Redkite Environmental

Westar Homes Ltd.

Proposed Residential Development

Finlay Park
Naas
Co. Kildare

Noise & Vibration Impact Assessment Report

December 2022

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Contents

1.0 Introduction

Redkite Environmental Ltd. was commissioned by Westar Homes Ltd. to complete a Noise & Vibration Impact Assessment Report in support of a planning application for a proposed development comprising a Large-Scale Residential Development (LRD) of 134 dwellings, open space and commercial/ health/medical unit floorspace (247.6sqm.) on a 2.9-hectare (ha) site at Finlay Park, Naas, Co. Kildare. Refer to Attachment 1 for the proposed layout.

This report addresses the noise and vibration related requirements of Kildare County Council as set out in the LRD Opinion dated 23rd August 2022. Specifically, Item 13 is addressed:

"The site is located close to Public Roads and the applicant is requested to submit an Acoustic Design Statement by a suitably qualified acoustic specialist to ensure the proposed development including external areas will not be exposed to noise levels in excess of the Kildare County Third Noise Action Plan L_{den} threshold of 70dB(A) and L_{night} threshold of 57 dB(A). (Mitigation measures are to be included as deemed required).

(a) A noise monitoring survey conducted mid-week during school term that is to contain a full set of noise monitoring results. These results are to include the Time Run Duration, LAeqT (1hour), LAeqT (15 min), LAFmax, LAF10, LAF90, calculated Lden noise levels and measured Lnight levels.
(b) Calculated Lden and measured Lnight values at the facades of the proposed development at levels not less than 1.5metres above each of the respective floor level. The useability of balconies (if applicable) are to be subject of this assessment.
(c) The predicted internal noise levels to be in accordance with the recommended indoor ambient noise levels as prescribed under the British Standards BS 8233:2014. This is also to have an assessment with regard to opening windows at night (summer months) and the impact on internal ambient noise levels. This assessment shall have consideration to the number of LAFmax events from 11pm to 7.00 am having regard to potential sleep disturbance.
(d) Concluding statement with regard to the compliance with the Kildare County Council Third Action Plan 2019 – 2023 and the British Standards BS 8233:2014."

Responses:

- Item (a) – Refer to Section 2.2.3 and 5.2 relating to recent survey completed in September 2022. Attachment 3 contains further detail on results for parameters requested.
- Item (b) – Refer to Section 6.0, page 19.
- Item (c) – Refer to Section 9.0
- Item (d) – Refer to Section 6.0 Page 19 and Section 11.2 of the Conclusions.

Note: The above is provided for specific items highlighted in the LRD Opinion however it is recommended that the report be read as a complete document.

1.1 Report Objectives

The principal aims of this report are to:

- Address Item 13 of the LRD opinion. Essentially, this is an inward noise impact assessment to identify the noise exposure risk of future residents to transportation noise and to prepare an Acoustic Design Statement on the basis of this. This will be completed in accordance with the UK ProPG: Planning & Noise, New Residential Development, May 2017.
- Prepare an assessment of the noise and vibration impacts associated with the site development and construction phases of development and related effects on nearby existing Noise Sensitive Receptors (NSRs).
- Prepare an assessment of noise of the noise and vibration impacts associated with the long-term operational phase of the development and related effects on nearby existing NSRs.

2.0 Methodology

2.1 Competency

This assessment has been prepared by Ms. Siobhan Maher whose qualifications include a B.Sc. in Analytical Science, M.Tech. in Environmental Management and a post graduate Diploma in Acoustics and Noise Control Engineering. Siobhan is a full Member of the Institute of Acoustics (MIOA) since 2003 and also a Member of the Association of Acoustic Consultants Ireland (AACI). Siobhan was recently involved in the preparation of the AACI Environmental Noise Guidelines for Local Authority Enforcement and Planning Sections published in June 2019. http://aaci.ie/industry-publications/

Siobhan is the Managing Director of Redkite Environmental with over 20 years of experience providing environmental consultancy and environmental assessment services to business, industry and public sectors. In the area of acoustics, she has experience in environmental noise and vibration impact assessment, building acoustics (design and standard assessment), environmental noise monitoring and prediction modelling and occupational noise assessment.

The methodology used in completing this report is presented below.

2.2 Characterisation of the Receiving Environment

The receiving environment, in terms of noise has been characterised by desk-based study, site visits and two noise monitoring surveys completed in March 2020 and September 2022.

2.2.1 Desk-Based Study

Transportation noise mapping available on https://gis.epa.ie/EPAMaps/ for the area was reviewed as part of the characterisation of the local soundscape.

2.2.2 Field Surveys, March 2020

Initial site visits were completed on the 18th, 19th and 20th March 2020 to conduct noise monitoring and review the site context. Both attended and unattended monitoring was conducted. The surveys were conducted midweek and before the full Covid-19 lockdown occurred however schools were closed at the time. The results of the March 2020 survey are still considered valid in relation to the site as the existing public road adjoining the site is effectively a cul-de-sac at present and therefore would not have been used for school related traffic. As noted earlier, a further survey was conducted in September 2022 which corroborates the findings of the March 2020 survey.

The noise measurement methodology followed was in accordance with the recommendations of the following:

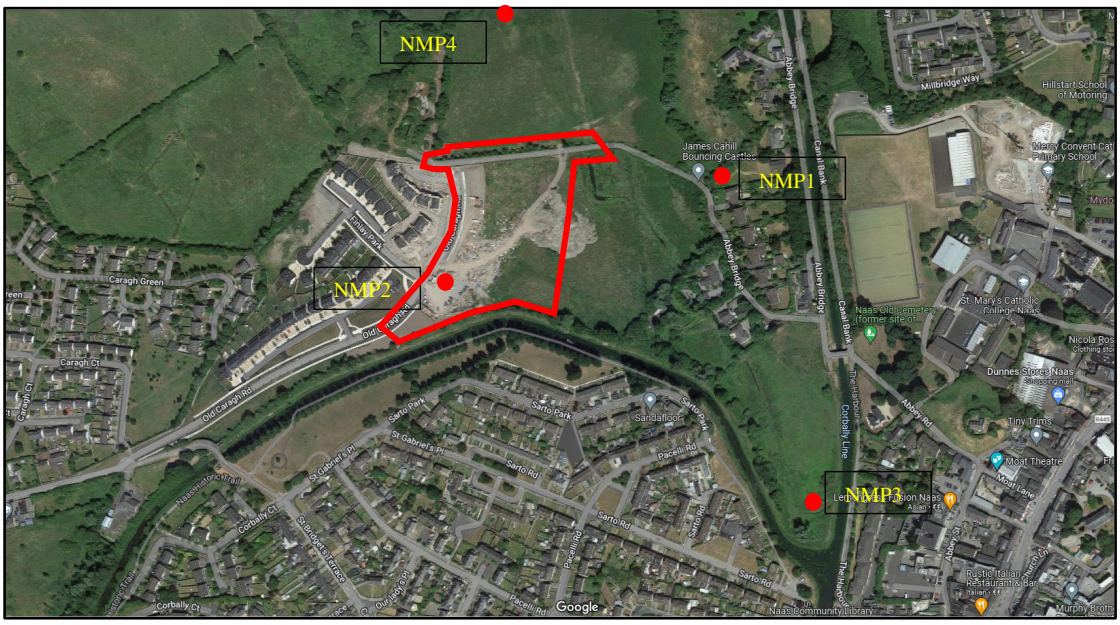
- ISO 1996 Acoustics – Description, Measurement and Assessment of Environmental Noise, Part 1, Basic Quantities and Assessment Procedures (2016) and Part 2 Determination of Environmental Noise Levels (2017), and,
- The EPA Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities, (NG4), revised January 2016.

Attended and unattended ambient sound monitoring was undertaken at Noise Monitoring Points (NMPs) as described in Table 1 below and as illustrated on Figure 1 and Plates 1 - 4 overleaf. Unattended noise monitoring was conducted over two separate periods up to 24-hours at NMP1 and NMP2.

Table 1 Noise Monitoring Points

Location	Grid Ref.	Description
NMP1 (unattended)	288973E; 219793N	123m east of eastern site boundary. Within the back garden of a dwelling off Abbey Bridge Road.
NMP2 (unattended)	288671E; 219675N	Western site boundary, in the site compound adjacent to the current finished phase of Finlay Park. No construction occurring. Approx. 1.7km to the M7 motorway due west.
NMP3 (attended)	289073E; 219444N	Southwest of site, close to town centre and at harbour and junction of the Corbally and Naas lines of the canal.
NMP4 (attended)	288734E; 219971N	120m north of northern site boundary in adjacent agricultural land. Approx. 1.6km from the M7 motorway due west.

Figure 1 Noise Monitoring Locations – March 2020



Source: Google Maps

Plate 1 NMP1

Plate 2 NMP2

Plate 3 NMP3

Plate 4 NMP4

Unattended monitoring at NMP1 was completed from Wednesday, 18/3/2020 @ approx. 11.30 hrs to Thursday, 19/3/2020 @11.00 hrs.

The meter was then moved to NMP2 for a second 24-hour monitoring event until approx.12.00 hrs on Friday 20/3/2020.

Attended 15-minute x 3 measurements were completed at NMP3 and NMP4 during the daytime period on 18/3/2020 from 11.30 hrs – 14.15 hrs.

All primary noise sources contributing to the ambient sound environment were noted during the attended noise monitoring. Audio was recorded during the unattended events to aid with later analysis.

Overall weather conditions prevailing during the survey were suitable for noise monitoring. During the attended survey, wind speeds measured on site were on average < 1m/sec. Wind direction was from the west/southwest. Temperatures were mild. No rainfall occurred during the monitoring period.

Sound measurements were carried out using two Type 1 Sound Level Meters (SLMs) and associated hardware (calibrators, weather-proof outdoor kit (24-hour meter) and tripods). Software used includes Nti Extended Acoustic Pack and Noise Explorer Version 1.85 for post-processing and analysis.

The monitoring equipment was calibrated before and after use. The observed drift was <0.1 dB. Sound levels were measured using the A-weighted network, and a fast sampling interval. Wind speed was measured using a portable

anemometer. Further details of the monitoring equipment used are set out in Table 2 below.

Table 2 Monitoring Equipment

Instrument Type	Manufacturer	Model Number	Serial Number
Sound Level Meter	NTi	XL2	A2A-16311-E0 A2A-08898-E0
Microphone	NTi	MA220	8567 5062
Acoustical Calibrator	NTi/Larson Davis	CAL 200	16757 11728

The SLMs including the microphones and the calibrators have been externally calibrated in accordance with standard procedures. All tests are traceable in accordance with ISO/IEC 17025. Attachment 2 contains the calibration certs for the equipment used.

A Testo 410-1 (Serial No. 38463402/711 with manuf. calibration cert) Digital Wind Speed Scale Gauge Meter Anemometer with a range from 0.4 – 20m/s and a temperature range from -10 – 50°C was used on-site to measure wind speeds and temperature.

2.2.3 Field Surveys, September 2022

A second survey was completed by Enfonic on behalf of Redkite Environmental between 12th September – 15th September 2022.

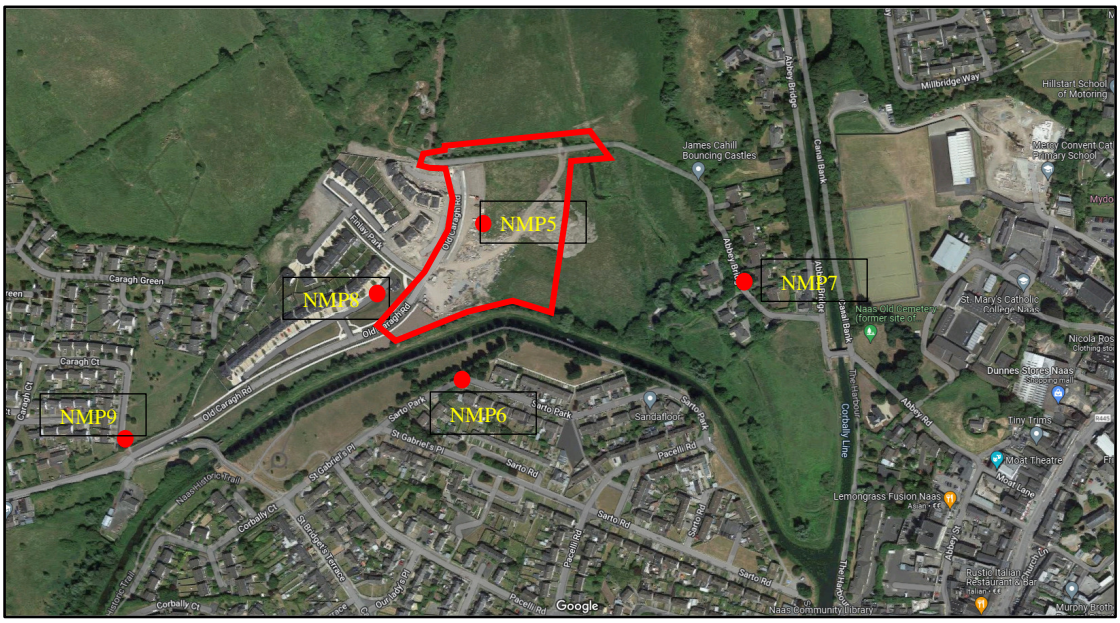
Both attended and unattended monitoring was conducted using the same methodology as listed under Section 2.2.2.

Attended and unattended ambient sound monitoring was undertaken at Noise Monitoring Points (NMPs) as described in Table 3 below and as illustrated on Figure 2 and Plates 5 - 9 overleaf. Unattended noise monitoring was conducted continuously over the mid-week period at NMP5.

Table 3 Noise Monitoring Points

Location	Grid Ref.	Description
NMP5 (unattended)	288707E; 219734N	In site. Within 10m of roadside.
NMP6 (attended)	288706E; 219574N	Sarto Park. Existing 2-storey residential NSRs.
NMP7 (attended)	288996E; 219673N	Finlay Park. Existing 2-storey residential NSRs.
NMP8 (attended)	288601E; 219657N	Abbey Bridge Road. Existing 2-storey residential NSRs.
NMP9 (attended)	288340E; 219498N	Caragh Court. Existing 2-storey residential NSRs.

Figure 2 Noise Monitoring Locations – September 2022



Source: Google Maps

Plate 5 NMP5 (unattended)

Plate 6 NMP6

Plate 7 NMP7

Plate 8 NMP8

Plate 9 NMP9

Unattended monitoring at NMP5 commenced on Monday 12/9/2022 at approx. 10.45 hrs to Wednesday, 14/9/2022 @23.15 hrs. The data from Monday was excluded from the assessment as rainfall occurred during this period.

Attended 30-minute x 1 measurements were completed at NMP6 - NMP9 during the daytime period on 15th September 2022 from 13.45hrs – 16.30 hrs. These measurements were taken as part of the baseline study for the assessment of site development and construction noise.

All primary noise sources contributing to the ambient sound environment were noted during the attended noise monitoring. Audio was recorded during the unattended events to aid with later analysis.

Overall weather conditions prevailing during the survey were suitable for noise monitoring. Wind speeds were low and < 5m/sec. Temperatures were mild. No rainfall occurred during the monitoring period except on Monday 12th September 2022(this data was excluded from the assessment).

Sound measurements were carried out using two Type 1 Sound Level Meters (SLMs) and associated hardware (calibrator, weather-proof outdoor kit (24-hour meter) and tripods). Software used includes Bruel &Kjaer 7815 Noise Explorer software for post-processing and analysis.

The monitoring equipment was calibrated before and after use. The observed drift was <0.1 dB. Sound levels were measured using the A-weighted network, and a fast-sampling interval. Wind speed was measured using a portable anemometer. Further details of the monitoring equipment used are set out in Table 4 below.

