power level of 87dB(A). Two emergency diesel generators are proposed to be located within the 220kV substation; at a maximum sound power level of 85dB(A) each. The transformers will be in operation continuously, 24 hours a day. The emergency generators will only be used in the event of a power supply outage at the 220kV substation, and it will be tested periodically on a scheduled basis.

Table 8.7 details the operational noise sources on site.

Table 8.7 Noise model input data

Plant	Quantity	Sound power level dB(A)	Operational Times	Location
Transformers	10	87	24 hours	220kV Substation
Emergency Generator	2	85	Intermittent – assumed at night time as a worst case	220kV Substation

There will be no noise emissions from the underground cables.

The new overhead lines and the new towers will give rise to intermittent noise. Transmission lines carrying high voltages generate variable and intermittent corona discharge, and wind interacting with the lines and towers can generate aeolian noise.

8.8.2.1 Operational Related Traffic

In relation to traffic noise during the operational phase of the development, the noise impact has been assessed at locations which are predicted to experience a greater than 25% increase in annual average daily traffic (AADT), including the AADT associated with the construction of further data halls.

There are two locations R01a (west of site access along R348) and R01b (east of site access along R348), along the R348, where a greater than 25% increase is predicted to occur. Traffic noise is predicted to increase from 56.2dB(A) to 58.7B(A) at R01a and from 56.2dB(A) to 58.2B(A) at R01b. Both these impacts are categorised as minor, short term impacts, refer to **Table 8.2.**

Furthermore, by 2032 when all the construction of all the data halls is completed, there will be no locations where a significant increase in traffic (greater than 25%) will occur. Therefore no 2032 operational assessment is required.

8.8.2.2 Corona Discharge

Corona noise is the predominant noise audible from overhead lines and can occur on transmission lines carrying higher voltages. Most modern transmission lines and substations are designed to reduce the magnitude of the electric field surrounding the line conductors below the air breakdown value. Corona discharge typically occurs where a sharp point or edge is present, either on the conductor or the tower coupling. Occasionally a small sharp point can be found on a line or on nearby hardware that will result in a corona discharge.

Such discharges are often more active during the increased humidity conditions provided by fog or light rain. Water drops impinging or collecting on the conductors produce a large number of corona discharges, each of them creating a burst of noise. In dry conditions, the conductors usually operate below the corona inception level, and much less corona sources are present.

Corona noise comprises two sound components; one is irregular (random noise) sound and the other is the pure sound (corona hum noise) of buzzing. The random sound has a wide frequency band because the impulsive sounds caused by corona discharge overlap randomly. The corona hum noise results from the excitation of ion groups, which are generated from corona discharge, caused by the electric field surrounding the conductors. 100Hz is the frequency of the corona hum noise in this instance.

The level of operational noise from overhead lines will vary depending upon the environmental conditions, the locality and a number of other factors including the distance to ground and voltage. The noise derived from this discharge is typically a short burst of random 'crackling'. Due to these factors, an exact level of noise impact cannot be definitively predicted. It may be the case, that under certain circumstances, the background level may be exceeded by more than +10 dB. However due to the unpredictability of corona noise and very short limited duration of such discharges (typically peak levels of a duration of less than 1 second), the overall impact when considered over an hour can be deemed minimal.

Based on established industry guidance and experience, corona noise is rarely a problem at distances beyond 50m from a transmission line[5]. The level of audible corona at any time is dependent on the prevailing weather conditions. The dielectric strength of air is lower in wet weather than in dry weather. Thus the voltage stress at a conductor surface does not have to reach such high levels in wet weather for corona noise to become audible.

Corona noise attains higher levels and may become audible in wet weather, when large numbers of corona sources form as water droplets on the conductors. However, on such occasions the background noise level of rainfall and wind tend to mask the noise from the line. People tend to find noise from a high voltage line to be more noticeable during periods of light rain, snow or fog, when they are more likely to be outdoors or to have windows open, and when the background noise is generally lower. In fair weather, corona sources are sufficiently few in number that this noise is unlikely to cause complaint due to the very short term nature of the source (less than 1 second).

In all cases, the proposed overhead lines are more than 50 metres from the nearest residences, and for the sensitive receptors, the existing overhead lines are much closer than any of the proposed new overhead lines.

