ARUP

Amazon Data Services Ireland Limited

DUB159 IE Licence Application

Attachment-7-1-3-2 Noise Emissions Impact Assessment

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Executive Summary

Amazon Data Services Ireland Limited (ADSIL) (‘*the Applicant’*) is applying to the Environmental Protection Agency (‘*the Agency’*) for an Industrial Emissions (IE) Licence for its data storage facility (hereafter referred to as the ‘*Installation’*) located at Data Centre Building B1, Kildare Innovation Campus (KIC), Barnhall Road, Leixlip, County Kildare, Ireland. The Installation comprises of 1 no. data storage facility building, termed ‘Data Centre Building B1’, along with ancillary elements which includes 14 no. critical emergency generators, 1 no. house emergency generator and 2 no. fire sprinkler pumps.

This report presents the assessment of the noise impacts as a result of the operation of the Installation which requires a continuous supply of electricity to operate. During normal operations, the Installation is supplied electricity from the national grid. Outside of normal operations, the Installation will first be supplied electricity by an uninterruptible power supply (UPS) which will provide temporary power for a limited time while the generators start up, to allow the generators to activate without losing power to the data halls and then by some or all of the onsite emergency generators.

This technical report has been prepared to provide details in relation to the noise impact assessment undertaken for this IE licence application. The assessment is based on the most up-to-date design details available for the Installation and has been prepared with due consideration of the guidance contained within the Environmental Protection Agency (EPA) document *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2016*.

Section 6 of the EPA’s NG4 Guidance outlines the following assessment stages for the noise impact assessment for licence applications.

- Stage 1 – Baseline Noise Survey / Monitoring Locations;
- Stage 2 – Derivation of Noise Criteria;
- Stage 3 – Assessment of Noise Impact; and,
- Stage 4 – Reporting / Licence Application Form.

This report has been prepared with consideration of the four assessment stages outlined above.

An environmental noise survey was conducted to quantify the existing noise environment in the vicinity of nearest Noise Sensitive Receptors (NSRs) to the Installation. The survey was conducted in general accordance with the EPA’s NG4 Guidance.

Appropriate operational noise criteria have been derived for the Installation following review of noise survey data and receiving environment, in accordance with the relevant NG4 Guidance. The applicable noise criteria identified are in line with the typical limit values for noise from licensed sites.

To assess the impact of noise from the Installation at nearby NSRs, a detailed computer-based noise model has been prepared using a proprietary noise modelling software package. Noise prediction calculations have carried out in accordance with ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*. The predicted cumulative noise levels at all NSRs for the Installation and the levels of existing plant noise from the Installation are within the day, evening and night-time noise criteria for site operations.

1. Introduction

Amazon Data Services Ireland Limited (ADSIL) (‘*the Applicant’*) is applying to the Environmental Protection Agency (‘*the Agency’*) for an Industrial Emissions (IE) Licence for its data storage facility (hereafter referred to as the ‘*Installation’*) located at Data Centre Building B1, Kildare Innovation Campus (KIC), Barnhall Road, Leixlip, County Kildare, Ireland.

The Installation site covers an area of c. 3.645 hectares (ha) in total and sits within the wider KIC Masterplan site, which was granted planning permission in January 2024 under Kildare County Council (KCC) Planning Ref. 23/60047. An Environmental Impact Assessment Report (EIAR) and Appropriate Assessment (AA) Screening Report were prepared as part of this planning application and have been submitted with this IE Licence application, refer to Attachment 6-3-6 and Attachment 6-2-1 respectively.

ADSIL holds a 20-year lease that concerns lands within the IE licence boundary, which sits within the northwest corner of the KIC Masterplan site. The IE licence application relates only to the area concerning the Installation, as shown in Figure 1. The remaining areas within the KIC Masterplan site are controlled by the KIC Masterplan site owner, hereafter referred to as *‘the Landowner’*.

This report presents the assessment of noise impacts as a result of the operation of the Installation. The Installation will comprise of 1 no. data storage facility building, termed ‘Data Centre Building B1’, along with ancillary elements, including the emergency operation of 14 no. critical emergency generators, 1 no. house emergency generator and 2 no. fire sprinkler pumps.

Figure 1 below illustrates the site location in the context of the surrounding environment.