Table 4 Monitoring Equipment

Instrument Type	Manufacturer	Model Number	Serial Number
Sound Level Meter 1	Bruel & Kjaer	2250	3007000
Sound Level Meter 2	Bruel & Kjaer	2250 Light	620701
Acoustical Calibrator	Bruel & Kjaer	4231	3011175

The SLMs including the microphones and the calibrators have been externally calibrated in accordance with standard procedures. All tests are traceable in accordance with ISO/IEC 17025. Attachment 3 contains the calibration certs for the equipment used.

2.3 Impact Assessment

The following guidance and standards have been used in the setting of suitable noise and vibration criteria and assessment of impacts and effects on human beings:

- BS5228-1:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 1: Noise and Part 2: Vibration;
- BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration;
- BS6472-1:2008: Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting;
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation,
- UK Highways Agency Design Manual for Roads and Bridges, Sustainability and Environmental Appraisal, LA11, Noise and Vibration, Rev 2, May 2020, and,
- Transport Infrastructure Ireland (TII) publication Guidelines for the Treatment of Noise & Vibration in National Road Schemes, March 2014.

The EPA document entitled Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2022 also contains general guidance on the assessing of environmental effects in terms of quality, significance, duration, magnitude and type. This document has also been considered where appropriate in defining noise and vibration impacts, however the above guidance and standards listed form the main basis of setting of criteria and assessment.

The UK ProPG: Planning & Noise, New Residential Development, May 2017[1] was used as guidance in completing the inward noise impact assessment on future residents. This document outlines a systematic risk based 2 stage approach for evaluating noise exposure on prospective sites for residential development. Stage 1 comprises an initial noise risk assessment of sites proposed for residential development considering either measured and/or predicted noise levels. A site is then characterised as negligible to high risk in terms of exposure to transportation noise of future residents. A full stage 2 assessment including implementing a good acoustic design process is triggered depending on the existing ambient noise environment and findings of the Stage 1 Noise Risk Assessment.

3.0 Definitions

The following definitions apply in this report:

L_{Aeq} is the A – weighted equivalent continuous sound level – the sound level of a steady sound having the same energy as a fluctuating sound over a specified measurement period.

L_{A10} is the A-weighted noise level which is exceeded for 10% of the specified measurement period. This gives an indication of the upper limit of fluctuating noise such as that from intermittent road traffic over the measurement period.

[1] This document was prepared by a working group comprising members of the UK Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since its adoption, it has been generally considered as a best practice guidance for assessing inward noise risk for new residential development.

L_{A90} is the A-weighted noise level exceeded for 90% of the measurement period and is useful in providing an indication of the background noise level experienced over the measurement period.

L_{AFmax} is the maximum A-weighted noise level measured during a cycle with a fast time weighting.

L_{AFmin} is the minimum A-weighted noise level measured during a cycle with a fast time weighting.

L_{ASmax} is the maximum A-weighted noise level measured during a cycle with a slow time weighting.

$L_{Aeq,16hr}$ A-weighted, Leq. Sound Level, measured over the 16-hour period 07.00 - 23.00 hours

L_{day} Day equivalent level: A-weighted, Leq. Sound Level, measured over the 12-hour period 07.00 - 19.00 hours

L_{den} Day-evening-night level. It is a descriptor of noise level based on energy equivalent noise level (Leq) over a whole day with a penalty of 10 dB(A) for night-time noise (23.00-7.00) and an additional penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00).

$L_{evening}$ Evening time equivalent level: Leq. A-weighted, Sound Level, measured from 19.00 – 23.00 hours.

L_{night} Night equivalent level: Leq. A-weighted, Sound Level, measured overnight 23.00 – 07.00 hours.

Rw – weighted sound reduction index - a single-number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies. (Laboratory measurement). The apparent Rw is the value as measured in the field.

SEL – Single Event Level - the dB(A) level which if it lasted for one second would produce the same A-weighted sound energy as the actual event. Also known as L_{Ae}.

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

4.0 Description of Existing Conditions

The proposed development site has an area of 2.9 ha and is mainly grassed with some small mounds of natural materials present. Part of the site is in use as a construction compound for the existing ongoing development at Finlay Park.

The site is located in one large parcel of land, approximately 0.6km to the west of the centre of Naas. The M7 lies approximately 1.7km to the west/northwest. New developments, Caragh Court and Finlay Park, lie to west of the site. The Old Caragh Road bounds the site to the west and provides access. The Corbally branch of the Grand Canal lies along the tree-lined southern boundary. Agricultural lands lie to the north and immediate east.

The majority of the site can be described as within an area that is emerging suburban in nature. A new housing development, Finlay Park (Plate 10) lies across from the western boundary. The eastern boundary is within agricultural land with individual detached residential dwellings dotted along the canal tow-path further east. More mature housing estates, such as Sarto Park (Plate 11), overlook the southern portion of the site. Refer to Figures 1 and 2 earlier.

Plate 10 View South-west into Site (Finlay Park in right background)

Plate 11 View south (Sarto Park in right background)

5.0 Results of Monitoring

5.1 March 2020

Attachment 4 contains the logged printout results from NTi Explorer Software for all monitoring locations (NMP1 – NMP4). The ambient sound environment of the site is dominated by continuous distant traffic noise from the M7. Traffic on local roads was not a significant contributor. In this regard, it is noted that the monitoring was conducted just before Covid-19 lockdown and therefore this may have contributed to reduced flows on local roads. However, none of the monitoring locations are in proximity to local heavily trafficked roads. The site is set back from these. NMP3 is closest to the town centre however it is screened from the Main Street and the local routes are mainly for residential and pedestrian access. During the site visit, the area was in use as a local amenity. As the Site is mainly disused at present, birdsong was a significant contributor to average noise levels recorded during the daytime. Other sources audible included distant construction site noise and occasional overhead aircraft. Tables 5 and 6 below summarise the ambient sound environment over approx. 24 hours at NMP1 and NMP2.

Table 5 Summary Results NMP1 (unattended)

Interval	L_{Aeq}	L_{A10}	L_{A90}	L_{AFmax}	Description of Ambient Noise Environment
$L_{Aeq,16hr}$ (07.00 - 23.00 hrs)	46	48	41	74	Birdsong is predominant noise source affecting NMP1. Distant motorway traffic forms background noise levels ($L_{A90,t}$). During the daytime, sounds from construction sites in the distance were audible. The dawn chorus occurred at approx. 05.51 hrs and was the only event where L_{Amax} values during the night were over 60 dB(A).
L_{day} (07.00 – 19.00hrs)	47	49	41	74	
$L_{evening}$ (19.00 – 23.00hrs)	45	45	42	68	
L_{night} or $L_{Aeq,8hr}$ (23.00 – 07.00hrs)	45	47	36	74	
L_{den}	52				

Table 6 Summary Results NMP2 (unattended)

Interval	L_{Aeq}	L_{A10}	L_{A90}	L_{AFmax}	Description of Ambient Noise Environment
$L_{Aeq,16hr}$ (07.00 -23.00 hrs)	47	48	40	86	Motorway traffic noise is more predominant at this location compared to NMP1. Also, occasional individual local vehicles were audible on the Finlay Park access road. Occasional overhead aircraft were audible. The dawn chorus occurred at approx. 06.06 hrs and was the only event where L_{Amax} values during the night were over 60 dB(A). Approx. 4 values occurred above 60 dB(A).
L_{day} (07.00 – 19.00hrs)	45	46	40	86	
$L_{evening}$ (19.00 – 23.00hrs)	42	43	40	59	
L_{night} or $L_{Aeq,8hr}$ (23.00 – 07.00hrs)	43	46	38	63	
L_{den}	50				

The summary findings of the ambient sound survey during the daytime at the two attended noise monitoring points, NMP3 and NMP4, are presented in Table 7 below.

Table 7 Summary Results NMP3 & NMP4 (attended)

Location /Start - time	$L_{Aeq,15min}$	$L_{A10,15,min}$	$L_{A90,15min}$	L_{AFmax}	Description of Ambient Noise Environment
NMP3#1 11.50	47	50	42	62	Continuous birdsong accounting for max values recorded and L_{Aeq}. Distant background traffic masked but audible.
NMP3#2 12.06	45	48	42	60	
NMP3#3 12.22	45	47	42	62	
NMP4#1 13.16	44	48	40	60	Continuous birdsong and horses accounting for max values recorded and L_{Aeq}. Distant M7 background traffic continuously audible. Overhead aircraft during #2 ($L_{Aeq,t,\ 2min}$ 50 dB)
NMP4#2 13.31	47	49	40	74	
NMP4#3 13.47	44	45	41	63	

5.2 September 2022

Attachment 3 contains a report prepared by Enfonic detailing the results for NMP 5 (unattended) during a 2-day midweek period during school term. The results are presented in the parameters as requested in the LRD opinion including $L_{AeqT\ (1hour)}$, $L_{AeqT\ (15\ min)}$, L_{AFmax}, L_{AF10}, L_{AF90}, calculated L_{den} noise levels and measured L_{night} levels.

$L_{Aeq,16hr}$ is also presented in this report as it is relevant to the assessment of noise exposure risk as required under Pro-PG.

Similar sources as described for the March 2020 survey at NMP2 apply to NMP5 with distant motorway traffic in the background and birdsong present. Both locations are within the site. Both surveys correlate well which is to be expected as the adjoining road is currently a cul de sac.

A comparison is presented below in Table 8 below:

Table 8: Comparison of Summary Results

Location	Date	L_{den}	$L_{Aeq,16hr}$	L_{night}
NMP2	Mar 2020	50	47	43
NMP5	Sept 2022	51	47	44

The results for short-term attended measurements at the nearest NSRs are presented in Table 9 below.

Table 9 Summary Results NMP6 – NMP9 (attended on 15/9/2022)

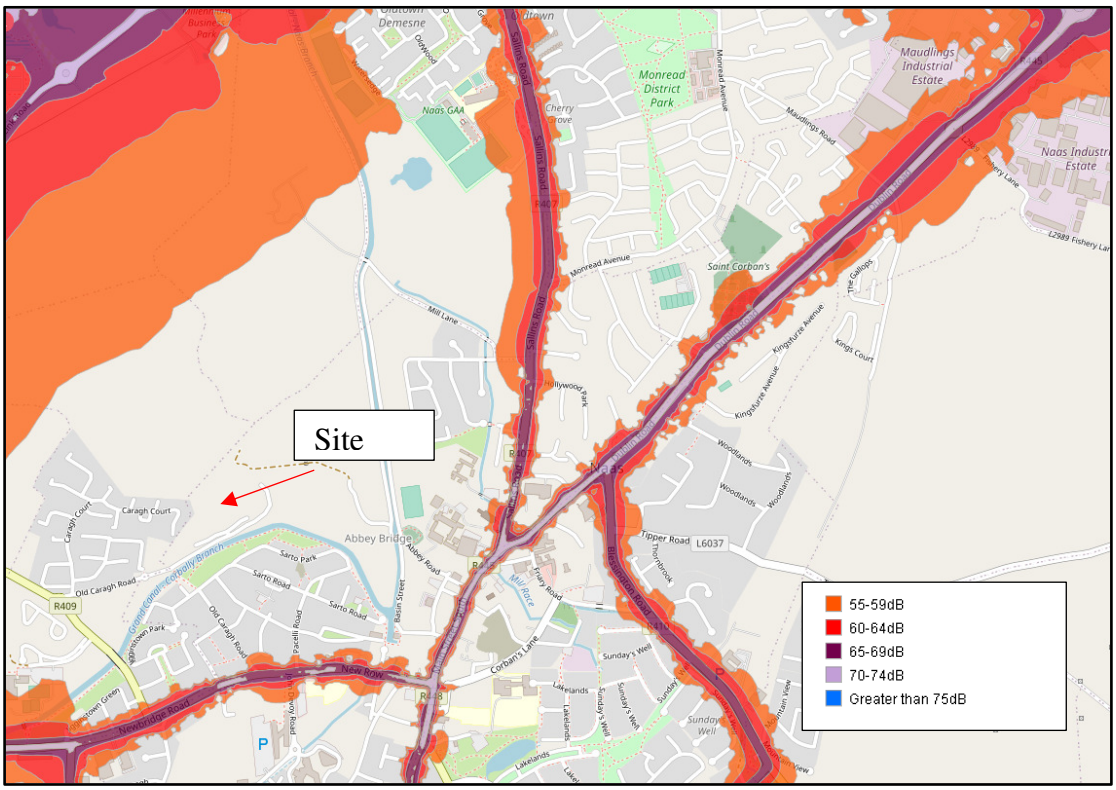
Location /Start - time	$L_{Aeq,30min}$	$L_{A10,30,min}$	$L_{A90,30min}$	L_{AFmax}	Description of Ambient Noise Environment
NMP6 15.09	49	50	43	69	Typical neighbourhood sounds, cars passing by, occasional overhead aircraft. L_{Amax} at NMP9 due to car starting which elevated L_{Aeq} above typical levels for this location and is therefore not representative of the location which is set back from the Caragh Road.
NMP7 14.28	50	49	38	75	
NMP8 15.46	47	48	40	72	
NMP9 13.45	62	50	41	96	

6.0 Desk-Based Study

Kildare County Council published the final Third Noise Action Plan (NAP) 2019 – 2023 for the county in September 2019. Related traffic noise mapping is available on the EPA's website https://gis.epa.ie/EPAMaps/ and includes for the M7, R445 road to Newbridge and the R448 (Main St, Naas). The NAP is referred to in the draft Kildare County Development Plan 2023-2029.

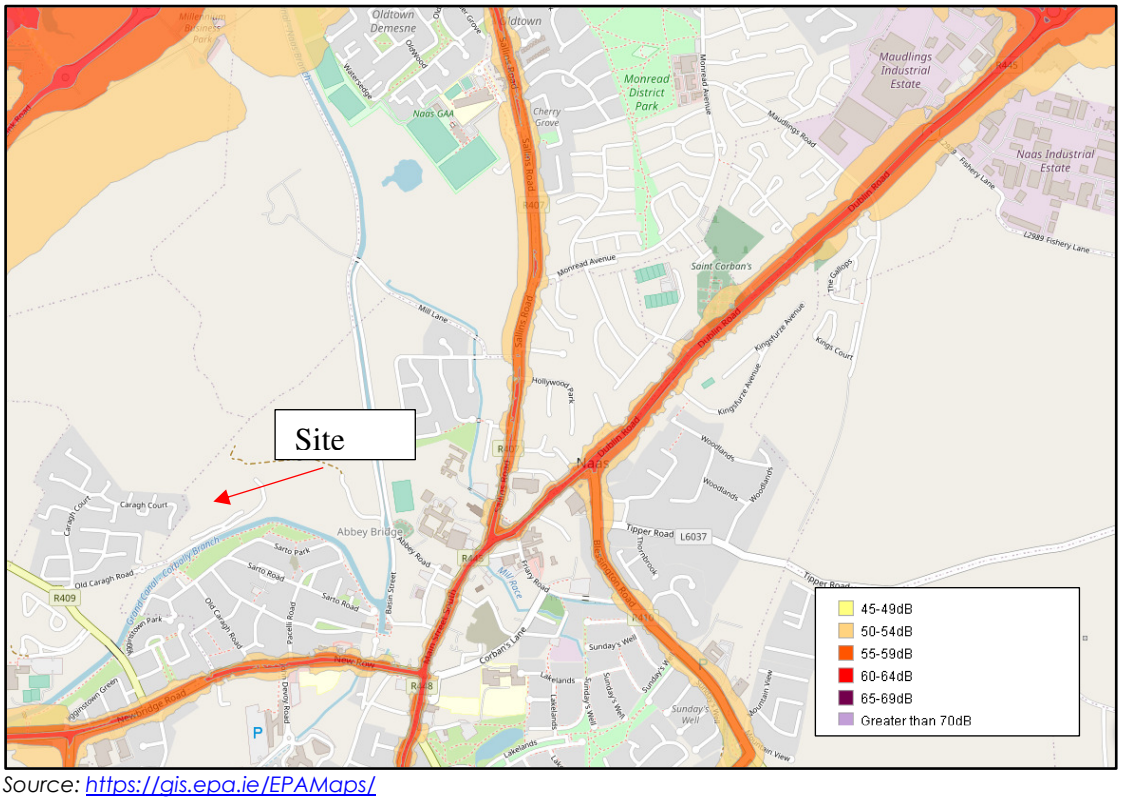
Figures 3 and 4 overleaf re-produce the Round 3 road noise mapping in the vicinity of the site. As expected, the proposed landbank is not within the main zone of influence of the roads. Rail sources do not affect the site.