8.8.2.3 Aeolian Noise

Aeolian noise, also known as turbulent wind noise, may be created due to high wind speeds affecting the towers and conductors. It refers to the audible sound of wind interaction with the towers and conductors. The amount of aeolian noise is directly linked to wind speed and direction. This type of noise impact is normally not considered significant with regard to noise impacts to sensitive receptors, as aeolian noise occurs when the ambient noise levels are also higher due to wind

[5] Electric Power Research Institute (EPRI) AC Transmission Line Reference Book – 200kV and Above (Third Edition 2005)

noise, therefore masking any specific aeolian noise from the conductors and towers.

Aeolian noise is present in the environment as a natural noise source and occurs when wind blows through tree branches, fences and other such structures. Aeolian noise from the overhead lines is not expected to cause significant noise impact to sensitive receptors.

8.8.2.4 Gap Sparking

Gap sparking can develop at any time on transmission lines at any voltage. It occurs at tiny electrical separations (gaps) that develop between mechanically connected metal parts. Combinations of factors like corrosion, vibration, wind and weather forces, mis-fabrication, poor design or insufficient maintenance contribute to gap formation. Gap sparking can give rise to electrical noise, i.e. it occurs at frequencies higher than those that are audible to humans and therefore can be omitted as a source of noise nuisance.

8.8.2.5 Vibration

No operational phase vibration is expected.

8.9 Predicted Noise and Vibration Impact Assessment

8.9.1 Construction Phase

Noise generation from the construction phase of the proposed power supply development will be due to site preparation works, foundation construction activities, construction activities and construction vehicle movements. Noise generation from the construction phase of the proposed data centre phase 1 development, which is likely to occur at the same time as the construction of the power supply, will also be due to site preparation works, foundation construction activities, construction activities and construction vehicle movements.

Table 8.8 presents the predicted construction noise levels (due to the construction of the power supply and the data centre phase 1) at the receptor locations in comparison to TII daytime limit values for Monday to Friday and Saturday. Actual receptor points are considered in the construction impact assessment as the TII limits apply to the façade of dwellings. All construction works will be undertaken from Monday to Friday between 07:00hrs and 19:00hrs and Saturday 08:00hrs and 16:30hrs.

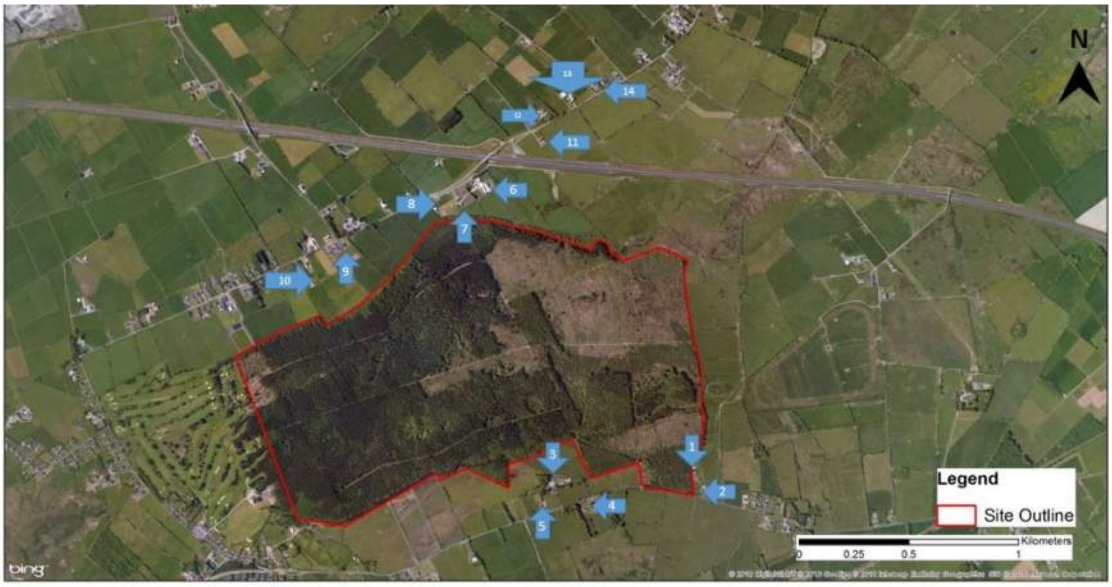

Figure 8.2 Representative Receptor Points (Construction Phase power supply and data centre phase 1) [Background mapping © Microsoft Corporation ©2016 Bing Maps]