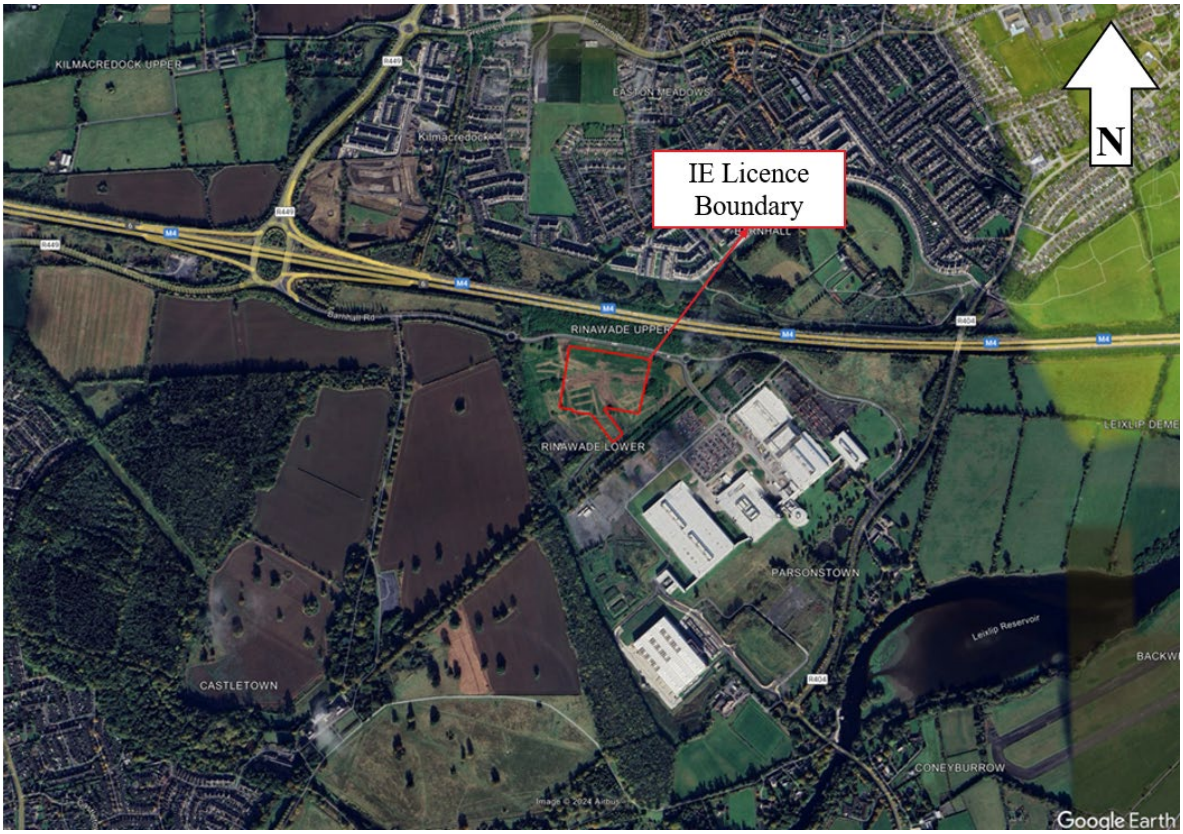

Figure 1: Site Location & Context | Not to Scale | Google Earth ©

The nearest residential locations are located to the north of the Installation on the opposite side of the M4 running along the northern boundary of the IE licence site boundary. This includes occupied residential properties located at Barnhall Meadows.

This assessment is based on the predicted noise emissions from the Installation and the most up-to-date design details available for the development and has been prepared with due consideration to the guidance contained within the Environmental Protection Agency (EPA) document *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2016*. This report has been prepared in accordance with the four noise impact assessment stages outlined in Section 6 of NG4, which are as follows:

- Stage 1 – Baseline Noise Survey / Monitoring Locations;
- Stage 2 – Derivation of Noise Criteria;
- Stage 3 – Assessment of Noise Impact; and,
- Stage 4 – Reporting / Licence Application Form.

Appendix A to this report presents a glossary of the acoustic terminology referred to in this document.

2. Fundamentals of Acoustics

In order to provide a broader understanding of some of the technical discussion in this report, this section provides a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment.

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. In order to take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the 'A-weighting' system has been found to provide one of the best correlations with perceived loudness. SPL's measured using 'A-weighting' are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) scale is presented in Figure 2.

The established prediction and measurement techniques for the dB(A) parameter are well developed and widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text[1].

[1] For example, Woods Practical Guide to Noise Control by Ian Sharland.