Figure 3 Latest Round 3 Road Noise Mapping L_{den}



Source: https://gis.epa.ie/EPAMaps/

Figure 4 Latest Round 3 Road Noise Mapping L_{night}



Source: https://gis.epa.ie/EPAMaps/

The NAP notes the following with regards to noise and new sensitive development such as residential:

> *In the scenario where new noise sensitive premises are introduced to locations already exposed to significant levels of long-term environmental noise as set out in the Environmental Noise Regulations, i.e. 70 dB (A) Lden and 57 dB (A) Lnight, it is considered appropriate to consider aiming to achieve target internal noise levels within noise sensitive rooms, such as living rooms and bedrooms.*
>
> *In the case of new development, or conversions, these targets could be introduced through the use of appropriate planning conditions, and possibly some form of pre-completion testing as used in a number of other EU countries. The choice of targets for internal noise levels can be informed by the:*
>
> 1. *WHO-Guidelines for Community Noise (1999),*
> 2. *WHO-Night Noise Guidelines for Europe (2009),*
> 3. *WHO-Environmental Noise Guidelines for the European Region (2018),*
> 4. *BS 8233 (2014) Guidance on Sound Insulation and Noise,*
> 5. *ProPG: Professional Practice guidance on Planning and Noise for new Residential Development (May 2017),*
> 6. *AACI: Environmental Noise Guidance for Local Authority Planning & Enforcement Departments (June 2019).*

Based on the noise survey undertaken, the site currently does not fall within an area exposed to significant noise levels for new residential development.

The existing L_{den} and L_{night} values are well below 70 and 57 dB(A) at 51 and 44 dB(A) respectively.

Additionally, the ambient sound environment at the site is below the 2018 guidelines set by the World Health Organisation (WHO) for external road traffic noise which are as follows:

> *For average noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic below 53 dB L_{den}, as road traffic noise above this level is associated with adverse health effects.*
>
> *For night noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic during night-time below 45 dB L_{night}, as night-time road traffic noise above this level is associated with adverse effects on sleep.*
>
> *To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from road traffic in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions, the GDG recommends reducing noise both at the source and on the route between the source and the affected population by changes in infrastructure.*

7.0 Description of Development

7.1 General Project Description

The proposed development will consist of the construction of 134 no. apartments (comprising a mixture of 70 no. 2 storey apartments and 64 no. apartments - 22 no. 1 bedroom apartments, 77 no. 2 bedroom apartments, and 35 no. 3 bedroom apartments) with private open space provided in the form of balconies/terraces as follows:

A) Block A (4 storey apartment block) comprising 26 no. apartments (6 no. 1 bed units, 16 no. 2 bed units & 4 no. 3 bed units); Block B (part 4 part 5 storey apartment block) comprising 66 no. apartments (10 no. 1 bed units, 33 no. 2 bed units and 23 no. 3 bed units), with a commercial/ health/medical unit (c. 247.6 sq. m) at ground floor; Block C (part 4 part 5 storey apartment block) comprising 42 no. apartments (6 no. 1 bed, 28 no. 2 bed units and 8 no. 3 bed units);

B) Vehicular/pedestrian and cyclist access from the Old Caragh Road (in new arrangement) along with the provision of 201 no. undercroft and surface car parking spaces as well as 388 no. undercroft and surface cycle parking spaces; internal road and shared surface networks including pedestrian and cycle paths;

C) Public Open space including proposed plaza, as well as central communal (courtyard) open space including outdoor playground area at podium level;

D) 1 no. temporary (for 3 no. years) 3-sided signage structure (c. 4.5m in height) at the entrance to the proposed development.

E) Provision of foul and surface water drainage, including relocation of existing foul main in northern part of site as well as green roofs; linear greenway path, bin stores; plant rooms; public lighting and all associated landscaping and boundary treatment works, site development and infrastructural works, ESB substations, and all ancillary works necessary to facilitate the development.

The proposed layout is indicated on Dwg. A0111 in Attachment 1.

7.2 Site Development & Construction Phases

The site development and construction phases are expected to comprise 4 phases over 30 -36 months in total. There will be overlap between phases to complete the development within the envisaged timeframe as indicated in Table 10. The following steps will be completed:

- Site enabling works.
- Foundation.
- Substructure.
- Main structure.
- Fit out.
- Final site development, landscaping.
- Handover.

Table 10 Proposed Construction Timetable

No.	Description	Timing (months)
1.	Site Development and foundations for all Blocks (A,B&C) and podium car-park	5
2.	Block B construction	12
3.	Block A construction	9
4.	Block C construction	12
TOTAL		**38***

Note;: there will be overlap between phases*

It is envisaged that precast construction type will be used but this is subject to full design post planning stage.

Based on existing site knowledge, vibro stone column (VSC) ground improvement techniques are proposed for foundations. However, this will be subject to site investigation and final construction design details. The envisaged duration for this element of the works will be 3 to 4 weeks.

Construction traffic will access and exit the Site via the Old Caragh Road arriving via the R409/R445 Millennium Park Road/M7 from the west/northwest and via the R409/R445 Newbridge Road/Southern Ring Road from the south.

It is envisaged that 25 – 30 HGVs will access the site per day during peak activities. Based on construction working hours of 08.00 – 18.00 hrs Monday to Friday, this equates to on average 2-3 HGVs/hr accessing the site or 6 trips per hour.

Staff cars will arrive mainly during the AM and PM peak periods. Total staff numbers envisaged at peak construction times such as earthworks are expected to number 60-80 personnel. It is expected that car-sharing will occur.

8.0 Assessment of Impact on Existing NSRs

8.1 Site Development & Construction Phases

The site development and construction phases can potentially give rise to temporary to short term noise and vibration impact and effects through the use of mobile and non-mobile heavy machinery and equipment. The following section discusses the applicable criteria applied to site development and construction phase noise and vibration.

8.1.1 Applicable Noise Criteria

There is no definitive published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project.

BS5228:2009 + A1:2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise* describes applicable noise level thresholds (construction noise plus ambient) not to be exceeded at noise sensitive receptors, depending upon existing ambient levels, as described in Table 11 below. This table is based upon report E3.2, Table E.1 of BS5228:2009 + A1:2014 Part 1. It should be noted that this assessment method is only valid for residential properties and not for commercial Noise Sensitive Receptors (NSRs).

Table 11 Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A	**Category B**	**Category C**
Night-time (23:00-07:00)	45	50	55
Evening and Weekends	55	60	65
Daytime (07:00-19:00) and Saturday (07:00-13:00)	65	70	75
NOTE 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. NOTE 2: If the ambient noise level exceeds the threshold values given, in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity. NOTE 3 Applied to residential receptors only.			
A) Cat A: Threshold values to use when ambient noise levels (rounded to nearest 5dB) are less than these values B) Cat B: Threshold values to use when ambient noise levels (rounded to the nearest 5dB) are the same as Cat A values C) Cat C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Cat A values D) 19:00-23:00 weekdays, 13:00-23:00 Saturday and 07:00-23:00 Sunday is deemed 'evening and weekend' period.			

In addition to the above, the following acceptable levels are described in the Transport Infrastructure Ireland (TII) publication Guidelines for the Treatment of Noise & Vibration in National Road Schemes, 2014. These limits are applied during the construction of road infrastructure projects at the facades of NSRs:

Table 12 TII Acceptable Levels for Construction

Day	**Working Hours**	**Level dB ($L_{Aeq,1hr}$)**	**Level dB (L_{ASmax})**
Mon-Fri	07.00 – 19.00	70	80
Mon-Fri	19.00 – 22.00	60*	65*
Saturday	08.00 – 16.30	65	75
Sundays & Bank Holidays	08.00 – 16.30	60*	65*

*Note *: Construction activity at these times, other than emergency works, will normally require specific permission from the local authority.*

Monitoring undertaken at NMPs 1, 6, 7, 8 and 9 is representative of noise exposure of existing residential NSRs to the east (Abbey Bridge), west (Finlay Park), south (Sarto Park) and southwest (Caragh Court). Accordingly, Category A daytime (07.00 -19.00) threshold values apply at these NSRs.

There will be no requirement for night-time or evening (19.00 – 23.00 hrs) construction works.

The LRD Opinion notes that construction working hours are to be 08.00 - 18.00 hrs Mon- Fri and 08.00 – 14.00 hrs Saturday.

Accordingly, the following construction noise criteria or threshold values are proposed for residential properties:

- 65 dB $L_{Aeq,1hr,}$ Mon-Fri (08.00 – 18.00hrs) and Sat (08.00 – 14.00 hrs) at Finlay Park, Abbey Bridge, Sarto Park and Caragh Court.

Limits or threshold values are typically applied to control construction noise as it is temporary to short term in nature and will not have long-term effects on NSRs. BS5228-1 notes that a potentially significant negative effect will occur if the predicted construction noise level plus ambient at an NSR exceeds the applicable threshold value. BS5228-1 also notes that factors such as the number of receptors affected, and the duration and character of the impact may need to be considered to determine if there is an actual significant effect.

The recently published UK LA111 Noise and Vibration Assessment Guidance for road projects similarly notes that the magnitude of impact is major if the construction noise impact is greater than or equal to the threshold value (from BS5228-1) +5dB. A moderate impact magnitude is above or equal to the threshold value and below the threshold value +5 dB. Impacts of major and moderate magnitude are then considered to constitute a significant effect *depending* on duration.

A significant effect is deemed to have occurred where an impact of major or moderate magnitude will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights;
- A total number of days exceeding 40 in any 6 consecutive months.

The following summary table applies with regards to magnitude of impact and construction noise level:

Table 13 Magnitude of Impact & Construction Noise Descriptors

Magnitude of Impact	Construction Noise Description
Major	Above of equal to threshold value +5 dB
Moderate	Above or equal to threshold value and below threshold value +5 dB
Minor	Above or equal to baseline and below threshold value
Negligible	Below baseline.

LA111also offers guidance on construction related traffic noise as follows:

Table 14 Magnitude of Impact at NSLs for Construction Traffic

Magnitude of Impact	Increase in Baseline Noise Level of Closest Public Road Used for Construction Traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

The same durations apply as stated for construction noise.

8.1.2 Applicable Vibration Criteria

Vibration impacts can typically potentially occur during demolition (not applicable to this proposed development), site development and construction phases of development particularly through the use of equipment such as rock breakers (transient) or piling (transient or continuous, depending on method employed). Vibration can affect both human beings and buildings. Humans are more sensitive to vibration stimuli although the risk of cosmetic or structural damage to buildings is the more usual concern for site development/ construction.

Guidance relevant to the protection of building structures is contained in the following documents:

- British Standard BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration, and;
- British Standard BS 5228: 2009+A1 2014: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Both standards contain similar guidance relating to building damage criteria. Table 15 below details the transient vibration guide values for cosmetic damage to buildings as set out in BS5228-2:

Table 15 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	**Peak Component Particle Velocity in Frequency Range of Predominant Pulse**	
	4 – 15 Hz	15 Hz and above
Reinforced or Framed Structures Industrial and Heavy Commercial Buildings	50mm/sec at 4 Hz and above	50mm/sec at 4 Hz and above
Unreinforced or Light-weight Structures Residential or Light Commercial Buildings	15mm/sec at 4Hz increasing to 20mm/sec at 20Hz	20mm/sec at 15Hz increasing to 50mm/sec at 40Hz

The above values are for transient or intermittent vibrations which do not cause a resonant response in buildings. The criteria should be reduced by 50% for more sustained or continuous vibration which may occur during activities such as continuous piling methods. The values should also be reduced by 50% for listed buildings although they may not necessarily be more vulnerable than new builds.

The following limits therefore apply for continuous vibrations:

- Light Buildings – 7.5mm/sec
- Heavy Buildings – 25mm/sec

BS7385-2 indicates that the probability of damage tends towards zero at a component PPV of 12.5 mm/sec.

BS5228-2 also provides the following range of vibration values and associated potential effects on humans:

Table 16 Vibration Criteria – Human Beings

Vibration Level mm/sec PPV	Effect
0.14	Vibration might just be perceptible in the most sensitive in the most sensitive situations for most vibration frequencies.
0.3	Vibration might just be perceptible in residential environments.
1	A vibration level of this magnitude is likely to cause complaint.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

As can be seen from Table 16 above, the limits for humans are much lower than for cosmetic damage to buildings.

8.1.3 Prediction of Site Development and Construction Phase Impacts & Effects - Noise

A variety of potentially noisy equipment will be used during the earthworks and construction phases of development.

Prediction of likely noise impact has been completed using data from BS5228:1. However, with regards to prediction of demolition, site development and construction noise at NSRs the following factors are relevant:

- The sound power ratings used for each piece of equipment in the assessment, as taken from BS5228, may vary from the actual equipment used on site (Annex C of the Code of Practice outlines various noise levels for each type of equipment);
- It is not possible to outline for definite the type of equipment which will be in use, or the duration of time each piece of equipment will be in use; and,
- Noise emissions from construction vary in intensity and character but also in location and over time.

Typical sources that may be in operation during excavation works and installation of foundations include:

- Tracked excavators to dig out and load material, and,
- Lorries to transport material off-site.

Sources potentially in operation during the superstructure construction include:

- Pumping of pre-mixed concrete;

- Lifting crane to move and place pre-cast floors and/or steel beams;
- A variety of handheld tools including saws for cutting concrete, drills and welding;
- Generators for power supply.

Some of the above will be more easily screened as construction works progress compared to the initial stages of site development.

Finlay Park to the west is the nearest NSR at approximately 28.5m from the nearest residential façade to the site boundary.

Table 17 below provides source data from BS5228-1 used in the assessment of impact during the site development works which is likely to generate the most noise and therefore represents a worst-case scenario. It is assumed that site development works will be completed in one Phase at the start of the project.

Table 17 Source Data Used for Prediction of Construction Noise

Source	Frequency (Hz)								SPL@ 10m
	63	125	250	500	1k	2k	4k	8k	
	dB(A)								
Tracked Excavator	59	62	68	74	73	72	69	62	79
Wheeled Loader	60	66	68	71	70	67	63	54	76

Not all sources will be in operation at a given time or location. Based on the site size, a conservative estimate of noise arising from 3 sets of tracked excavators/wheeled loaders in operation at 50, 100 and 150m from Finlay Park has been estimated assuming the equipment is on for 66% of the time during a 1-hour period. Screening to the groundfloor of Finlay Park has been assumed only for equipment operating at 50m. The existing ambient noise has been taken into account at 47 dB(A). The estimated $L_{Aeq,1h}$ is 62 dB and indicates that the site development and construction works will be below the threshold value ($L_{Aeq,1h}$ 65 dB). Based on the guidance presented earlier in Table 13, the magnitude of impact is deemed to be minor and therefore not significant. Notwithstanding, this, mitigation measures will be applied to ensure that site development and construction noise is minimised as much as possible as detailed later in Section 10.1 of this report.

It is envisaged that construction traffic will access the site off the Old Caragh Road, directly adjacent to the site.