Table 8.8 Predicted construction noise levels (power supply and data centre phase 1) at receptor locations

Receptor (refer to Figure 8.2)	Daytime noise levels due to construction plant $L_{Aeq\,(1hr)}$ dB	Compliant with TII limit? Mon-Fri (70 $L_{Aeq,1hr}$ dB)	Compliant with TII limit? Saturday (65 $L_{Aeq,1hr}$ dB)
1	49	Yes	Yes
2	45	Yes	Yes
3	44	Yes	Yes
4	44	Yes	Yes
5	43	Yes	Yes
6	45	Yes	Yes
7	44	Yes	Yes
8	45	Yes	Yes
9	42	Yes	Yes
10	39	Yes	Yes
11	39	Yes	Yes
12	39	Yes	Yes
13	38	Yes	Yes
14	37	Yes	Yes

The intensive construction activity will be carried out at distances well in excess of 100 metres from the identified sensitive receptors, and this, in conjunction with clear contractual requirements that the construction contractor must comply with the TII (NRA) noise limits will mean that no significant noise impacts will be experienced at these receptors. Animal receptors in the surrounding area (such as

pedigree sheep, and horses) will already be habituated to the ongoing operation of forestry machinery on the data centre site and the construction of the M17/M18, and no significant impacts on animal receptors are anticipated. No significant vibration impacts are envisaged during the construction phase and compliance with the limits outlined in **Section 8.5.1.1** will be achieved.

Table 8.8 indicates the noise levels at receptor locations, when both the power supply project and data centre phase 1 project are under construction. At most receptor locations, noise levels would be lower, if only the power supply project was under construction. Consequently, it can be concluded that the noise emissions from the construction of the power supply project will comply with the TII limits at the sensitive receptors, and no significant noise impacts will be experienced. Similarly, it can be concluded no significant impacts on animal receptors are anticipated. **Figure 8.3** shows a contour map of the results contained in **Table 8.8**.