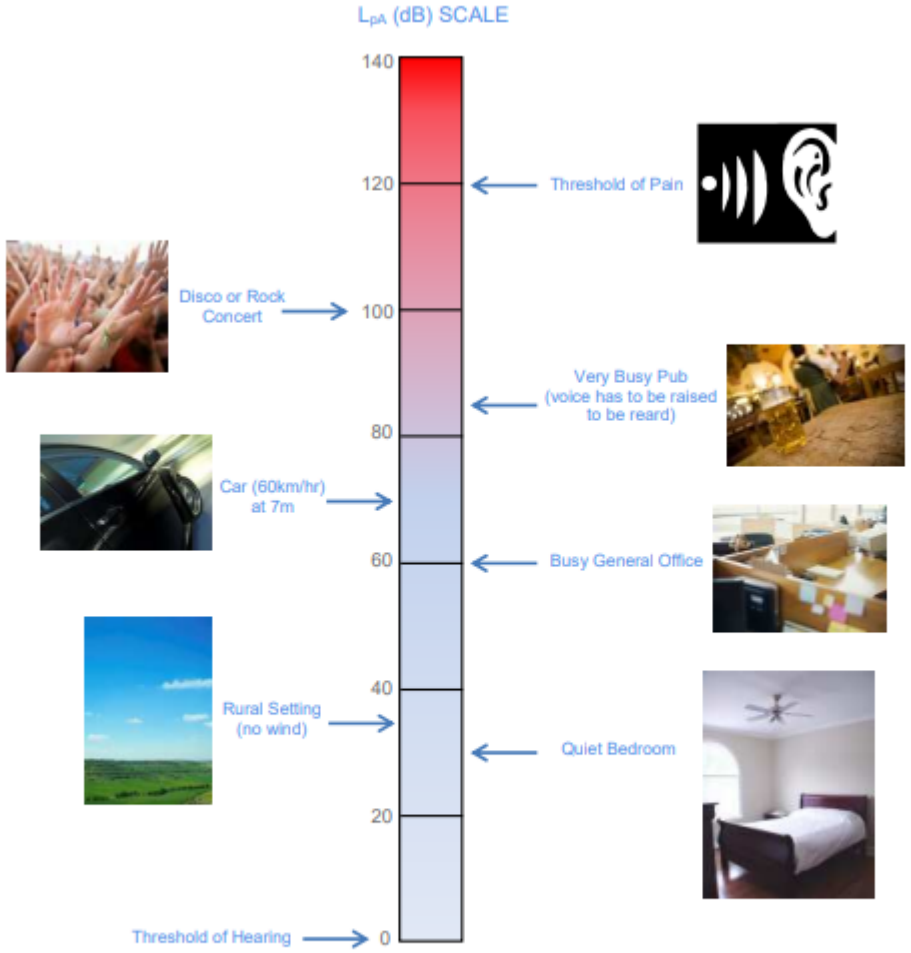

Figure 2: Level of typical sounds on the dB(A) Scale (Source: EPA NG4 Figure 2)

3. Receiving Environment

This section deals with 'Stage 1' of the noise impact assessment as outlined in the EPA's NG4 Guidance. The results of the environmental noise survey undertaken as part of the EIAR for the KIC Masterplan site planning application (KCC Planning Ref. 23/60047) have been used to outline the receiving and baseline noise environments at the Installation in this report.

An environmental noise survey has been conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Noise levels were measured over 15-minute intervals at each location in a round-robin fashion. Measured noise levels were saved to instrument memory. Survey personnel noted sources of noise contributing to measure noise levels. Specific details are set out below.

3.1 Choice of Measurement Locations

Noise measurements from the environmental noise survey undertaken as part of the EIAR for the KIC Masterplan site planning application (KCC Planning Ref. 23/60047) were conducted at five positions in the vicinity of the KIC Masterplan site. The locations of these measurements are described in Table 1.

Table 1: Measurement Locations & Descriptions

Location	Description
A	In an open area to the north-east of the existing KIC Masterplan site. The noise survey at this location is representative of that at the housing area on the opposite side of the M4 motorway.
B	Near the entrance to the existing KIC Masterplan site, at a location representative of the house on the opposite site of Celbridge Road.
C	At the boundary with MU Barnhall Rugby Football Grounds. On the most recent survey visit there was new plant operating at this location.
C (Night)[Note 1]	At a location representative of the noise environment at the houses to the east of the roundabout.
D	Within the Castletown house grounds.
D (Night)[Note 1]	Within the Woodview housing estate to the southwest of the KIC masterplan site.
E	At a roundabout on a local road to the north-west of the existing KIC masterplan site. The noise survey at this location is representative of the housing area on the opposite site of the M4 motorway.

Note 1: The EIAR prepared as a part of the KIC Masterplan site planning application (KCC Planning Ref. 23/60047) does not provide an explanation for the use of two C and two D locations. Based on a review of this EIAR, it was determined that since C and D locations are touristic and / or recreational facilities which would operate only during the day, locations C (Night) and D (Night) were incorporated into the assessment to represent the locations of the closest night time noise sensitive receptors nearest to the KIC Masterplan site boundary.

The approximates locations of the noise measurement locations A through E are illustrated in Figure 3 below.

Figure 3: Approximate Locations of Noise Measurement Positions | Not to Scale | Google Earth ©

3.2 Survey Periods

Noise measurements were conducted during a daytime period and a typical night-time period selected to measure of existing background noise levels during periods where people are attempting to go to sleep or are sleeping. Due to the fact that some of the proposed noise sources operate on a 24-hour basis, their potential impact during night-time periods is the critical issue. The surveys were conducted during the following periods:

- 12:00hrs 04 November 2021 to 00:53hrs on 06 November 2021.

3.3 Personnel & Instrumentation

Noise measurements were performed by AWN Consulting Ltd.

3.4 Procedure

Measurements were conducted at the locations noted above and seen in Figure 3. Sample periods for the noise measurements were typically 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis if required. Survey personnel noted the primary noise sources contributing to noise build-up.

3.5 Measurement Parameters

The survey results are presented in terms of the following parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

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

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

Another parameter that will be commented upon in this report is the L_{ArT}.

$L_{Ar\,T}$ is the L_{Aeq} during a specified time interval, plus specified adjustments for tonal character and impulsiveness of the sound.

It should be noted for this assessment it has been assumed that detailed design will be carried out in order that there will be not tonal or impulsive noise emissions for the development. Therefore, in this instance L_{Aeq} is equal to $L_{Ar\,T}$.

3.6 Survey Results

The survey results for Locations A, B, C, D and E are given in Table 2 below. The existing environment is dominated by traffic noise.

Table 2: Summary of Results for Location A, B, C, D and E

Location	Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
			L_{Aeq}	$L_{AF90,\,15min}$
Location A	Daytime	12:14 on 4 Nov 21	67	65
		15:18 on 4 Nov 21	67	65
		11:50 on 5 Nov 21	65	63
	Evening	21:25 on 5 Nov 21	59	56
	Night-time	22:40 on 5 Nov 21	57	54
		23:28 on 5 Nov 21	56	50
Location B	Daytime	12:36 on 4 Nov 21	61	58
		15:39 on 4 Nov 21	61	58
		12:10 on 5 Nov 21	60	56
	Evening	21:52 on 5 Nov 21	51	48
	Night-time	23:02 on 5 Nov 21	50	46
		23:50 on 5 Nov 21	49	46
Location C	Daytime	13:13 on 4 Nov 21	56	55
		16:00 on 4 Nov 21	62	56
		12:29 on 5 Nov 21	58	55
	Evening	22:28 on 5 Nov 21	47	46
	Night-time	23:36 on 4 Nov 21	47	44