Based on an SEL value of 85 dB(A) for a HGV pass-by and 2-3 events per hour, the predicted noise level at NMP 8 (Finlay Park) is $L_{Aeq,1hr}$ is 49 dB (including existing baseline). The existing baseline is 47 dB(A). Accordingly, this element of noise impact magnitude is predicted to be minor.

The potential for cumulative temporary/short-term adverse noise impact associated with the site development and construction phases of the proposed development and other developments has been considered. Other

major developments granted permission are located >600m to the southwest from the proposed development site. Westar Investments Ltd are currently building 4 dwellings on a 0.35ha site adjacent to the existing development, Finlay Park. The planning file reference number is 22/160. It is expected that this development will be complete before commencement on the proposed development. Overall, as the development site is off a cul-de-sac, and the immediate adjacent land is in the ownership of the developer, no cumulative temporary/short-term adverse noise impacts with other developments are considered likely.

8.1.4 Prediction of Site Development and Construction Phase Impacts & Effects - Vibration

VSC ground improvement techniques are proposed for the development foundations.

VSCs are an alternative to piling and deep foundation solutions. They densify or strengthen weak or poorly compacted soils in-situ.

A vibrating poker known as a 'vibroflot' is fitted to a purpose-built vibropiling rig and is used to penetrate the ground. Penetration is achieved using the vibroflot's own mass, the 'pull-down' facility of the rig (when used) and pressurised air flushes. Either top feed or bottom feed methods are used.

When top-feed is used, once design depth is reached, the vibroflot is removed and stone is placed in the void. The vibroflot is then re-inserted to compact the stones into the soil.

When bottom feed is used the stone is fed during the penetration of the ground.

This technique is less likely to give rise to unacceptable vibration levels compared to more classic methods of piling.

Table D.4. of BS5228-2:2009 Part 2 contains historic vibration measurements for vibroflotation/vibroreplacement techniques for strengthening soils. The data was collated in the 1970s and 1980s for different soil types. It may be outdated as technology has improved but vibration levels recorded in made ground and sand/gravel type soils are summarised below:

Table 18 Historical Vibration Levels

Material	PPV ($mmsec^{-1}$)	Distance (m)
Unspecified fill	5.1	3.5
Silty sand fill over chalk or sand and gravel	5.0	6
	1.2	15
Miscellaneous fill over weak cohesive soil over gravel	7.6	1.9
	2.4	4
	1.1	10.5

Vibration levels reduce significantly to 1 - 2 mmsec^{-1} at 10m. The data may vary based on local soil conditions however it is likely to be similar to historic data in BS5228.

Other sources may potentially produce transient vibrations although these are not likely to be significant.

The nearest vibration sensitive receptors are in Finlay Park, >10m from the proposed works and therefore adverse vibration impacts are not likely to occur. Nevertheless, precautionary measures in terms of monitoring are proposed in Section 10.1. of this report.

8.2 Operational Phase

8.2.1 Traffic Noise Generation

The potential long-term effect of additional traffic related noise impact on existing NSRs has been considered. As a general rule of thumb, a doubling of traffic flow will likely result in a 3 decibel increase in traffic noise levels.

In order to assist with the interpretation of the noise impact associated with vehicular traffic on public roads, Tables 19 and 20 below, from the UK LA111 document, offer guidance as to the likely noise impact magnitude of short-term medium term and long-term change due to operational traffic. Short term medium term is defined as noise change between the Do Minimum Opening Year (DMOY)and the Do Something Opening Year (DSOY). The opening year is envisaged as 2025 with no Millbridge Street Link in place (linking the Old Caragh Road to the Millbridge area of Naas to the north via a crossing of the Grand Canal).

The magnitude of long-term change as set out in Table 20 is determined on the basis of change between the Do Minimum Opening Year (DMOY) and the Do Something Future Year (DSFY). Future year traffic modelling is available up to 2030 with the envisaged Millbridge link in place. However, it is not considered appropriate to compare the DMOY 2025 to the DSFY 2030 as the link, if built, will increase daily traffic on the Old Caragh Road in 2030 which is not related to the proposed development.

Table 19 Magnitude of Change Short to Medium term Traffic

Noise Change (dB $L_{A10.18hr}$ or L_{night})	**Magnitude**	**Corresponding Effect**
Greater than or equal to 5.0	Major	Significant
3.0-4.9	Moderate	Significant
1.0-2.9	Minor	Not significant
Less than 1	Negligible	Not significant

Table 20 Magnitude of Change Long-term Traffic

Noise Change (dB $L_{A10.18hr}$ or L_{night})	Magnitude	Corresponding Effect
Greater than or equal to 10.0	Major	Significant
5.0 – 9.9	Moderate	Significant
3.0-4.9	Minor	Not significant
Less than 3	Negligible	Not significant

In completing the assessment of operational noise impact, L_{den} will be used In lieu of $L_{A10,18hr}$ as this is a preferred parameter used in Ireland.

Summarised traffic flows used for the assessment are presented below in Table 21.

Table 21 Summary Estimated Short -term Traffic Flows (Old Caragh Road)

	DMOY 2025 no link			DSOY 2025 no link		
	D	E	N	D	E	N
Car	3112	670	248	3916	770	285
LGV	256	41	32	256	41	32
HGV	15	1	1	15	1	1
Total	3383	712	280	4187	812	317

D=day, E=Evening and N=Night
Note: DSOY based on 148 as opposed to 134 units as indicated in final design. Therefore conservative.

The above flows have been combined with the following single event sound exposure levels (SELs) presented in Table 22 to predict free-field road traffic noise at 5m from the Old Caragh roadside. The values below are considered to be conservative and have been derived from numerous noise studies completed by Redkite Environmental and have regard to noise data used in the Common Noise Assessment Methods (CNOSSOS – EU).

Table 22 SELs @ 5m Used to Predict Future Road Traffic Noise

SEL (dB(A))	Car	LGV	HGV
	72	75	85

The predicted L_{den} and L_{night} for each scenario is presented below:

Table 23 Predicted L_{den} and L_{night} Values @5m from Old Caragh Road

Scenario	L_{den}	L_{night}
DMOY 2025 no link	62	53
DSOY 2025 no link	63	53

Based on the differences above, the expected impact of the proposed development traffic in the short term is considered to be minor to neutral and therefore not significant.

8.2.2 Plant Equipment & Refuse Handling

The main plant and refuse stores will be located at the car-park podium and will be enclosed within proposed buildings and therefore screened from existing NSRs. Accordingly, no potential adverse impacts are expected on existing (of future) NSRs.

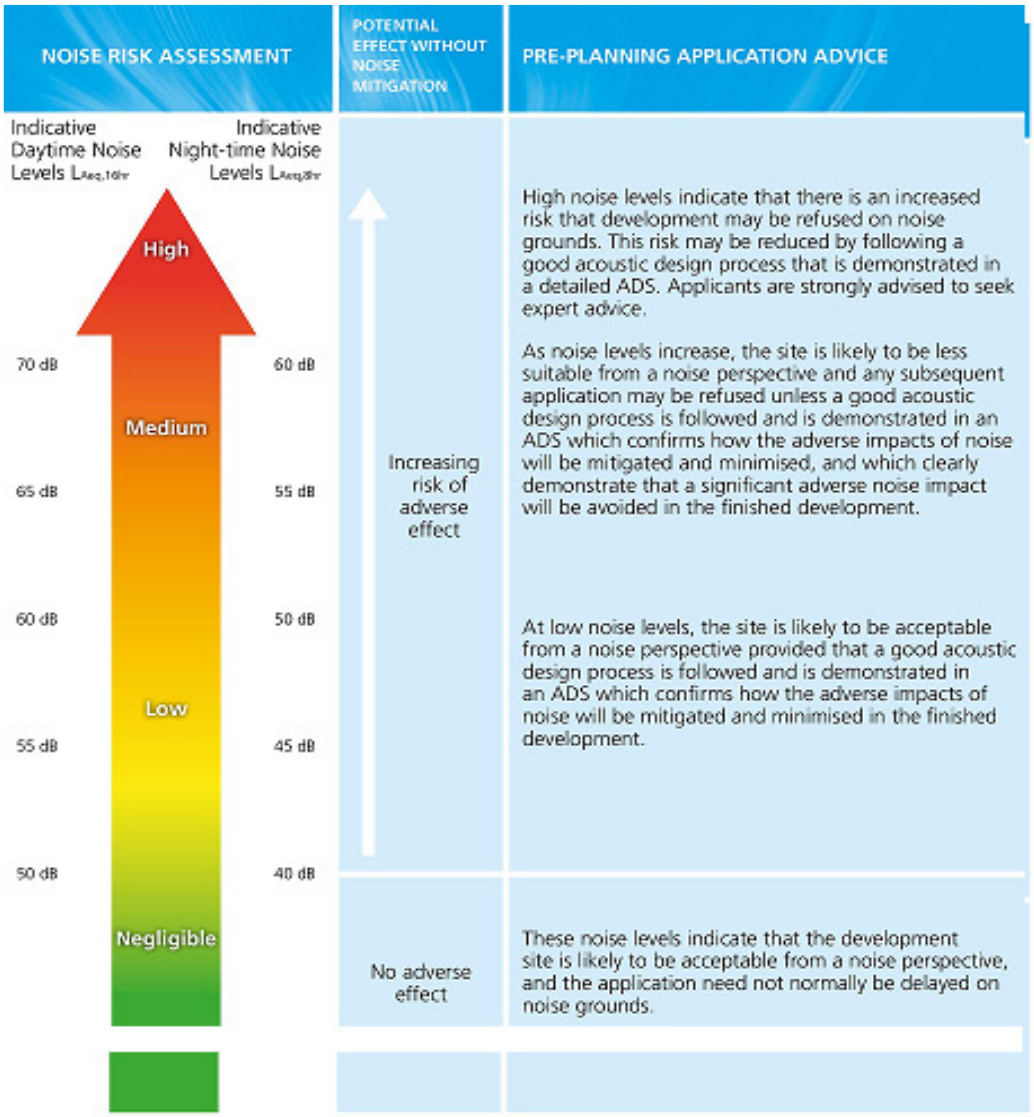
9.0 Inward Noise Risk Assessment – Future Residents

Noise can have a significant effect on the health and well-being of individuals and communities. Therefore, noise is a material consideration in the planning process and a key aspect of sustainable development. This is recognised in the NAP as discussed earlier in Section 6.0. The Plan makes reference to the UK ProPG: Planning & Noise, New Residential Development, May 2017[2] which is a guidance document now widely used to provide a methodology to assess the potential for noise exposure risk future residents. This document outlines a systematic risk based 2 stage approach for evaluating noise exposure on prospective sites for residential development.

Stage 1 comprises an initial noise risk assessment of sites proposed for residential development considering either measured and/or predicted noise levels. A site is then characterised as negligible to high risk in terms of exposure to noise of future residents. A full stage 2 assessment including implementing a good acoustic design process is triggered depending on the existing ambient noise/predicted future transportation noise environment and findings of the Stage 1 Noise Risk Assessment. Figure 5, as shown overleaf, is taken from the Guidance and illustrates the potential noise exposure risk relative to indicative daytime ($L_{Aeq,16hr}$) and night-time ($L_{Aeq,8hr}$) noise levels.

[2] This document was prepared by a working group comprising members of the UK Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since its adoption, it has been generally considered as a best practice guidance for assessing inward noise risk for new residential development.

Figure 5 Stage 1 Risk Assessment



Source: UK ProPG: Planning & Noise, New Residential Development, May 2017

ProPG requires that the site be assessed for noise exposure risk without any potential screening from existing buildings or structures (within the site) that do not form part of the proposed development. There are no buildings currently on the site. Additionally, the risk assessment should have regard to any reasonably foreseeable changes in existing and/or new sources of noise.

Based on the monitoring completed, (refer to Table 8 earlier), the site currently falls within the negligible noise exposure risk range for transportation noise

(excluding the effects of the dawn chorus which were included in the L_{night} figures).

However, the public road adjacent to the western site boundary may be developed as a future transport link within the next 15 – 20 years. Therefore, future traffic flows and resulting traffic noise levels for this road have been examined in order to future-proof the development.

24-hour traffic flows for the link road have been provided by Systra for 2030 broken down into hourly flows of passenger cars, light goods vehicles and heavy goods vehicles. The envisaged flows are considered to be a conservative estimate and are summarised as follows:

Table 24 Summary Predicted Traffic Flows DSFY 2030

Period	**Cars**	**LGV**	**HGV**
07.00 - 23.00	7494	512	28
23.00 – 07.00	491	55	2
Total	**7985**	**567**	**30**
Overall Total for 24-hour period	**8581**		

Note: DSFY based on 148 as opposed to 134 units in final design. Therefore conservative.

The above flows have been combined with the single event sound exposure levels (SELs) presented earlier in Table 22 to predict free-field road traffic noise at 5m from the roadside.

The conservative predicted free-field values at 5m from the roadside are:

$L_{Aeq,16hr}$ 64dB
L_{night} 55dB
L_{den} 65dB

Both the L_{den} and L_{night} are under the limits for significant noise exposure risk specified in the Noise Action Plan.

Under this scenario, the site close to the road boundary falls under a medium noise exposure risk rating dropping to medium/low and low >20m to negligible>100m from the roadside. This rating does not take account of any screening or low noise surfaces that may be used in the future. The impact of increase in electric vehicles is also unaccounted for, however the % would need to be substantial to reduce noise.

The figures in Tables 22 and 24 have been used to predict a conservative estimate of road traffic noise levels at the closest façade of Block A @ 7.23m from the roadside under non-freefield conditions. +2.5 dB has been included for façade reflections and +1 dB for increasing height.

Under this scenario, the predicted values for $L_{Aeq,16hr}$ and L_{night} at Block A façade 7.23m from the roadside are 66 and 57 dB.

9.1 Internal Noise

Appropriate guidance in relation to noise intrusion in residential and other buildings is contained within BS8233:2014 – *Guidance on Sound Insulation and Noise Reduction for Buildings.* This British standard sets out recommended noise limits for indoor ambient noise levels and takes account of guidelines issued by bodies such as the WHO. Details taken from the standard are presented in Table 25 below.

Table 25 Recommended Indoor Ambient Noise Levels

Criteria	**Typical Situation**	**Design Range $L_{Aeq,T}$**	
		07.00-23.00	**23.00 -07.00**
Resting	Living Room	35 $L_{Aeq,16hr}$	-
Dining	Dining Room	40 $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 $L_{Aeq,16hr}$	30 $L_{Aeq,8hr}$ 45 $L_{Amax,f}$*

Source: BS8233:2014 and Pro-PG

Column 4 in the table above includes for an additional $L_{Amax,f}$ value as per Pro-PG guidelines. The following is noted in this regard:

Note 4:

> *"Regular individual noise events (for example scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,f}$ depending on the character or number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night time (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,f}$ more than 10 times a night.*

Pro-PG also notes the following with regards to achieving internal target levels:

Note 5:

> *Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible, demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the open position, and, in this scenario, the internal LAeq target values subject to the further advice in Note 7.*

Note 7:

> *Where development is considered necessary or desirable, despite external noise levels above WHO Guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.*

Taking account of a 10 -15 decibel reduction of external noise levels to internal across a partially open window, the following external noise levels apply:

Table 26 External Noise Levels to Achieve Internal Criteria with Partially Open Windows

Internal Condition	$L_{Aeq,16hr}$ (dB)	$L_{Aeq,8hr}$ (dB)
Good	50 - 55	45
Reasonable	55 - 60	50

Based on the monitoring undertaken, mapping available the proposed layout, and existing transportation noise risk across the site the following is expected:

- Good internal criteria will be achieved with open or partially open windows throughout the proposed development.

However, the operation of the new road has been considered to ensure that the development is reasonably future-proofed for sound insulation.