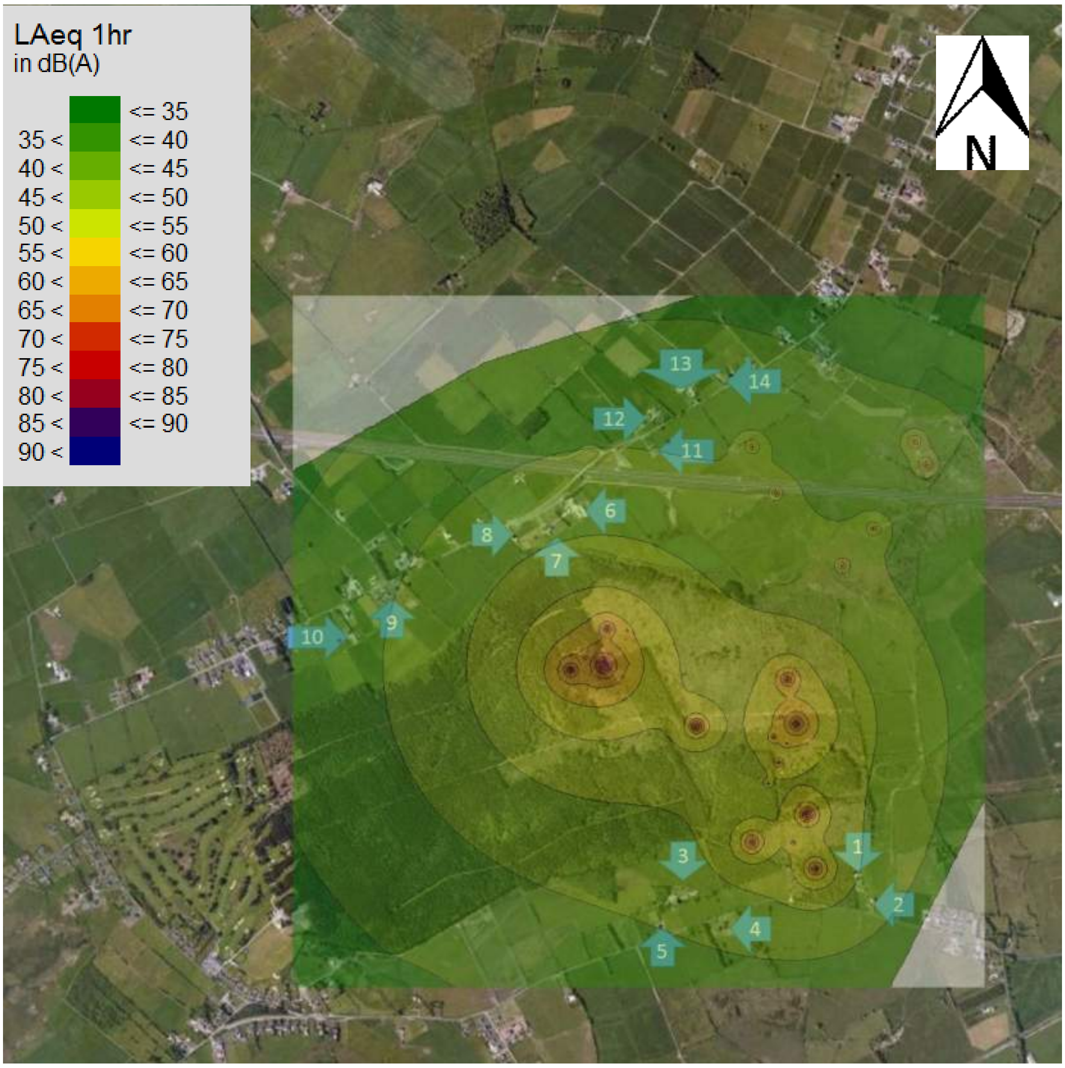

Figure 8.3 Construction Phase Noise Levels at Selected Receptors (for proposed power supply development and proposed data centre phase 1) | Not to Scale [background mapping © Microsoft Corporation ©2016 Bing Maps]

The construction of the cable trench is not predicted to require blasting, so no significant noise or vibration effects arising from this activity are predicted at the identified receptors.

During the construction phase of the proposed data centre and power supply developments, the greatest predicted traffic noise increase is from 55dB(A) to 59.5dB(A). Refer to section 8.8.1.2 above. This is considered a moderate, short-term impact, refer to **Table 8.2**.

8.9.2 Operational Phase

Noise generation from the operational phase of the proposed development will be due to the operation of the transformers and the emergency generators in the 220kV substation, As discussed in Section 8.8.2.1 and 8.8.2.2 above, the impacts of corona discharge noise and the aeolian noise at the nearest sensitive receptors are not expected to be significant. Apart from noise from these sources, there will be no operational noise from the power lines and towers.

Table 8.9 presents the predicted operational noise levels at the site data centre boundary in comparison to the relevant EPA limits. The data centre site boundary is used as there is not expected to be significant noise sources from the power supply outside the data centre site boundary. The routine testing of one of the 220kv substation emergency generators has been assumed (as a worst case scenario) to be taking place during night-time for 1 hour as the generators will not be tested concurrently.

Figure 8.4 Representative Receptor Points (Operational Phase)

[Background mapping © Microsoft Corporation ©2015 Bing Maps]

Table 8.9 Predicted operational noise levels (10 transformers and 1 generator in 220kV substation)

Receptor (refer to Figure 8.4)	Night-time noise levels due to substation plant ($L_{Aeq\ (1hr)}$ dB(A))	Compliant with EPA night-time limit? (45 dB $L_{Aeq\ (1hr)}$)
1	23	Yes
2	23	Yes
3	23	Yes
4	24	Yes
5	26	Yes
6	30	Yes
7	31	Yes
8	25	Yes
9	21	Yes
10	24	Yes
11	26	Yes
12	26	Yes
13	23	Yes
14	21	Yes
15	23	Yes

All predicted levels are incompliance with the EPA night-time limit of 45dB $L_{Aeq\ (1hr)}$.

Figure 8.5 shows the contour maps of for the operational phase of the proposed data centre phase 1, as presented in **Table 8.9**.