Location	Start Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
			L_{Aeq}	$L_{AF90, 15min}$
		00:42 on 5 Nov 21	48	46
Location D	Daytime	13:51 on 4 Nov 21	53	49
		16:31 on 4 Nov 21	57	53
		13:04 on 5 Nov 21	53	48
	Evening	22:51 on 5 Nov 21	38	28
	Night-time	01:14 on 5 Nov 21	30	27
		23:59 on 5 Nov 21	38	26
Location E	Daytime	14:42 on 4 Nov 21	62	60
		17:10 on 4 Nov 21	64	62
		13:42 on 5 Nov 21	67	65
	Evening	22:01 on 5 Nov 21	56	51
	Night-time	23:17 on 5 Nov 21	55	44
		00:23 on 6 Nov 21	55	45

3.7 Ecologically Sensitive Areas or Areas of Special Interest

An Appropriate Assessment (AA) Screening Report prepared by Ecology Ireland Wildlife Consultants Ltd. previously submitted as part of the planning application for the KIC Masterplan site (KCC Planning Ref. 23/60047) and has been submitted with this IE licence application (Attachment 6-2-1 AA Screening-Planning-July-2023). Based on the AA Screening, the Installation is not within, or proximal to a European conservation site. The closest European site is the Rye Water Valley/Carton Special Area of Conservation (SAC) (site code 001398) which is located 1.6km north of the IE licence site boundary.

Based on the separation distance from the Installation to the nearest European site and to the high number of sources located in the intervening area, it is highly unlikely that noise arising from the Installation under any scenario would have any impact on this European site. Therefore, the noise impact on ecologically sensitive area has been scoped out of any further assessment.

4. Review of Relevant Guidance

This section deals with 'Stage 2' of the noise impact assessment as outlined in the EPA's NG4 Guidance.

The discussion of appropriate IE Licence noise emission criteria for the overall Installation will be conducted in accordance with the NG4 document. This approach is summarised below in accordance with guidance detailed in Section 4 of the NG4 document.

4.1 Quiet Area Screening

The Installation is not considered a quiet area in this instance as it fails to meet any of the criteria outlined in EPA's Guidance. The most stringent of these criteria are noted and commented on below in Table 3.

Table 3: Quiet Area Screening

Criteria	Comment	Is the Criteria Met?
At least 3km from urban area with a population >1,000 people.	In this instance the Installation lies between Leixlip and Celbridge.	No
At least 3km away from any local industry.	Collinstown Industrial Park lies at less than 2km to the north.	No

Criteria	Comment	Is the Criteria Met?
At least 5km away from any National Primary Route.	The M4 motorway runs along the northern boundary of the Installation.	No

4.2 Low Background Noise Area Screening

In order to establish whether the noise sensitive locations in the vicinity of the Installation would be considered 'low background noise' areas, the noise levels measured during the environmental noise survey need to satisfy all three of the following criteria:

- Arithmetic Average of L_{A90} During Daytime Period ≤40dB L_{A90}; and
- Arithmetic Average of L_{A90} During Evening Period ≤35dB L_{A90}; and
- Arithmetic Average of L_{A90} During Night-time Period ≤30dB L_{A90}.

It should be noted that the noise levels measured during the environmental noise survey were recorded to accurately represent the baseline in the vicinity of the KIC Masterplan site. As the Installation is situated in the north-western section of the KIC Masterplan site, only the results from the most representative location of the area surrounding the Installation (Location E as seen in Figure 3) were considering for the Low Background Noise Area Screening.

Table 4: Comparison of Measurement Results with NG4 Low Background Noise Area Criteria

Location	Period	$L_{A90,15min}$ (dB)	NG4 Screening (dB $L_{A90,T}$)	Satisfies All Criteria for Low Background Noise Area?
E	Daytime	60	≤40	No
		62	≤40	
		65	≤40	
	Evening	51	≤35	
	Night-time	45	≤30	
		44	≤30	

The arithmetic average L_{A90} results at each location are compared against the criteria in Table 4. As outlined in Table 4, none of the locations would be considered 'Areas of Low Background Noise' as the measured noise levels do not satisfy the criteria.

4.3 Determining Appropriate Noise Criteria

Based on the EPA NG4 guidance for all other areas that are not considered 'quiet areas' or 'areas of low background noise', the following noise criteria are appropriate at the nearest NSRs to the Installation:

- Daytime (07:00 to 19:00hrs) 55dB $L_{Ar,T}$
- Evening (19:00 to 23:00hrs) 50dB $L_{Ar,T}$
- Night Time (23:00 to 07:00hrs) 45dB L_{Aeq}

During the night period, no tonal or impulsive noise from the Installation should be clearly audible or measurable at any NSR. The applicable noise criteria identified are in line with the typical limit values for noise from licensed sites.

Plant items proposed for the Installation are designed to be used in emergency situations, for example, when grid power supplies fail. It is common practice to allow a relaxation of noise limits associated with emergency plant operations. Section 4.4.1 of EPA NG4 contains the following comments in relation to emergency plant items:

> *'In some instances, licensed sites will have certain items of emergency equipment (e.g. standby generators) that will only operate in urgent situations (e.g. grid power failure). Depending upon the*

context, it may be deemed permissible for such items of equipment to give rise to exceedances in the noise criteria/limits during limited testing and emergency operation only. If such equipment is in regular use for any purposes other than intermittent testing, it is subject to the standard limit values for the site'.