Therefore, this section outlines the building envelope requirements based on the following sound data which has been used for external noise break-in at the nearest façade at Block A:

Table 27 Traffic Noise Spectra

Measurement No.	31.5	63	125	250	500	1000	2000	4000	8000	Total
	Hz dB(A)									
$L_{Aeq16hr}$	36	46	48	42	53	64	58	50	38	66
L_{night}	28	38	40	34	45	55	50	42	30	57

Window, wall, glazing, roof and ventilation specifications have been determined to achieve the good internal noise level criteria as set out in Table 25. The specification has been determined in accordance with EN ISO 12354-3: 2017 based on the predicted façade day and night noise levels, the room and facade dimensions from the drawings provided.

9.1.1 Glazed Elements and Ventilation

The glazed elements and ventilation openings are typically the acoustically weakest elements of any façade. The required sound insulation performance

of façade glazed elements and ventilation openings is outlined in Table 28 below.

It is required that the glazing, frame and seals as a whole achieve the performance when the window is in the closed position. The performance requirements outlined in Table 28 below are considered to provide adequate sound insulation to achieve the relevant day and night internal design goals respectively.

Table 28 Sound Insulation performance requirements for glazed elements and ventilation

Façade	Glazed Elements (Frame & Glazing) Sound Insulation Requirements (Indicative requirements equal or approved)							Façade Ventilation Requirement
	Octave Band Frequency Requirements[1]						Glazing Acoustic Performance R_W	
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
Western & Northern Façade of Block A only	24	19	32	40	35	49	31	Mechanical Ventilation[2]
Remaining Blocks/ Facades	Standard Double Glazing[1]							Mechanical Ventilation[2]

1) Standard double glazing assumes a construction of two panes of 3mm glass with a 10mm cavity achieving a minimum 29dB R_W, equal or approved.
2) Assumes fully sealed system with no passive openings or trickle vents.

It is important to note that the requirements outlined above are minimum requirements for the glazed element as a whole. The octave band values are indicative and specific to the assessed glazing type, equal or approved to meet the minimum project requirements is acceptable.

The ventilation strategy proposed is a fully mechanical ventilation system. Based on the information provided on the ventilation system, it has been assumed that this system is a fully sealed with no passive openings or trickle vents. Should the ventilation strategy change to natural ventilation strategy an acoustic consultant should be engaged to provide an appropriate natural ventilation sound insulation performance requirement for any passive ventilation openings including trickle vents. Typically, the use of a natural ventilation strategy will lead to an enhanced glazing specification compared to a sealed mechanical ventilation system. This assessment is based on the windows in closed position.

It should be noted that the above façade specification for glazing and ventilation units is intended for the purpose of habitable spaces and is not a requirement for WCs and communal space corridors.

It is recommended that the window supplier provide laboratory tests confirming the airborne sound insulation performance in the absence of suitable laboratory data a composite sound reduction index calculation undertaken

by a suitably qualified acoustic consultant can be used to demonstrate compliance.

9.1.2 External Wall Construction

The façade wall construction has been assumed to achieve a sound insulation performance of 55dB R_W. Typical façade construction such as concrete, blockwork, timber frame and brick offer high levels of sound insulation and will meet this requirement.

9.1.3 Roof Construction

The roof construction has been assumed to achieve a sound insulation performance of 50dB R_W. Any skylights and glazing in the roof system inside habitable spaces should be of standard double-glazed construction to meet a minimum of 29 dB R_w.

9.2 External Amenity Areas

BS8233:2014 states that "*the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 -55 dB* $L_{Aeq,16hr.}$"

ProPG goes further to extend the advice contained within BS8233:2014 to include:

"*Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process.*"

Based on the ambient monitoring undertaken, all proposed private and public amenity space will comply with the ideal range *50 -55 dB* $L_{Aeq,16hr.}$

In the future, should the transport link be built out in 15 -20 years, the balconies proposed on Block A and Block B directly facing the road will not meet the above criterium.

However, other external amenity space, screened or set-back from traffic will be provided within the proposed development thus demonstrating good acoustic design as follows:

- The units in Block A with rooms facing the road are dual aspect. The facades facing east will be screened from traffic noise.
- Access will be provided to the canal and to screened public spaces within the development.
- Part of the canal greenway will be developed.
- The provision of planted areas and water features in urban settings can *qualitatively* improve the soundscape for local residents and enjoyment

of the proposed amenity areas. Natural features as provided in the design have been shown to improve perceived tranquillity.[3]

10.0 Mitigation Measures and/or Factors

10.1 Site Development & Construction Phases

The use of preformed built elements is a significant mitigating factor to reduce the duration of the construction phase and in turn the duration of the construction-related noise impacts.

The following noise and vibration management measures shall apply to the short-term site development and construction phases to ensure that the construction noise and vibration threshold values outlined in Sections 8.1.1 and 8.1.2 are not exceeded.

- A Site Representative shall be appointed for matters related to noise and vibration.
- Any complaints received shall be thoroughly investigated.
- A written complaints log shall be maintained by the Site Representative. This shall, at a minimum, record complainant's details (where agreed) the date and time of the complaint, details of the complaint including where the effect was observed, corrective and preventative actions taken and any close-out communications. This will ensure that the concerns of NSRs who may be affected by site activities are considered during the management of activities at the site.
- Noise monitoring with capability for real-time review both on-site and remotely shall be conducted at the nearest NSR.
- In the event of meeting or exceedance of the threshold value at the NSR and depending on duration (measured or expected) works shall be ceased and measures implemented immediately to ensure that the threshold values are complied with including movement of equipment and temporary acoustic screening used directly to surround particularly noisy equipment when in use.
- Standard hoarding shall be placed around the site at the west boundary as is currently in place.
- Equipment shall be chosen by the contractor to ensure that the threshold values are met.
- The operation of certain pieces of equipment, where substitution etc cannot be carried out shall be managed through monitoring and timing of use to ensure that the threshold values/criteria specified are complied with.
- During the construction phase all equipment shall be required to comply with noise limits set out in EC Directive 2000/14/EC and the 2005/88/EC amendment on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. The directive covers equipment such as compressors, welding generators, excavators, dozers, loaders and dump trucks.

[3] Tranquillity and Soundscapes in Urban Green Spaces, Predicted and Actual Assessments from a Questionnaire Survey, Environment and Planning B: Planning and Design, 2013, Vol 40.

Vibration monitoring will be completed as a precautionary measure, where deemed necessary. In this regard, test monitoring should be conducted with the equipment on at low levels before increasing incrementally to operational levels if deemed necessary. Works will be ceased, and mitigation measures implemented during the construction phase where monitoring detects vibration levels associated with the construction phase of the facility above the relevant guidance values set out in Section 8.1.2.

The outline CMP submitted with this application shall include the noise and vibration management measures listed above.

10.2 Operational Phase (existing NSRs)

Any plant equipment proposed for installation in the future to serve the commercial unit will be assessed in accordance with the procedures set out in BS4142:2014+A1:2019 to ensure there is no significant effect on the nearest NSRs.

At a minimum, these units must comply with the external day and night-time criteria specified in The World Health Organisation Community Guidelines for Noise, 1999:

- Night-time - L_{Aeq} 45 dB, 1 meter from the façade of a dwelling.
- Daytime – L_{Aeq} 55 dB, to protect the majority of people from being seriously annoyed during the daytime.

Tonal or impulsive noise shall be avoided.

10.3 Future Residents

The following mitigation measures apply in the long term:

- During construction, the final specifications for the building envelope shall take account of the specifications and recommendations in Section 9.1.1 of this report.
- During construction, glazing suppliers shall provide laboratory tests confirming the sound insulation performance to BSEN ISO 140 Part 3 1995 and BS EN ISO 717, 1997.

11.0 Conclusions

The site of the proposed development is located in an emerging suburban area of Naas. The existing ambient sound environment is mainly characterised by birdsong and distant traffic noise from the M7. The existing nearest NSRs are similarly located in relatively quiet areas.

11.1 Existing NSRs

Construction noise arising from the proposed development will cause a temporary to short term elevation of ambient sound levels in the vicinity of the

existing NSLs at times when works are *close to the boundary*, but this will be controlled to ensure that standard criteria or limit values for construction works are not exceeded. The criteria, by necessity, are higher than existing ambient levels as construction works are temporary to short term in nature. The mitigation measures, as part of best practice will ensure that the limits, at a minimum, are not reached or exceeded. As works move away from NSLs and/or as new buildings provide screening, it is expected that construction noise levels will reduce to well below standard limit values for the majority of the duration of the total works.

Notwithstanding the above, conservative prediction of construction noise at the nearest NSLs pre-mitigation indicates that the limit values will not be exceeded and therefore the effect will be short-term minor and not significant.

Construction traffic accessing the proposed works will have a minor short-term effect on NSRs off Caragh Road.

In the long term, operational traffic noise impact on existing NSRs is predicted to range from minor to neutral and will therefore not be significant.

11.2 Future Residents

Due to distance and screening from main routes, the existing daytime ($L_{Aeq,16hr}$) and night-time (L_{night}) noise levels are indicative of an area with negligible noise exposure risk to future residents. Based on the noise survey undertaken, the site currently does not fall within an area exposed to significant noise levels as designated in the NAP for new residential development. The external amenity criterium and internal criteria for good living and sleeping conditions with open windows will be met across the proposed development.

However, a new distributor route (Millbridge Street Link) may become operational on the western site boundary in 15 – 20 years, therefore this has been considered in future-proofing the proposed development. In this regard, it should be noted that Pro-PG states that good acoustic design should avoid "unreasonable" conditions and prevent "unacceptable" acoustic conditions as defined in the Guidance. It goes on to state that good acoustic design does not mean overdesign or gold plating of all new development but seeking to deliver the optimum acoustic outcome for a particular site. It should not mean compromising other sustainable design objectives and requirements.

The following measures are noted as part of Good Acoustic Design under this future scenario:

- The majority of habitable rooms will still achieve good internal criteria with open or partially open windows due to screening and set-back from the road.
- Block A is closest to the road. Units within this block with rooms facing the road are dual aspect thus parts of these units face inwards to quieter areas.
- Balconies are recessed where possible, thus improving usability.

- The building envelopes, especially the glazing elements, have been specified to ensure that good internal criteria are met in the future with closed windows. Mechanical ventilation will be provided.
- Proposed external amenity and links to the canal will ensure that all residents have access to a quiet or relatively quiet external amenity space as required under Pro-PG.

12.0 References

- BS5228:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 1: Noise and Part 2: Vibration.
- BS4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound.
- BS 7385: 1993: Evaluation and Measurement for Vibration in Buildings Part 2: Guide to Damage Levels from Ground-borne Vibration.
- BS6472-1:2008: Guide to Evaluation of Human Exposure to Vibration in Buildings. Vibration Sources other than Blasting.
- BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings.
- Environmental Noise Guidelines for the European Region, World Health Organisation (WHO), Oct 2018.
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Environmental Protection Agency, May 2022.
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
- Kildare County Development Plan 2017 – 2023, Kildare County Council.
- Kildare County Draft Development Plan 2023 – 2029, Kildare County Council.
- Third Noise Action Plan 2019 – 2023, Kildare County Council.
- LA111 Noise and Vibration, Standards for Highways, Highways England, Version 2, May 2020
- ProPG: Planning and Noise: Professional Practice Guidance on Planning and Noise, New Residential Development, ANC, IOA and UK CIEH, May 2017.
- Tranquillity and Soundscapes in Urban Green Spaces, Predicted and Actual Assessments from a Questionnaire Survey, Environment and Planning B: Planning and Design, 2013, Vol 40.

Attachment 1

1 Proposed Site Layout - Zone 1

1 : 500

Description:
Digital Cartographic Model (DCM)

Publisher / Source:
Ordnance Survey Ireland (OSi)

Data Source / Reference:
PRIME2

File Format:
Autodesk AutoCAD (DWG_R2013)

File Name:
v_50119998_1.dwg

Clip Extent / Area of Interest (AOI):
LLX,LLY= 687832.0,719115.0
LRX,LRY= 689356.0,719115.0
ULX,ULY= 687832.0,720311.0
URX,URY= 689356.0,720311.0

Projection / Spatial Reference:
Projection= IRENET95_Irish_Transverse_Mercator

Centre Point Coordinates:
X,Y= 688594.0,719713.0

Reference Index:
Map Series | Map Sheets
1:1,000 | 3559-07
1:1,000 | 3559-02
1:2,500 | 3558-B
1:2,500 | 3509-C
1:1,000 | 3509-22
1:1,000 | 3559-06
1:2,500 | 3508-D
1:2,500 | 3559-A

Data Extraction Date:
Date= 14-May-2020

Source Data Release:
DCLMS Release V1.128.109a

Product Version:
Version= 1.3

License / Copyright:
Ordnance Survey Ireland 'Terms of Use' apply.
Please visit 'www.osi.ie/about/terms-conditions'.

NOTES:

DESIGN INTENT DRAWING

FOR INFORMATION PURPOSES

LEGEND:

SITE OUTLINED IN RED
SITE AREA =28,825.07 m² / 2.9 H.A

LAND OWNERSHIP EXTENDS BEYOND RAWING. FUTURE DEVELOPMENT

APARTMENT BLOCKS

SCHEDULE OF ACCOMMODATION

1BED	2BED	3BED	TOTAL
22	77	35	134
16%	57%	26%	100%

Rev	Date	Description	Issued By
P01	06/12/2022	Planning Issue	

Project Stage

PLANNING

Client:

Westar Homes Limited

Project:

Residential @ Finlay Park
Finlay Park, Naas, Co. Kildare

Drawing Title:

Proposed Site Layout

Drawn	Checked	Paper Size	Scale	Date
VM	BB	A1	As indicated @A1	06/12/2022

Project No.	Drawing No.	Classification	Revision
PE17019	0111		P01

File Name
PE17019-CWO-01-ZZ-DR-A-0111

Status:
S2-Suitable for information

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Please consider the environment before printing this sheet

Attachment 2

Manufacturer Calibration Certificate

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3. All tests are traceable in accordance with ISO/IEC 17025.

No pattern approval is available for this sound level meter configuration.

Sound Level Meter

Manufacturer	NTi Audio		
Type	XL2	S/N	A2A-16311-E0
Firmware	V4.20		
Reference Level Range	mid		
Microphone Model	M2230		
Preamplifier	MA220	S/N	8567
Microphone Capsule	MC230A	S/N	A17383
Performance class	Class 1		
Customer Inventory Nr.			

Customer

Date 31 July 2019

Certificate FL-19-193

Results **PASSED**
(for detailed report see next pages)

Operator

Markus Frick

NTi Audio AG • Im alten Riet 102, 9494 Schaan • Liechtenstein
info@nti-audio.com • www.nti-audio.com

NTi AUDIO

Measurement equipment

Test System

Model	NTi Audio FX100, S/No. 11094
Last Calibration	16 July 2019
Cal Certificate	NTI Cal #3393
Next Calibration	15 July 2020

Reference Microphone

Model	MTG MV203 S/N #630, Mic Capsule, MK221 S/N #16502
Last Calibration	08 December 2017
Cal Certificate	METAS #259-16159
Next Calibration	08 December 2019

Sound Calibrator

Model	Norsonic 1251 S/N #30930
Reference Level	114 dB
Calibration Frequency	1000 Hz
Last Calibration	06 December 2018
Cal Certificate	METAS #259-17305
Next Calibration	05 December 2020

Environmental conditions

Temperature	24.7 °C
Humidity	39 %
Pressure	968 hPa

Notes

- This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the international Systems of Units (SI).
- The user is obliged to have the object recalibrated at appropriate intervals.
- This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.
- All limits listed in this report are acceptance limits in accordance with IEC61672.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the regulations of the GUM.