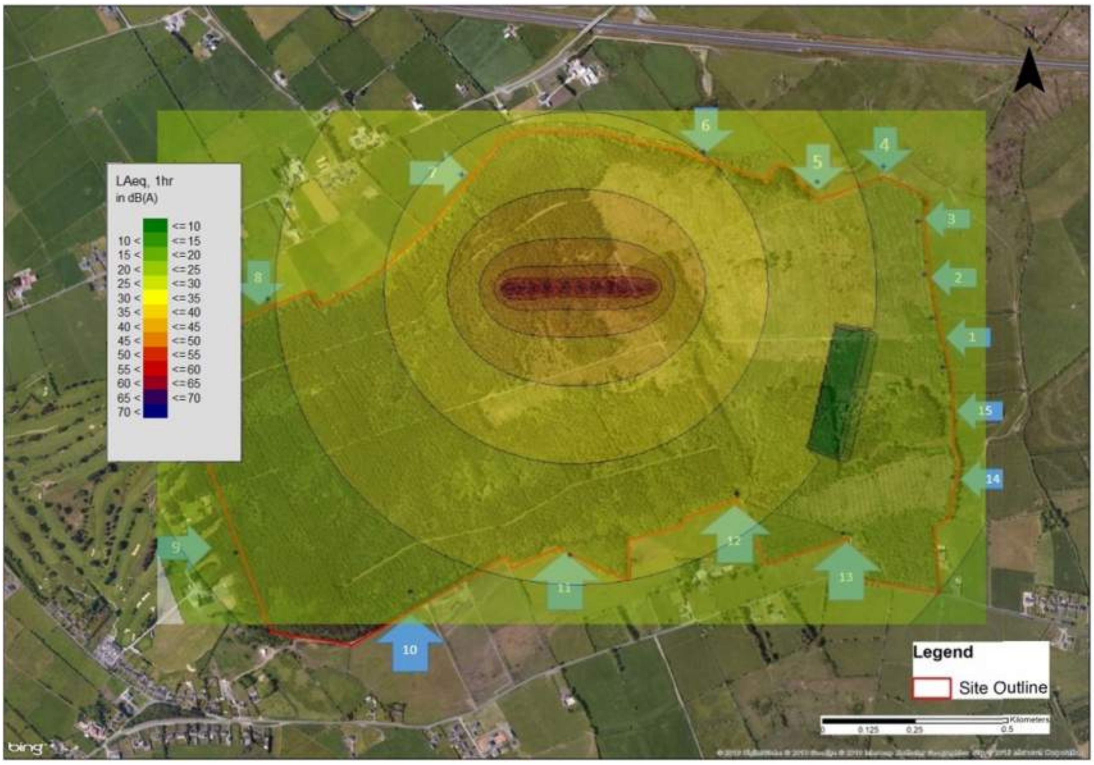

Figure 8.5 Representative Receptor Points (Operational Phase of proposed power supply) [Background mapping © Microsoft Corporation ©2015 Bing Maps]

The operational phase of the proposed power supply project is not predicted to increase traffic. Therefore, no detailed noise assessment is required.

During the operation phase and subsequent construction of an additional data centre, the greatest predicted traffic noise increase is from 56.2dB(A) to 58.7dB(A). Refer to section 8.8.1.2 above. This is considered a minor, short-term impact, refer to **Table 8.2**.

8.10 Cumulative Impacts

8.10.1 Construction impacts

The proposed development is for the purpose of providing a power supply for the proposed Phase 1 data centre, and also a power supply for the full build out of eight data halls on the site. Construction of phase 1 of the data centre and the power supply project, at the same time, will result in a significantly higher level of construction activity that the construction of any of the subsequent data halls. Noise levels during the construction of subsequent data halls will be required to comply with the TII limit values outlined in Section 8.5. The noise emissions during construction of the subsequent data halls is unlikely to exceed that assessed in Section 8.9.1.

The construction of the M17/18 roads project will comply with the TII daytime construction noise limits, as set out in Section 8.5 at the nearest sensitive receptor, outlined in **Table 8.1**. Therefore, an estimate of the worst case construction noise due to the construction of the M17/M18 roads project has been made at the closest

receptor (R02) considered. A value of 55dB(A) is predicted as a worst case. Adding the predicted construction noise value at R02 due to the construction of the proposed data centre phase 1 and the 220 kV substation with the construction value predicted from the M17/18 roads project will result in cumulative noise level of 55 dB(A).

In addition, the list of site access routes as presented in Appendix 9 of the N18 Oranmore to Gort road project EIS, does not include the R348 as a main route.

The effects of construction of the proposed power supply development and proposed data centre phase1 over and above the construction of the M17/M18 roads project has also been assessed.