It is therefore considered that the proposed noise criterion of 55dB $L_{Aeq, (15\ min)}$ is appropriate in emergency scenarios for daytime, evening and night-time periods.

4.4 Compliance Noise Monitoring

See Attachment 7-5 Noise Emissions of this IE Licence application for further details on the NSRs.

Once operational, compliance noise monitoring at the proposed monitoring locations will be undertaken in accordance with the guidance outlined in the EPA NG4 document and supported by a sufficiently detailed noise report outlining the survey methods used to determine the noise emission levels at the NSRs.

5. Assessment

This section deals with 'Stage 3' of the noise impact assessment as outlined in the EPA's NG4 Guidance.

The noise levels expected at nearest NSRs, due to the operation of the Installation, must be considered and presented as part of the IE licence application.

The following sections present details of the assessment and the findings. Further information in relation to the noise prediction model, inputs, calculation settings and assessment assumptions are provided in Appendix B to this report.

It should be noted that noise impact assessment has been completed using information obtained from ADSIL for significant items of plant which were procured from vendors.

5.1 Noise Sensitive Locations

Noise prediction calculations have been carried out at the representative nearest NSRs surrounding the Installation. Details of the NSRs used for the prediction calculations are presented in Table 5.

Table 5: Coordinates of Noise Sensitive Receivers

Noise Sensitive Receptor	National Grid Reference (m)		Modelled Height (m)
	North	East	
NSR1[Note 1]	298962	235295	1.5 (Free field)
NSR2[Note 2]	298253	235413	2.4 (First floor)
NSR3[Note 3]	298383	235443	2.4 (First floor)
NSR4[Note 4]	298716	235347	7 (Third floor)

Note 1: NSR1 pertains to N1 in Attachment 7-5 Noise Emissions

Note 2: NSR2 pertains to N2 in Attachment 7-5 Noise Emissions

Note 3: NSR3 pertains to N3 in Attachment 7-5 Noise Emissions

Note 4: NSR4 pertains to N4 in Attachment 7-5 Noise Emissions

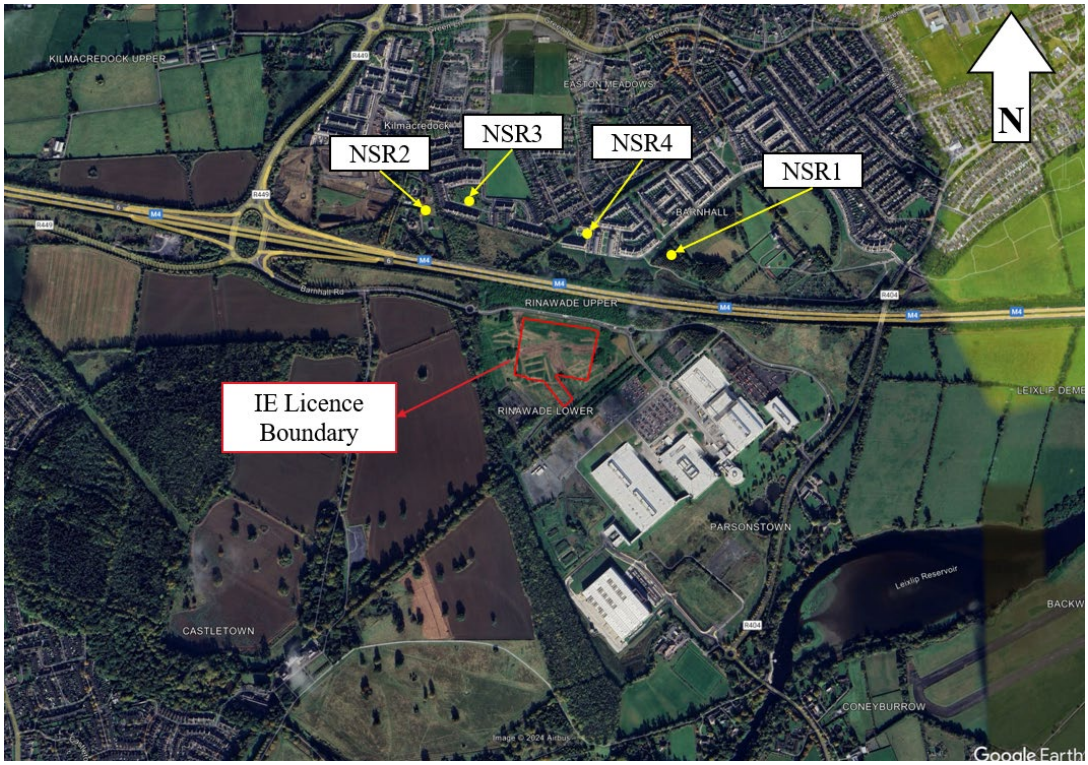

Figure 4: Approximate Noise Sensitive Receptor (NSR) Locations | Not to Scale | Google Earth ©

5.2 Noise Source Data

The sound power levels outlined in Table 6 of various items of plant associated were used in the modelling. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise).

Table 6: L_{WA} levels Utilised in Noise Model for Data Centre Plant.