NTi AUDIO

1. Indication at the calibration check frequency

The indication of the sound level meter at the calibration check frequency is checked by application of the sound calibrator and adjusted, if necessary, to indicate the required sound level for the environmental conditions under which the tests are performed. All levels in [dB].

Sensitivity before calibration	Sensitivity after calibration	Meas level	Limit -	Limit +	Uncert.	Status
41.8 mV/Pa	42.2 mV/Pa	114	113	115	0.2	Passed

2. Self-generated noise

2.1 Microphone cartridge installed

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level with frequency-weighting A and an averaging time of 30 seconds. All levels in [dB].

Weighting	Meas level	Limit +	Uncert.	Status
A	16.8	18.0	0.1	Passed

2.2 Microphone cartridge replaced by the capsule replacement NTI-K65-15

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level for all frequency-weightings and an averaging time of 30 seconds. All levels in [dB] referenced to S = 42 mV/Pa.

Weighting	Meas level	Limit +	Uncert.	Status
A	10.8	13.0	0.1	Passed
C	13.6	16.0	0.1	Passed
Z	18.7	24.0	0.1	Passed

3. Acoustic signal tests of a frequency weighting

The frequency weighting is tested for frequency-weighting A, using an acoustic test facility. The sound level meter is set to a fast time-weighted sound level in the reference level range. All levels in [dB].

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
125	78.0	78.2	0.2	-1.0	1.0	0.4	Passed
250	85.3	85.6	0.3	-1.0	1.0	0.4	Passed
500	90.8	91.0	0.2	-1.0	1.0	0.4	Passed
1000	94.0	94.1	0.1	-0.7	0.7	0.4	Passed
2000	95.2	95.2	0.0	-1.0	1.0	0.4	Passed
4000	95.0	95.2	0.2	-1.0	1.0	0.4	Passed
8000	92.8	93.2	0.4	-2.5	1.5	0.4	Passed

NTi AUDIO

4. Electric signal tests of frequency weightings

Frequency weightings are determined relative to the response at 1 kHz using steady sinusoidal electrical input signals. The sound level meter is set to display F-time-weighted sound level in the reference level range. All available frequency weightings provided in the sound level meter are verified. All levels in [dB].

4.1 A-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	106.2	79.9	-0.1	-1.0	1.0	0.1	Passed
125	96.1	79.9	-0.1	-1.0	1.0	0.1	Passed
250	88.6	79.9	-0.1	-1.0	1.0	0.1	Passed
500	83.2	80.0	0.0	-1.0	1.0	0.1	Passed
2000	78.8	80.0	0.0	-1.0	1.0	0.1	Passed
4000	79.0	80.0	0.0	-1.0	1.0	0.1	Passed
8000	81.1	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	84.3	80.0	0.0	-2.5	1.5	0.1	Passed
16000	86.6	79.9	-0.1	-2.5	1.5	0.1	Passed

4.2 C-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.8	79.9	-0.1	-1.0	1.0	0.1	Passed
125	80.2	80.1	0.1	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.1	0.1	-1.0	1.0	0.1	Passed
2000	80.2	80.1	0.1	-1.0	1.0	0.1	Passed
4000	80.8	80.0	0.0	-1.0	1.0	0.1	Passed
8000	83.0	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	86.2	79.9	-0.1	-2.5	1.5	0.1	Passed
16000	88.5	79.8	-0.2	-2.5	1.5	0.1	Passed

4.3 Z-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.0	79.9	-0.1	-1.0	1.0	0.1	Passed
125	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
2000	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
4000	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
8000	80.0	80.0	0.0	-2.5	1.5	0.1	Passed
12500	80.0	80.0	0.0	-2.5	1.5	0.1	Passed
16000	80.0	80.1	0.1	-2.5	1.5	0.1	Passed

5. Frequency and time weightings at 1kHz

While injecting a constant steady signal at the reference frequency of 1 kHz the F-time-weighted sound level, S-time-weighted sound level and time-averaged sound level are verified with frequency weighting A. Additionally the F-time-weighted sound level for frequency weightings C and Z is measured. The first measurement serves as reference and differences in the reading with respect to this first one are determined. All levels in [dB].

Level	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LAS	114.0	113.8	-0.2	-0.7	0.7	0.1	Passed
LAeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed

6. Level linearity on the reference level range

The level linearity on the reference level range is determined by applying steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A and fast time-weighting. All levels in [dB].

Exp abs level	Meas. level	Abs dev	Abs Limit -	Abs Limit +	Exp rel level	Rel dev	Rel Limit -	Rel Limit +	Uncert.	Status
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
119.0	119.0	0.0	-0.8	0.8	119.0	0.0	-0.3	0.3	0.1	Passed
124.0	124.0	0.0	-0.8	0.8	124.0	0.0	-0.3	0.3	0.1	Passed
125.0	125.0	0.0	-0.8	0.8	125.0	0.0	-0.3	0.3	0.1	Passed
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
109.0	109.0	0.0	-0.8	0.8	109.0	0.0	-0.3	0.3	0.1	Passed
104.0	104.0	0.0	-0.8	0.8	104.0	0.0	-0.3	0.3	0.1	Passed
99.0	99.0	0.0	-0.8	0.8	99.0	0.0	-0.3	0.3	0.1	Passed
94.0	94.0	0.0	-0.8	0.8	94.0	0.0	-0.3	0.3	0.1	Passed
89.0	89.0	0.0	-0.8	0.8	89.0	0.0	-0.3	0.3	0.1	Passed
84.0	84.0	0.0	-0.8	0.8	84.0	0.0	-0.3	0.3	0.1	Passed
79.0	79.0	0.0	-0.8	0.8	79.0	0.0	-0.3	0.3	0.1	Passed
74.0	74.0	0.0	-0.8	0.8	74.0	0.0	-0.3	0.3	0.1	Passed
69.0	69.0	0.0	-0.8	0.8	69.0	0.0	-0.3	0.3	0.1	Passed
64.0	64.0	0.0	-0.8	0.8	64.0	0.0	-0.3	0.3	0.1	Passed
59.0	59.0	0.0	-0.8	0.8	59.0	0.0	-0.3	0.3	0.1	Passed
54.0	54.0	0.0	-0.8	0.8	54.0	0.0	-0.3	0.3	0.1	Passed
49.0	49.0	0.0	-0.8	0.8	49.0	0.0	-0.3	0.3	0.1	Passed
44.0	44.0	0.0	-0.8	0.8	44.0	0.0	-0.3	0.3	0.1	Passed
39.0	39.1	0.1	-0.8	0.8	39.0	0.1	-0.3	0.3	0.1	Passed
34.0	34.2	0.2	-0.8	0.8	34.1	0.1	-0.3	0.3	0.1	Passed
33.0	33.2	0.2	-0.8	0.8	33.2	0.0	-0.3	0.3	0.1	Passed
32.0	32.2	0.2	-0.8	0.8	32.2	0.0	-0.3	0.3	0.1	Passed
31.0	31.3	0.3	-0.8	0.8	31.2	0.1	-0.3	0.3	0.1	Passed
30.0	30.4	0.4	-0.8	0.8	30.3	0.1	-0.3	0.3	0.1	Passed

7. Level linearity including the level range control

The test is performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter set for frequency weighting A and fast time weighting. With the input signal level kept constant, the indicated signal level is recorded for all level ranges where the applied signal level is displayed. All levels in [dB].

		Low Range		Mid Range		High Range			
Starting Range	Source level	Dev	Limit +/-	Dev	Limit +/-	Dev	Limit +/-	Uncert.	Status
Low	94	0.0	0.40	0.0	0.15	0.0	0.15	0.1	Passed
Mid	114			0.0	0.30	0.0	0.55	0.1	Passed
High	134					0.0	0.30	0.1	Passed
Low	29	0.1	0.30					0.1	Passed
Mid	36			0.1	0.30			0.1	Passed
High	58					0.1	0.30	0.1	Passed

8. Toneburst response

The response of the sound level meter to short-duration signals is tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter is set for frequency weighting A. All levels in [dB].

The continuous signal level is 123 dB.

Burst signal	Burst duration [ms]	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	200	122.0	121.9	-0.1	-0.5	0.5	0.2	Passed
LAF	2	105.0	104.9	-0.1	-1.5	1.0	0.2	Passed
LAF	0.25	96.0	95.8	-0.2	-3.0	1.0	0.2	Passed
LAS	200	115.6	115.5	-0.1	-0.5	0.5	0.2	Passed
LAS	2	96.0	95.9	-0.1	-3.0	1.0	0.2	Passed
LAeq10s	200	106.0	105.9	-0.1	-0.5	0.5	0.2	Passed
LAeq10s	2	86.0	85.8	-0.2	-0.5	0.5	0.2	Passed
LAeq10s	0.25	77.0	76.8	-0.2	-0.5	0.5	0.2	Passed

9. C-weighted peak sound level

The sound level meter is tested on the least-sensitive level range with fast time weighting and C frequency weighting. The test signals are a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings. All levels in [dB].

Burst signal	Source level	Exp LCp-LCF	Meas LCp-LCF	Dev	Limit -	Limit +	Uncert.	Status
8kHz	129.0	3.4	3.1	-0.3	-2.0	2.0	0.2	Passed
500Hz +	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed
500Hz -	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed

10. Overload Indication

Overload indication is tested on the least-sensitive level range with the sound level meter set to A-weighted, time-averaged sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz are used. All levels in [dB].

Start level	OV +	OV -	Dev	Limit -	Limit +	Uncert.	Status
137.0	139.1	139.1	0.0	-1.5	1.5	0.3	Passed

NTi AUDIO

LESS NOISE . MORE SOUND

Manufacturer Calibration Certificate

The following instrument has been tested and calibrated to the manufacturer specifications.
The calibration is traceable in accordance with ISO/IEC 17025 covering all instrument functions.

- Device Type: **Class 1 Sound Calibrator CAL200**
- Serial Number: **16757**

- Certificate Issued: **23 July 2019**
- Certificate Number: **43669-16757-CAL200**
- Results: **PASSED**
  (for detailed report see next page)

Tested by: M. Frick

Signature:

Stamp:

NTi Audio AG
Im alten Riet 102
LI - 9494 Schaan
www.nti-audio.com

Calibration of:	Class 1 Sound Calibrator CAL200
Serial Number:	16757
Date:	23 July 2019

- Detailed Calibration Test Results:

	actual	actual error	max. tolerance	calibration uncertainty[1]
Measured Level @ 94 dBSPL	**93.88 dBSPL**	-0.1%	±0.2 dB	0.25 dB
Measured Level @ 114 dBSPL	**113.90 dBSPL**	-0.1%	±0.2 dB	0.25 dB
Measured Frequency	**1000 Hz**	≤0.1%	±1 %	0.1 Hz

- Test Conditions:

Temperature:	**26 °C**
Relative Humidity:	**36 %**

- Calibration Equipment Used:

- Norsonic Sound Calibrator, Type 1251, S/No. 30930
  Last Calibration: 05.12.2018, Next Calibration: 05.12.2020
  Calibrated by Metas, Switzerland

- NTi Audio FX100, S/No. 11094
  Last Calibration: 14.08.2018, Next Calibration: 14.08.2019
  Manufacturer calibration based on Agilent 34410, Serial No. MY47014254,
  Last Calibration: 14.05.2019, Next Calibration: 14.05.2020
  which is calibrated by ELCAL to national standards maintained
  at Swiss Federal Office of Metrology. SCS 0002

[1] The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the regulations of the GUM.

Certificate of Calibration

Issued to:	Certificate Number
Redkite Environmental Huntersmoon Ballykeane Road Redcross Co. Wicklow	AC190065

Test Date: 26/07/2019

Equipment Information

Item Calibrated:	Acoustic Calibrator	**Model:**	CAL200
Make:	Larson Davis	**Serial Number:**	11728

Calibration Procedure

The above calibrator was verified in line with the requirements of BS EN 60942:2003. The calibrator was allowed to stablize for a suitable period, as described in the manufacturer's instruction manual, in laboratory conditions. The sound pressure level in the cavity (half-inch). The operating frequency and signal distortion were also measured.

Calibration Standards

Description	Serial Number
National Instruments PXI-4461	19C91D2
GRAS 42AA Pistonphone	227947
GRAS 46A0 Pressure Field Microphone	228216

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

Signed on behalf of Sonitus Systems:

SONITUS SYSTEMS

Calibration Report

Equipment Information

Model: CAL200
Serial Number: 11728

Ambient Conditions

Measurement conditions were within the tolerances defined in BS EN 60942.

Barometric Pressure: 1045 hPa
Temperature: 26.0 °C
Relative Humidity: 43 %

Results

Calibrator Setting	Measured Parameter	Measured Value	Tolerance +/-	Uncertainty +/-
94 dB, 1KHz	Sound pressure level (dB)	94.26	0.40	0.14 dB
	Frequency (Hz)	1000.44	10 Hz	0.25 Hz
	Distortion (%)	0.19	3.0	0.3
94 dB, 1KHz	Sound pressure level (dB)	114.24	0.40	0.14 dB
	Frequency (Hz)	1000.42	10 Hz	0.25 Hz
	Distortion (%)	0.28	3.0	0.3

RESULT: PASS

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003

The manufacturer's guidelines concerning free-field correction should be observed.

Notes

1. All measurements were made with the half-inch configuration of the calibrator in place.
2. The measurement uncertainty is reported as a standard uncertainty multiplied by a coverage factor k=2 which, for a normal probability distribution, corresponds to a coverage probability of approximately 95%.
3. The given uncertainty corresponds to measured values only and does not relate to the long term stability of the device under test.

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

Certificate of Calibration and Conformance

CALIBRATION

0789

Certificate No.: U29202

Test object:	**Sound Level Meter, BS EN IEC 61672-1:2003 Class 1 (Precision)**
Manufacturer:	**NTi Audio**
Type:	**XL2-TA**
Serial no:	**A2A-08898-E0**
Customer:	**Redkite Environmental Ltd**
Address:	**Hunter's Moon, Ballykeane Road, Redcross, Co. Wicklow. Ireland.**
Contact Person:	**Siobhan Maher**
Order No:	**P009/01**

Method :
Calibration has been performed as set out in CA Technical Procedures TP01 & 02 as appropriate. These are based on the procedures for periodic verification set out in BS EN IEC 61672-3:2006. Results and conformance statement are overleaf and detailed results are in the attached Test Report.

	Producer:	Type:	Serial No:	Certificate number
Microphone	NTi Audio	MC230	8694	29201
Calibrator*	Larson Davis	CAL200	11728	U29200
Preamplifier	NTi Audio	MA220	5062	Included

Additional items that also have been submitted for verification

Wind shield	None
Attenuator	None
Extension cable	None

These items have been taken into account wherever appropriate.

Environmental conditions:	Pressure:	Temperature:	Relative humidity:
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.73 ± 0.01kPa	21.5 ± 0.2°C	42.3 ± 2%RH

Date received :	30/07/2018
Date of calibration:	02/08/2018
Date of issue:	02/08/2018

Engineer

M. Panivel

Palanivel Marappan B.Eng (Hons), M.Sc

Supervisor

Michael Tickner

Certificate of Calibration and Conformance

UKAS Laboratory Number 0789

Certificate No.: U29202

Conformance

From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to BS EN IEC 61672-1:2002 and similarly that the associated sound calibrator conforms to BS EN IEC 60942.

Statement of conformance

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of BS EN IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available[1], from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with BS EN IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in BS EN IEC 61672-1:2002, and that the sound level meter submitted for testing conforms to the class 1 requirements of BS EN IEC 61672-1:2003.

[1] This evidence is held on file at the calibration laboratory

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.1 #9	Passed
Self-generated noise - IEC 61672-3 Ed.1 #10	Passed
Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 #11	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 #13	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.1 #14	Passed
Level linearity including the level range control - IEC 61672-3 Ed.1 #15	Passed
Toneburst response - IEC 61672-3 Ed.1 #16	Passed
Peak C sound level - IEC 61672-3 Ed.1 #17	Passed
Overload indication - IEC 61672-3 Ed.1 #18	Passed
Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 #12	Passed

Comment

Correct level with associated calibrator is 113.9dB(A).