There are two locations R01a (west of site access along R348) and R01b (east of site access along R348), along the R348, where a greater than 25% increase is predicted to occur. Traffic noise is predicted to increase from 58.3dB(A) to 61.4B(A) at R01a and from 58.3dB(A) to 60.3B(A) at R01b. These impacts are categorised as moderate and minor impacts, respectively, refer to **Table 8.2**.

8.10.2 Operational impacts

The proposed 220kV substation will operate concurrently with the proposed data centre. Each data hall is expected to have 18 emergency generators, for use if there use a power failure. The emergency generators will be tested routinely. Testing of all emergency generators required for the data centre, will not take place concurrently. Apart from the emergency generators, there will be no significant noise sources from the data centre phase 1 or the in full build out, with seven additional data halls.

Table 8.10 contains the modelling results for one standby generator associated with the data centre in operation concurrent, the noise generated by the proposed 220kV substation in operation along with the construction noise associated with an additional data hall. As a worst case scenario, construction noise values for the proposed data centre phase 1 and 220kV substation have been used for each receptor based on the receptor location.

All results comply with the EPA night-time limit. Noise contours for the proposed cumulative assessment are shown in **Figure 8.6** and **Figure 8.3.**

Table 8.10 Predicted cumulative operational noise levels

Receptor (refer to Figure 8.5)	Night-time noise levels due to sub-station and data centre plant ($L_{Aeq\,(1hr)}$ dB (A)) Refer to Figure 8.6	Daytime noise levels due to construction plant $L_{Aeq\,(1hr)}$ dB Refer to Figure 8.3	Total noise level $L_{Aeq\,(1hr)}$ dB	Compliant with G.C.C. Development Plan day-time limit? (55 dB $L_{Aeq\,(1hr)}$)
1	35	49	49	Yes
2	34	49	49	Yes
3	30	49	49	Yes
4	27	49	49	Yes
5	29	49	49	Yes

Receptor (refer to Figure 8.5)	Night-time noise levels due to sub-station and data centre plant ($L_{Aeq\,(1hr)}$ dB (A)) Refer to Figure 8.6	Daytime noise levels due to construction plant $L_{Aeq\,(1hr)}$ dB Refer to Figure 8.3	Total noise level $L_{Aeq\,(1hr)}$ dB	Compliant with G.C.C. Development Plan day-time limit? (55 dB $L_{Aeq\,(1hr)}$)
6	30	49	49	Yes
7	31	42	42	Yes
8	25	42	42	Yes
9	21	42	42	Yes
10	24	42	42	Yes
11	26	42	42	Yes
12	27	42	42	Yes
13	26	42	42	Yes
14	26	49	49	Yes
15	31	49	49	Yes