Source	Lw (dB) per Octave Band (Hz)								Lw dB(A)
	63	125	250	500	1k	2k	4k	8k	
Extract Fans	86	88	87	90	87	84	80	79	92
DAHU	87	87	86	82	80	76	70	69	85
DAHU Inlet attenuator D_e	-12	-20	-34	-50	-50	-50	-49	-39	
DAHU Sound power level (L_w) for a single AHU intake + attenuation	75	67	52	32	30	26	21	30	73
CRAC Condensers	--	94	83	74	71	67	59	54	81
Admin AHU – Breakout	65	70	66	67	64	67	54	31	71
Admin AHU – Intake	58	68	51	52	47	45	44	41	56
Admin AHU –Exhaust	73	81	76	84	85	81	80	71	89
Split Unit Condenser	37	44	49	54	57	61	62	62	67
VRF Condenser	82	72	74	72	67	63	57	53	73
Generator – Side	102	108	97	92	89	86	81	86	97
Generator -Front	108	105	93	89.4	87	90	87	90	97
Generator - Rear (intake)	111	114	101	85	72	71	79	93	100
Generator – Roof (solid)	102	108	97	92	89	86	81	86	97
Generator – Discharge	114	117	94	70	68	68	73	98	103

Generator – Exhaust Outlet	115	114	100	94	90	88	84	80	101

5.3 Calculation Methodology

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the Installation. This section discusses the methodology behind the noise modelling process.

5.3.1 SoundPLAN 8.2

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, SoundPLAN, calculates noise levels in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

SoundPLAN is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. Predictor calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

5.3.2 Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

Site Layout The general site layout has been obtained from the drawings forwarded by ADSIL.

Local Area The location of NSRs has been obtained from a combination of site drawings provided by ADSIL and others obtained from Ordnance Survey Ireland (OSI).

Heights The heights of buildings on site have been obtained from site drawings forwarded by the ADSIL. Off-site residential buildings have been assumed to be 8m high.

Contours Site ground contours/heights have been obtained from site drawings forwarded ADSIL.

5.4 Predicted Noise Levels

This section presents the predicted noise levels at the nearest NSRs to the Installation. The impact of all modelled noise sources on the Installation has been assessed for three distinct operational scenarios.

Scenario A would be considered to be the most representative of the day to day operation. As this excludes emergency operation of generators, there are 0 generators running in Scenario A.

Scenario B is representative of emergency situation when a power outage or issue with supply from the national grid has occurred and backup electrical power is therefore required to keep the Installation operating. Scenario B assumes 14 generators are continuously running at a 100% load. It should be noted that such an event is an extremely rare occurrence.

Scenario C considers the impact associated with the testing of emergency generators. Testing of generators will occur once per week for a maximum of 1 hour each, one generator at a time, sequentially during daytime periods. Testing of generators shall take place only between 09.00 and 17.00hrs. (For the noise assessment of generator testing, it is assumed that each unit generate the same noise levels as for Scenario B). The predicted noise levels for Scenario C presented here assume that one generator, situated the closest to an NSR (in this case NSR2) is being tested and is running continuously at a 100% load.

Table 7 presents the predicted plant noise emission levels at the nearest NSRs and compares the results against the relevant criteria that have been derived for the Installation for Scenario A. All limits are fully complied with.

Table 7: Predicted Operational Noise Levels vs Criteria – Scenario A

Receptor	Predicted $L_{Aeq, T}$	Day (07:00 – 19:00hrs)		Evening (19:00 – 23:00hrs)		Night (23:00 – 07:00hrs)	
		Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Aeq, T}$	Complies?
NSR01	32	55	Yes	50	Yes	45	Yes
NSR02	34		Yes		Yes		Yes
NSR03	33		Yes		Yes		Yes
NSR04	37		Yes		Yes		Yes

Table 8 presents the predicted plant noise emission levels at the nearest NSRs and compares the results against the relevant criteria that have been derived for the Installation for Scenario B. All limits are fully complied with.

Table 8: Predicted Operational Noise Levels vs Criteria – Scenario B

Receptor	Predicted $L_{Aeq, T}$	Day (07:00 – 19:00hrs)		Evening (19:00 – 23:00hrs)		Night (23:00 – 07:00hrs)	
		Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Aeq, T}$	Complies?
NSR01	48	55	Yes	55	Yes	55	Yes
NSR02	50		Yes		Yes		Yes
NSR03	49		Yes		Yes		Yes
NSR04	52		Yes		Yes		Yes

Table 9 presents the predicted plant noise emission levels at the nearest NSRs and compares the results against the relevant criteria that have been derived for the Installation for Scenario C. Generator testing will only occur during the daytime hours so is only assessed against the daytime limit. All limits are fully complied with.

Table 9: Predicted Operational Noise Levels vs Criteria – Scenario C

Receptor	Predicted $L_{Aeq, T}$	Day (07:00 – 19:00hrs)		Evening (19:00 – 23:00hrs)		Night (23:00 – 07:00hrs)	
		Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Ar, T}$	Complies?	Criterion dB $L_{Aeq, T}$	Complies?
NSR01	37	55	Yes	50	N/A	45	N/A
NSR02	42		Yes		N/A		N/A
NSR03	40		Yes		N/A		N/A
NSR04	41		Yes		N/A		N/A

Figure 5 – Figure 7 below show the noise contours for each modelled scenario.