Observations

No information on the uncertainty of measurement, required by 11.7 of BS EN IEC 61672-3:2006 of the adjustment data given in the instruction manual or obtained from the manufacturer or supplier of the sound level meter, or the manufacturer of the microphone, or the manufacture of the electrostatic actuator was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of the adjustment data has therefore been assumed to be numerically zero for the purposes of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the sound level meter may not conform to the requirements of BS EN IEC 61672-1:2003.

No adjustment data have been published in the instruction manual or made available by the manufacturer or supplier of the sound level meter to account for the average effects of reflections from the case of the sound level meter and diffraction of sound around the microphone as required by sub-clause 11.4 and 12.6 of BS EN IEC 61672-3:2006. The average effects of reflections from the case of the sound level meter and diffraction of sound around the microphone have therefore been assumed to be numerically zero for the purposes of this periodic test. If these adjustment data are not actually zero, there is a possibility that the frequency response of the sound level meter may not meet the requirements of BS EN IEC 61672-1:2003.

The details of the uncertainty for each measurement is available from the Calibration Laboratory on request and is based on the standard uncertainty multiplied by a coverage factor K=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. Details on the sources of corrections and their associated uncertainties that relate to this verification are contained the detailed test report accompanying this certificate.

Calibration Report

Certificate No.:29201

Manufacturer:	**NTi Audio**
Type:	**MC230**
Serial no:	**8694**

Customer:	**Redkite Environmental Ltd**
Address:	**Hunter's Moon, Ballykeane Road, Redcross, Co. Wicklow. Ireland.**
Order No:	**P009/01**
Contact Person:	**Siobhan Maher**

Measurement Results:

	Sensitivity: (dB re 1V/Pa)	Capacitance: (pF)
1:	-26.51	17.8
2:	-26.51	17.7
3:	-26.52	17.7
Result (Average):	**-26.51**	**17.7**
Expanded Uncertainty:	0.10	2.00
Degree of Freedom:	>100	>100
Coverage Factor:	2.00	2.00

The following correction factors have been applied during the measurement:
Pressure:-0.005 dB/kPa Temperature:-0.010 dB/°C Relative humidity:0.000 dB/%RH

Reference Calibrator: WSC2 - GRAS42AA-18277 Volume correction: 0.000 dB
Records:K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\2018\MC230_8694_M1.nmf
Measurement procedure: TP05
All results quoted are directly traceable to National Physical Laboratory, London

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Comment:

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
101.720 ± 0.041 kPa	21.1 ± 0.1 °C	47.1 ± 0.9 %RH

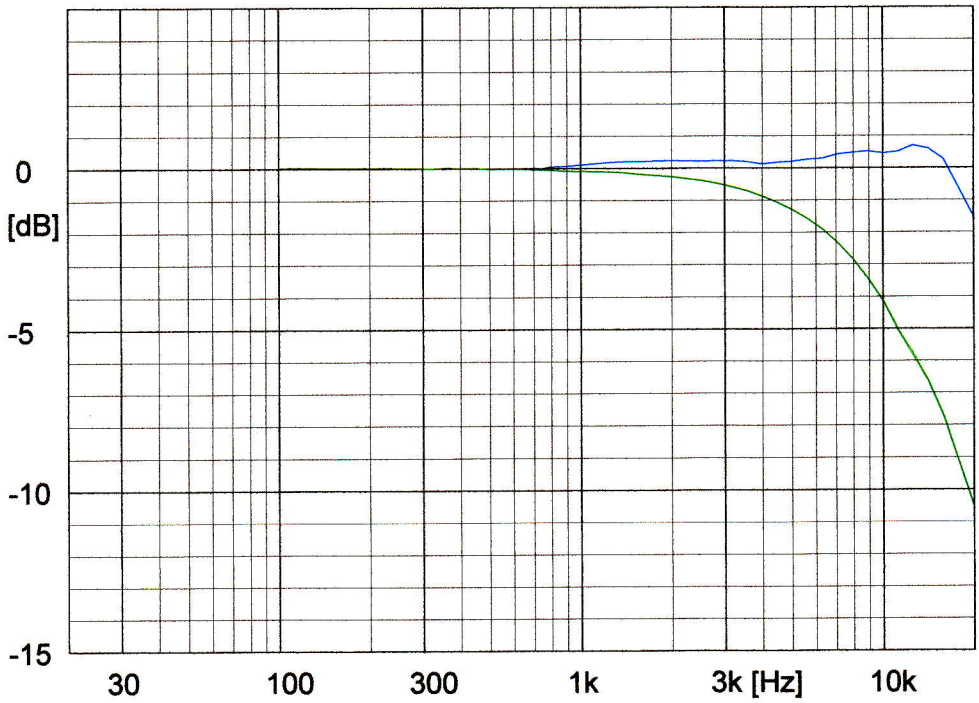
Date of calibration: 02/08/2018
Date of issue: 02/08/2018

Supervisor : Darren Batten TechIOA
Engineer :

Campbell Associates
www.campbell-associates.co.uk

Palanivel Marappan B.Eng (Hons), M.Sc
Software version: 6.0h

Microphone Calibration Certificate



NTi Audio
Type: MC230

Serial no: 8694

Sensitivity: 47.24 mV/Pa
-26.51 ±0.10 dB re. 1 V/Pa
Capacitance: 17.7 ±2.0 pF
Date: 02/08/2018

Signature: M-Hanivel

Measurement conditions:

Polarisation voltage:	0.0 V
Pressure:	101.72 ±0.04 kPa
Temperature:	21.1 ±0.1 °C
Relative humidity:	47.1 ±0.9 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

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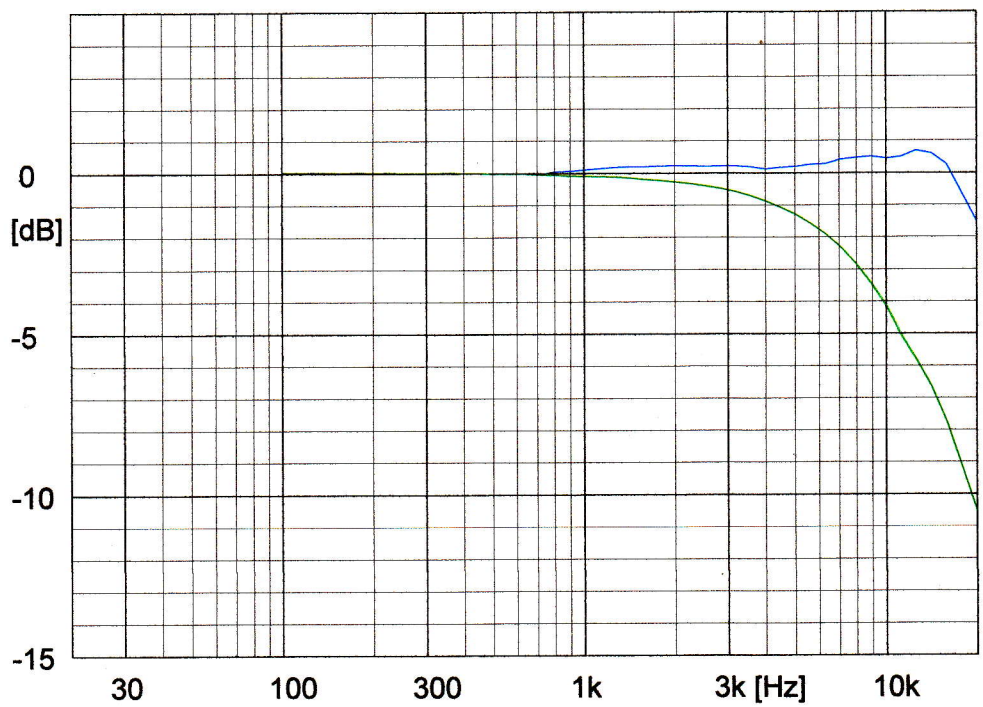
Microphone Calibration Certificate



NTi Audio
Type: MC230

Serial no: 8694

Sensitivity: 47.24 mV/Pa
-26.51 ±0.10 dB re. 1 V/Pa
Capacitance: 17.7 ±2.0 pF
Date: 02/08/2018

Signature: M-Hanivel

Measurement conditions:

Polarisation voltage:	0.0 V
Pressure:	101.72 ±0.04 kPa
Temperature:	21.1 ±0.1 °C
Relative humidity:	47.1 ±0.9 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

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Comment:

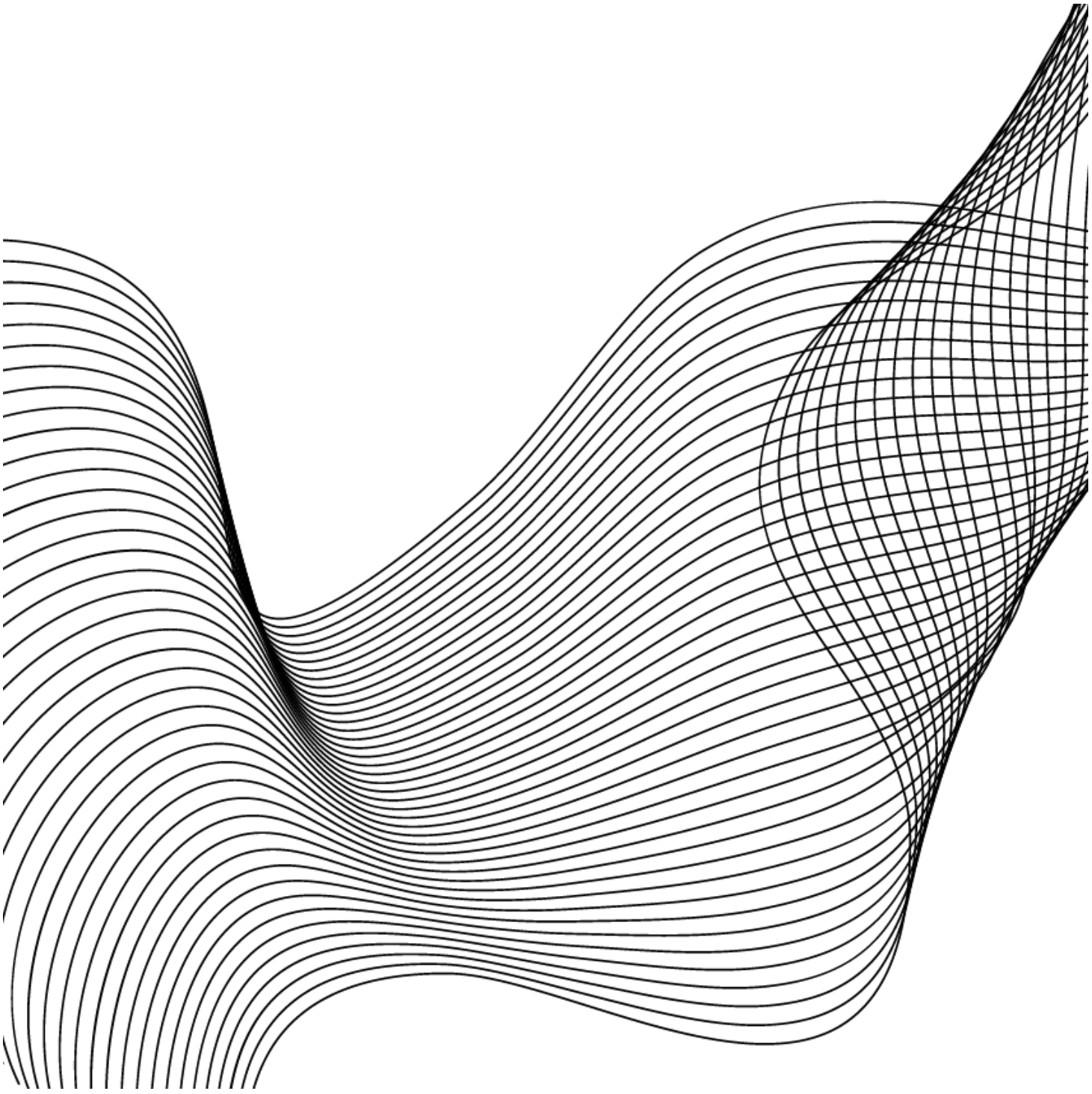
Attachment 3

Enfonic

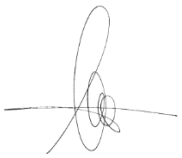
Redkite Environmental

Noise Survey – LRD Naas

Issued



Client:	Site:	Project No:
Redkite Environmental	LRD Naas	3993

	Prepared by:	Checked by:	Approved by:
Name:	Patricia Redondo	David Courtney	Gary Duffy
Position:	Consultant	Consultant	Principle Consultant
Signature:			

Document History:

Revision:	Date:	Description:
1	23.09.2022	Issued

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Contents

1.0 Introduction

Enfonic conducted a noise survey near Nass for a Large Residential Development (LRD) which consisted of the following:

- 1no. Unattended Noise Monitoring Terminals (NMTs)
- 4no. Attended measurement locations

The survey period was between 12/09/2022 to 15/09/2022.

2.0 Measurements Locations

The monitoring locations are presented in Figure 1 and their grid references given in Table 1

Figure 1. Noise Monitoring Locations

Table 1. Location for the Noise Monitoring.

Location	Easting	Northing
ANMT1	288706	219574
ANMT2	288996	219673
ANMT3	288601	219657
ANMT4	288340	219498
UNMT	288707	219734

4. Equipment and Personnel

Measurements were made using Brüel and Kjær Type 2250 and 2270 Sound Level Meters and audio recording was turn on to identify possible noise sources during night-period.

Before the survey instruments were calibrated and checked afterwards for any deviation in sensitivity – none was found. Details of the instrumentation used are given in Table 2 below.

Table 2. Monitoring Equipment

Equipment	Model	Serial Number
Sound Level Meter	Brüel & Kjær 2250	3007000
Sound Level Meter	Brüel & Kjær 2250 Light	620701
Calibrator	Brüel & Kjær 4231	3011175

Surveying was conducted by Patricia Redondo, Acoustic Consultant and Kial Wallace, Acoustic Technician.

3.0 Noise Data

All measurements taken in suitable weather conditions with wind speeds under 5m/s and no rainfall.

The main sources for each location during the attended survey are detailed in Table 2.

Table 2. Main Noise Sources

Location	Main Noise Sources
ANMT1	Cars passing by, Aircraft noise, Rustling vegetation, Bird song, Dogs barking
ANMT2	Bird song, Rustling vegetation, Constant traffic noise, Aircraft noise
ANMT3	Cars passing by, Children playing, Bird song, Aircraft noise, Rustling vegetation
ANMT4	Constant Traffic Noise, Cars passing by, Bird Song, Dogs barking, Children playing. Car starting nearby during measurement

Attended Monitoring: The noise data and parameters are presented in Table 3.