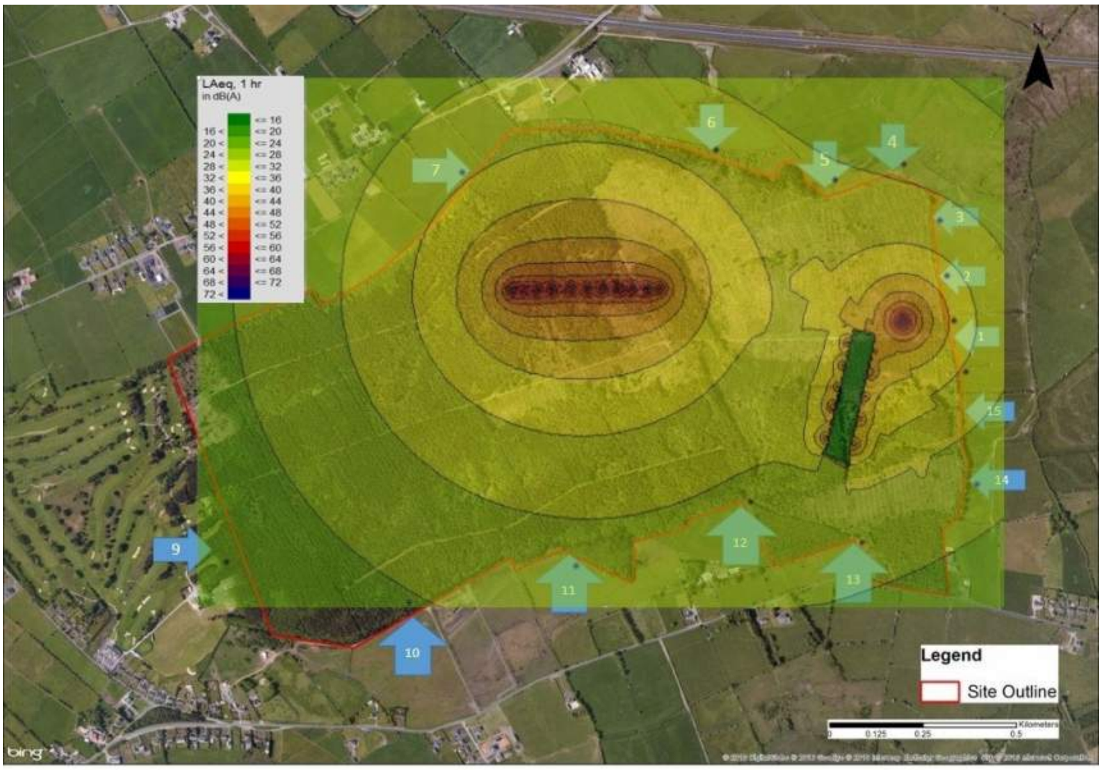

Figure 8.6 Operational Phase Noise Levels at Selected Receptors (Cumulative Effects with the Operation of the Data Centre)

[Background mapping © Microsoft Corporation © 2016 Bing Maps]

8.11 Mitigation and Monitoring Measures

8.11.1 Construction Phase

The assessment of construction noise impacts show that the proposed works will not exceed the permitted noise levels as set out in **Section 8.3** above.

The construction contractor will be required to manage noise and vibration aspects of the project in accordance with BS 5228-1:2009+A1:2014) and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites*'. This document provides for practical measures that limit the hours in which noisy activities are permitted, provision of acoustic screening for noisy activities, use of silencers on equipment, siting of noisy mobile equipment away from sensitive receptors, and the provision of relevant training with respect to minimising noise disturbance.

BS 5228 includes guidance on several aspects of construction site practices, including, but not limited to:

- Selection of quiet plant
- Control of noise sources
- Screening

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring.

Selection of quiet plant

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

General comments on noise control at source

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

BS 5228 states that "*as far as reasonably practicable sources of significant noise should be enclosed*". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be

used to screen operatives using hand tools and will be moved around site as necessary.

Screening

Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen should be wrapped around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

BS 5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7 kg/m^2 will give adequate sound insulation performance.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances materials such as topsoil or aggregate can provide a degree of noise screening if placed between a noise source and receptor.

8.11.2 Operational Phase

The assessment of noise impact during the operational phase show that the proposed development will not exceed the site boundary noise limits.

8.12 Residual Impacts

8.12.1 Construction Phase

The construction assessment undertaken shows that there will be a moderate short term residual impact associated with traffic noise along one access road, the R348, due to the proposed data centre phase 1 together with and proposed power supply development. As stated in Section 8.8.1.2, this impact will reduce significantly after month six of construction.

In addition, the measures outlined in BS 5228 will be implemented to ensure compliance with site construction limit values.

8.12.2 Operational Phase

The operational traffic assessment undertaken shows that there will be a minor short term residual impact associated with traffic noise along one access road, the R348, due to the construction of additional data halls. This will reduce to no impact upon the completion of the final data hall in 2032.

The operational plant assessment has shown with the implementation of the mitigation measures outlined in Section 8.8.2, all limit values at the site boundary will be complied with. Therefore, no residual impacts are envisaged as a result of the proposed development.

8.13 References

British Standards Institution (BSI), *BS 5228-1:2009+A1:2014 Code of practice for Noise Vibration Control on Construction and Open Sites - Noise*. British Standards Institution, United Kingdom.

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EPA, 2012. *Guidance Note for Noise: Licence Applications, Surveys and Assessments in relation to Scheduled Activities (NG4)*. Environmental Protection Agency, Wexford, Ireland.

International Electrotechnical Commission (IEC), 2002. *IEC 61672-1: Electroacoustics – Sound Level Meters – Part 1: Specifications*. IEC, Geneva, Switzerland.

International Standards Organisation (ISO), 2003. *ISO 1996-1: Acoustics – Description, measurement and assessment of environmental noise - Part 1: Basic Quantities and Assessment Procedures*. ISO, Geneva, Switzerland (2nd edition).

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