Figure 5: Operational Noise Prediction Contours - Scenario A

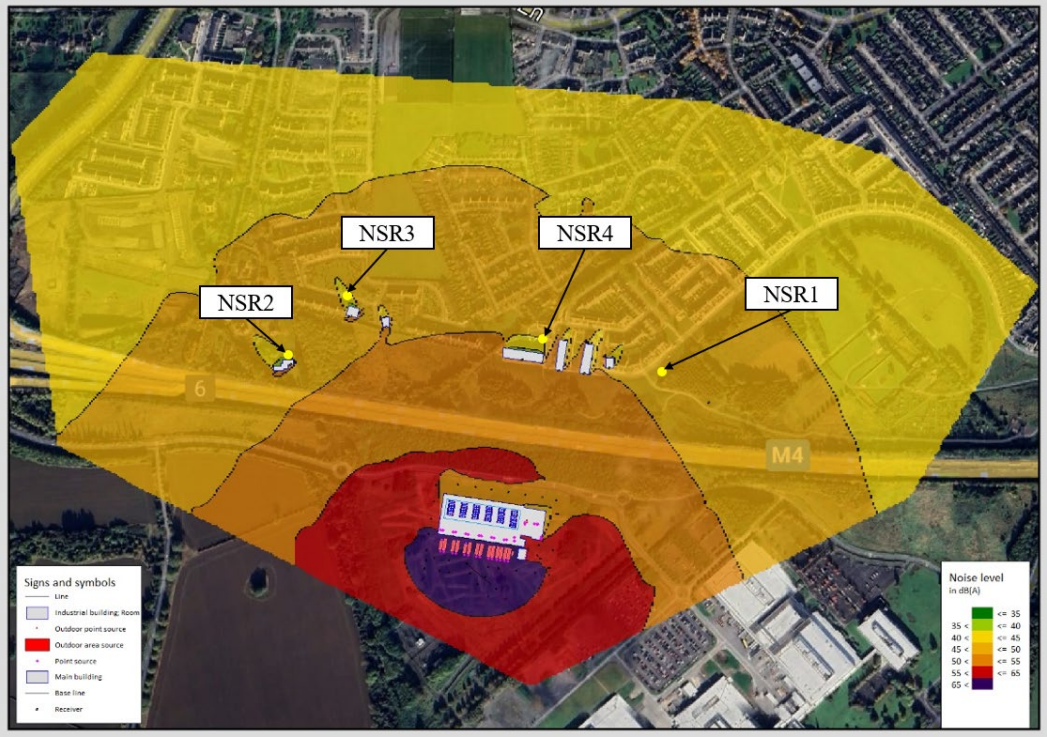

Figure 6: Emergency Operation Noise Prediction Contours - Scenario B

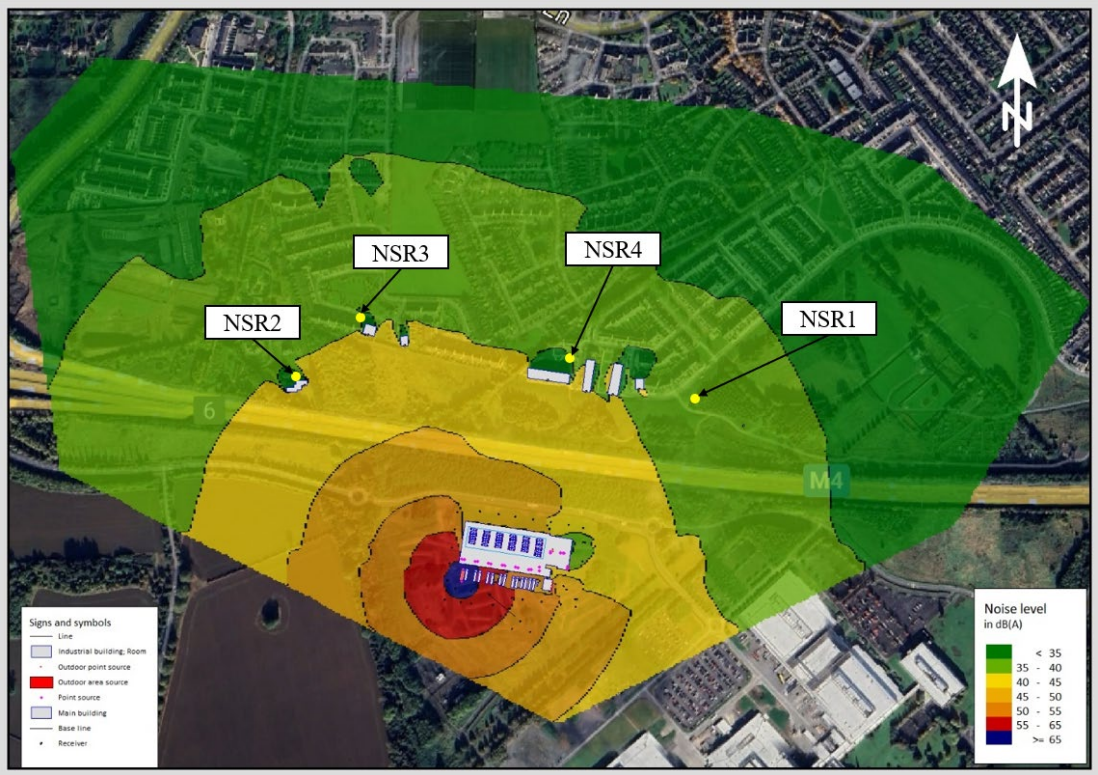

Figure 7: Generator Testing Noise Prediction Contours - Scenario C

6. Conclusion

An environmental noise survey was undertaken as part of the EIAR for the KIC Masterplan site planning application (KCC Planning Ref. 23/60047). This noise survey was completed at four NSRs in proximity to the KIC Masterplan site, which includes the Installation site, to establish the existing noise environment. The existing noise environment is dominated by road traffic noise.

The EIAR for the KIC Masterplan site planning application (KCC Planning Ref. 23/60047) concluded that the noise cumulative effect of the full site will be negative, not significant to moderate and short-term. Refer to Attachment 6-3-6 EIAR-Planning-July-2023 for further details.

In accordance with the relevant NG4 Guidance, appropriate operational noise criteria have been derived for the Installation which are based on consideration of EPA guidance and the existing noise environment at the nearest NSRs.

A noise impact assessment has been completed using information obtained from ADSIL for significant items of the Installation. A detailed computer-based noise model has been prepared using proprietary noise modelling software in accordance with the calculation method outlined in ISO 9613-2:1996.

The predicted noise levels at all NSRs are below the day, evening and night-time noise criteria that are applicable to the Installation operations.

Appendix A

Glossary of Acoustic Terminology

ambient noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
background noise	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).
broadband	Sounds that contain energy distributed across a wide range of frequencies.
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).
dB L_{pA}	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hertz (Hz)	The unit of sound frequency in cycles per second.
impulsive noise	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AFN}	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.
$L_{AF\ max}$	is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).
$L_{AF\ min}$	Is the instantaneous fast time weighted minimum sound level measured during the sample period.
$L_{Ar,T}$	The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
L_{AF10}	Refers to those A-weighted noise levels in the lower 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting
L_{AT}(DW)	equivalent continuous downwind sound pressure level.
L_{fT}(DW)	equivalent continuous downwind octave-band sound pressure level.

low frequency noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
noise	Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.
noise sensitive receptor	NSR – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
Rating level	See $L_{Ar,\,T}$
sound power level	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) where: $Lw = 10\log(P/P_0)dB$ Where: p is the rms value of sound power in pascals and P_0 is 1 pW.
sound pressure level	The sound pressure level at a point is defined as: $Lp = 20\log(P/P_0)dB$
specific noise level	A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: ‘the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ($L_{Aeq,\,T}$)’.
tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being ‘tonal’.
1/3 octave analysis	Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

Appendix B

Noise Modelling Details

Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the Installation. This section discusses the methodology behind the noise modelling process.

SoundPLAN

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, SoundPLAN 8.2, calculates noise levels in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996.*

SoundPLAN is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. Predictor calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

Input Data and Assumptions

Figure 8 represents a 3D render of the developed site noise model for the current proposals.

Modelling Calculation Parameters[2]

Prediction calculations for plant noise have been conducted in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

[2] See Appendix C for further discussion of calculation parameters.

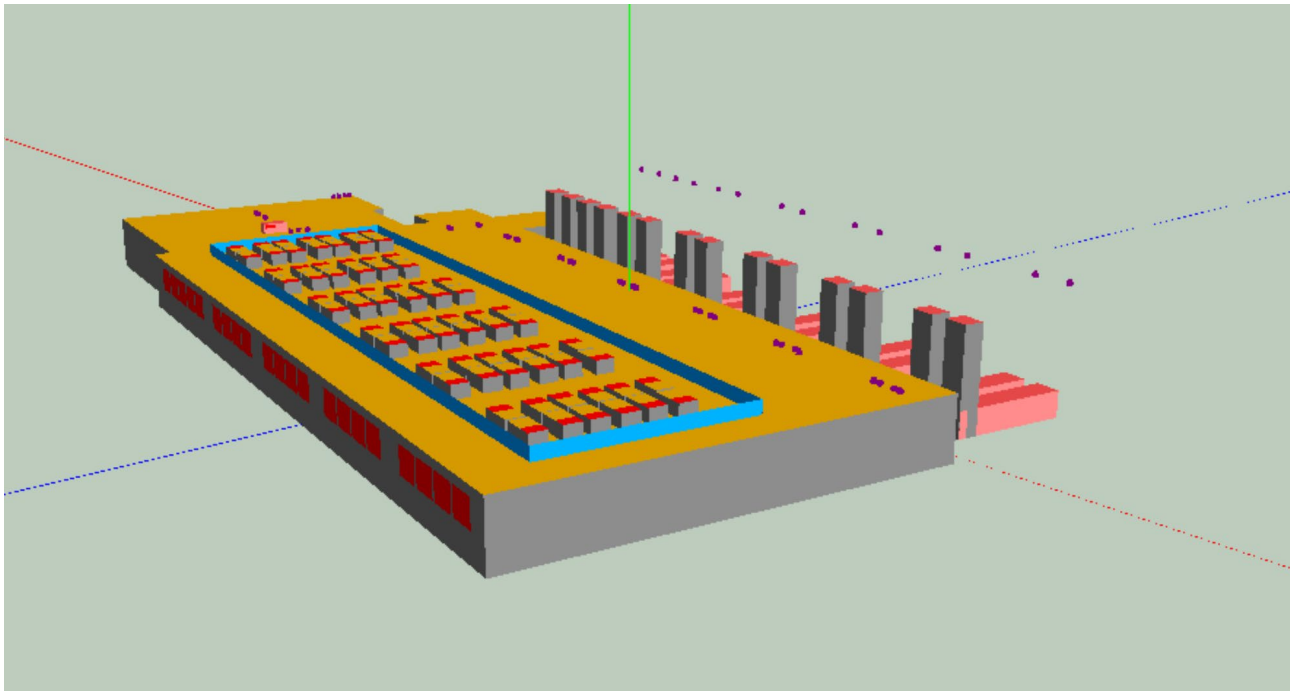

Figure 8: Image of Developed Noise Model - View of Installation Site