Unattended Monitoring: The noise data and parameters are presented in Table 4.Table 3

Appendix A – Noise Data

Table 3. Attended Results

Location ID	Start Date/Time	Elapsed Time	LAeq	LAFmax	LAF90.0	LAF10.0
ANMT1	15/09/2022 15:09	00:30:00	48.9	68.7	43.3	50.1
ANMT2	15/09/2022 14:28	00:30:00	50.4	75.3	38.0	49.1
ANMT3	15/09/2022 15:46	00:30:00	46.7	71.7	39.6	48.3
ANMT4	15/09/2022 13:45	00:30:00	61.6	96.2	40.5	49.8

Table 4. Unattended Results

Start Date/Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments	L_{DEN}	L_{night}	$L_{Aeq\ 16hour}$
13/09/2022 00:00	01:00:00	41.7	51.5	43.3	39.6		51	44	47
13/09/2022 01:00	01:00:00	40.6	50.9	42.5	37.9				
13/09/2022 02:00	01:00:00	41.2	51.1	43.4	38.0				
13/09/2022 03:00	01:00:00	42.8	52.1	44.6	40.2				
13/09/2022 04:00	01:00:00	43.0	53.0	44.7	40.7				
13/09/2022 05:00	01:00:00	46.4	52.1	48.5	42.9				
13/09/2022 06:00	01:00:00	49.5	60.1	50.8	47.9	Dawn Chorus, traffic distant			
13/09/2022 07:00	01:00:00	51.2	63.9	52.6	49.5	Dawn Chorus, traffic distant			
13/09/2022 08:00	01:00:00	50.8	58.1	51.9	49.6	Dawn Chorus, traffic distant			
13/09/2022 09:00	01:00:00	49.3	61.9	51.0	46.3				
13/09/2022 10:00	01:00:00	49.7	75.3	48.6	42.4				
13/09/2022 11:00	01:00:00	45.5	68.2	45.6	41.2				
13/09/2022 12:00	01:00:00	44.7	61.8	46.2	42.1				
13/09/2022 13:00	01:00:00	44.9	67.6	45.4	40.9				
13/09/2022 14:00	01:00:00	47.7	63.3	51.5	40.1				
13/09/2022 15:00	01:00:00	43.9	69.8	43.0	39.3				
13/09/2022 16:00	01:00:00	44.1	70.7	45.0	40.3				
13/09/2022 17:00	01:00:00	43.1	58.8	44.0	41.1				
13/09/2022 18:00	01:00:00	44.3	68.4	45.4	40.2				
13/09/2022 19:00	01:00:00	44.2	63.5	45.3	41.2				
13/09/2022 20:00	01:00:00	41.7	57.7	42.7	40.0				
13/09/2022 21:00	01:00:00	41.3	77.3	41.7	38.5				
13/09/2022 22:00	01:00:00	40.7	52.6	41.8	39.2				
13/09/2022 23:00	01:00:00	39.3	46.5	41.0	37.3				
14/09/2022	01:00:00	38.5	47.2	40.1	36.7				
14/09/2022 01:00	01:00:00	39.4	54.7	41.0	37.1				
14/09/2022 02:00	01:00:00	40.9	49.3	43.0	38.3				
14/09/2022 03:00	01:00:00	39.0	49.4	40.9	36.2				
14/09/2022 04:00	01:00:00	41.8	50.5	43.8	38.3				
14/09/2022 05:00	01:00:00	44.3	52.9	46.1	42.0				
14/09/2022 06:00	01:00:00	47.3	58.5	48.5	45.8	Dawn Chorus, traffic distant			
14/09/2022 07:00	01:00:00	46.5	59.2	48.3	43.6	Dawn Chorus, traffic distant			

Start Date/Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments	L_{DEN}	L_{night}	$L_{Aeq\ 16hour}$
14/09/2022 08:00	01:00:00	46.3	63.2	47.6	42.2	Dawn Chorus, traffic distant			
14/09/2022 09:00	01:00:00	44.3	60.0	45.7	41.7				
14/09/2022 10:00	01:00:00	44.4	61.1	45.8	41.5				
14/09/2022 11:00	01:00:00	44.6	69.7	45.7	41.8				
14/09/2022 12:00	01:00:00	50.2	75.6	46.7	42.5				
14/09/2022 13:00	01:00:00	43.1	63.2	44.4	40.8				
14/09/2022 14:00	01:00:00	44.9	58.5	46.6	42.7				
14/09/2022 15:00	01:00:00	45.9	64.9	46.7	42.1				
14/09/2022 16:00	01:00:00	45.4	64.5	46.3	41.8				
14/09/2022 17:00	01:00:00	48.2	70.6	46.9	41.4				
14/09/2022 18:00	01:00:00	43.7	62.0	45.7	41.3				
14/09/2022 19:00	01:00:00	44.2	66.3	44.8	42.1				
14/09/2022 20:00	01:00:00	44.0	58.8	45.4	42.3				
14/09/2022 21:00	01:00:00	44.9	56.7	46.4	42.7				
14/09/2022 22:00	01:00:00	43.5	58.2	45.6	40.8				

Start Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments
13/09/2022 00:00	00:15:00	41.1	48.8	42.7	39.1	
13/09/2022 00:15	00:15:00	41.7	49.5	43.1	39.9	
13/09/2022 00:30	00:15:00	42.2	50.7	43.8	40.2	
13/09/2022 00:45	00:15:00	41.7	51.5	43.5	39.4	
13/09/2022 01:00	00:15:00	41.0	47.9	43.0	38.2	
13/09/2022 01:15	00:15:00	40.6	50.9	42.5	37.9	
13/09/2022 01:30	00:15:00	40.6	48.1	42.2	38.4	
13/09/2022 01:45	00:15:00	40.1	47.8	42.1	37.5	
13/09/2022 02:00	00:15:00	40.1	47.5	42.4	37.3	
13/09/2022 02:15	00:15:00	40.7	47.8	42.8	37.8	
13/09/2022 02:30	00:15:00	42.3	47.9	44.4	39.9	
13/09/2022 02:45	00:15:00	41.4	51.1	43.4	38.6	
13/09/2022 03:00	00:15:00	42.2	52.1	43.9	39.5	
13/09/2022 03:15	00:15:00	42.9	51.6	44.8	40.1	
13/09/2022 03:30	00:15:00	42.8	51.2	44.5	40.1	
13/09/2022 03:45	00:15:00	43.2	49.2	45.0	41.1	
13/09/2022 04:00	00:15:00	43.5	49.6	45.5	40.8	
13/09/2022 04:15	00:15:00	43.1	53.0	44.9	40.6	
13/09/2022 04:30	00:15:00	42.4	50.7	43.9	40.5	
13/09/2022 04:45	00:15:00	42.8	48.0	44.2	41.0	
13/09/2022 05:00	00:15:00	43.7	48.0	45.3	41.9	
13/09/2022 05:15	00:15:00	45.5	50.6	47.0	43.5	
13/09/2022 05:30	00:15:00	46.9	50.9	48.4	45.0	
13/09/2022 05:45	00:15:00	48.2	52.1	49.3	47.1	
13/09/2022 06:00	00:15:00	48.4	52.2	49.3	47.3	Dawn Chorus, traffic distant

Start Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments
13/09/2022 06:15	00:15:00	49.2	54.6	50.5	47.9	Dawn Chorus, traffic distant
13/09/2022 06:30	00:15:00	49.8	54.2	50.9	48.5	Dawn Chorus, traffic distant
13/09/2022 06:45	00:15:00	50.3	60.1	51.2	48.8	Dawn Chorus, traffic distant
13/09/2022 07:00	00:15:00	50.7	63.9	51.6	49.4	Dawn Chorus, traffic distant
13/09/2022 07:15	00:15:00	51.6	61.7	52.8	49.9	Dawn Chorus, traffic distant
13/09/2022 07:30	00:15:00	52.1	60.4	53.3	50.5	Dawn Chorus, traffic distant
13/09/2022 07:45	00:15:00	50.2	56.3	51.2	49.0	Dawn Chorus, traffic distant
13/09/2022 08:00	00:15:00	50.4	57.8	51.2	49.4	Dawn Chorus, traffic distant
13/09/2022 08:15	00:15:00	50.9	57.7	51.8	49.7	Dawn Chorus, traffic distant
13/09/2022 08:30	00:15:00	50.5	54.8	51.4	49.4	Dawn Chorus, traffic distant
13/09/2022 08:45	00:15:00	51.4	58.1	52.4	50.2	Dawn Chorus, traffic distant
13/09/2022 09:00	00:15:00	50.8	58.3	52.3	49.3	
13/09/2022 09:15	00:15:00	49.7	60.1	51.0	48.1	
13/09/2022 09:30	00:15:00	47.8	57.5	49.6	45.5	
13/09/2022 09:45	00:15:00	48.1	61.9	49.2	46.1	
13/09/2022 10:00	00:15:00	47.7	53.1	49.1	45.4	
13/09/2022 10:15	00:15:00	45.9	53.0	47.6	43.8	
13/09/2022 10:30	00:15:00	53.8	75.3	48.1	41.6	
13/09/2022 10:45	00:15:00	45.9	67.4	46.3	42.4	
13/09/2022 11:00	00:15:00	45.7	62.5	45.5	41.1	
13/09/2022 11:15	00:15:00	46.9	68.2	45.1	41.6	
13/09/2022 11:30	00:15:00	43.7	64.7	45.5	40.6	
13/09/2022 11:45	00:15:00	44.8	59.8	46.7	41.6	
13/09/2022 12:00	00:15:00	44.7	60.7	47.1	41.4	
13/09/2022 12:15	00:15:00	44.4	61.8	45.8	42.2	
13/09/2022 12:30	00:15:00	44.5	57.8	46.2	42.6	
13/09/2022 12:45	00:15:00	45.2	61.0	45.5	42.8	
13/09/2022 13:00	00:15:00	43.6	59.3	44.0	40.6	
13/09/2022 13:15	00:15:00	45.3	67.6	44.6	40.8	
13/09/2022 13:30	00:15:00	46.4	64.9	47.4	40.8	
13/09/2022 13:45	00:15:00	44.0	52.7	45.5	42.4	
13/09/2022 14:00	00:15:00	50.9	61.2	52.9	47.4	
13/09/2022 14:15	00:15:00	48.7	63.3	52.1	41.3	
13/09/2022 14:30	00:15:00	43.1	56.7	46.2	39.3	
13/09/2022 14:45	00:15:00	42.8	57.2	45.1	40.0	
13/09/2022 15:00	00:15:00	41.2	53.2	42.2	39.1	
13/09/2022 15:15	00:15:00	44.5	65.5	43.6	39.3	
13/09/2022 15:30	00:15:00	46.0	69.8	43.0	39.4	

Start Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments
13/09/2022 15:45	00:15:00	42.3	63.9	43.2	39.4	
13/09/2022 16:00	00:15:00	43.3	63.5	44.7	39.9	
13/09/2022 16:15	00:15:00	44.5	63.2	44.6	40.1	
13/09/2022 16:30	00:15:00	44.6	70.7	44.7	40.4	
13/09/2022 16:45	00:15:00	43.9	57.1	45.6	41.1	
13/09/2022 17:00	00:15:00	43.8	58.8	44.9	41.4	
13/09/2022 17:15	00:15:00	42.8	53.4	43.8	41.3	
13/09/2022 17:30	00:15:00	42.4	49.6	43.3	41.3	
13/09/2022 17:45	00:15:00	43.2	57.8	44.2	40.8	
13/09/2022 18:00	00:15:00	43.2	54.2	44.3	41.0	
13/09/2022 18:15	00:15:00	42.4	57.4	43.6	39.9	
13/09/2022 18:30	00:15:00	45.7	67.0	47.6	39.9	
13/09/2022 18:45	00:15:00	45.1	68.4	45.9	40.7	
13/09/2022 19:00	00:15:00	44.3	60.8	46.5	41.0	
13/09/2022 19:15	00:15:00	44.5	60.4	45.4	41.6	
13/09/2022 19:30	00:15:00	44.7	63.5	45.4	41.6	
13/09/2022 19:45	00:15:00	43.0	58.0	44.3	40.9	
13/09/2022 20:00	00:15:00	42.6	57.0	43.6	40.2	
13/09/2022 20:15	00:15:00	41.1	57.7	42.0	40.0	
13/09/2022 20:30	00:15:00	41.1	47.6	42.2	39.8	
13/09/2022 20:45	00:15:00	41.6	51.1	43.1	39.9	
13/09/2022 21:00	00:15:00	43.5	77.3	42.2	39.1	
13/09/2022 21:15	00:15:00	40.0	47.2	41.4	38.6	
13/09/2022 21:30	00:15:00	39.7	51.6	40.9	37.8	
13/09/2022 21:45	00:15:00	40.9	51.7	42.2	39.0	
13/09/2022 22:00	00:15:00	41.1	49.5	42.0	39.8	
13/09/2022 22:15	00:15:00	41.1	52.6	42.5	39.2	
13/09/2022 22:30	00:15:00	40.4	50.6	41.2	38.9	
13/09/2022 22:45	00:15:00	40.3	43.5	41.4	39.1	
13/09/2022 23:00	00:15:00	39.6	43.2	41.0	37.7	
13/09/2022 23:15	00:15:00	39.8	46.5	41.9	37.6	
13/09/2022 23:30	00:15:00	39.2	43.6	40.8	37.2	
13/09/2022 23:45	00:15:00	38.6	44.1	40.1	37.0	
14/09/2022	00:15:00	38.2	43.6	39.9	36.4	
14/09/2022 00:15	00:15:00	38.6	44.3	40.3	36.5	
14/09/2022 00:30	00:15:00	38.2	43.7	39.6	36.7	
14/09/2022 00:45	00:15:00	39.0	47.2	40.4	37.4	
14/09/2022 01:00	00:15:00	38.0	43.4	39.5	36.4	
14/09/2022 01:15	00:15:00	40.4	54.7	41.9	37.6	
14/09/2022 01:30	00:15:00	39.7	46.9	41.2	37.8	
14/09/2022 01:45	00:15:00	39.3	45.1	40.9	37.3	
14/09/2022 02:00	00:15:00	40.5	47.7	42.2	38.0	
14/09/2022 02:15	00:15:00	41.9	49.3	44.2	38.3	
14/09/2022 02:30	00:15:00	40.6	48.1	42.1	38.7	
14/09/2022 02:45	00:15:00	40.7	47.5	42.6	38.3	
14/09/2022 03:00	00:15:00	39.7	49.4	41.5	37.3	

Start Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments
14/09/2022 03:15	00:15:00	39.4	46.8	41.1	37.3	
14/09/2022 03:30	00:15:00	38.9	48.6	40.8	36.2	
14/09/2022 03:45	00:15:00	38.0	49.1	40.0	35.2	
14/09/2022 04:00	00:15:00	40.1	49.2	42.8	36.3	
14/09/2022 04:15	00:15:00	41.8	49.3	43.2	39.9	
14/09/2022 04:30	00:15:00	42.0	50.5	43.7	39.8	
14/09/2022 04:45	00:15:00	42.7	48.4	44.7	39.9	
14/09/2022 05:00	00:15:00	43.7	50.9	45.3	41.8	
14/09/2022 05:15	00:15:00	43.5	52.9	45.2	41.4	
14/09/2022 05:30	00:15:00	44.2	51.2	45.5	42.7	
14/09/2022 05:45	00:15:00	45.7	50.2	46.9	44.4	
14/09/2022 06:00	00:15:00	46.5	50.9	47.8	45.0	Dawn Chorus, traffic distant
14/09/2022 06:15	00:15:00	47.7	52.8	49.0	46.4	Dawn Chorus, traffic distant
14/09/2022 06:30	00:15:00	47.4	52.9	48.5	46.1	Dawn Chorus, traffic distant
14/09/2022 06:45	00:15:00	47.5	58.5	48.4	46.3	Dawn Chorus, traffic distant
14/09/2022 07:00	00:15:00	44.3	52.8	45.6	42.7	Dawn Chorus, traffic distant
14/09/2022 07:15	00:15:00	46.7	55.4	48.4	43.8	Dawn Chorus, traffic distant
14/09/2022 07:30	00:15:00	47.8	59.2	49.0	45.9	Dawn Chorus, traffic distant
14/09/2022 07:45	00:15:00	46.4	57.2	47.9	44.4	Dawn Chorus, traffic distant
14/09/2022 08:00	00:15:00	48.9	63.2	51.5	44.4	Dawn Chorus, traffic distant
14/09/2022 08:15	00:15:00	46.1	60.9	47.4	42.0	Dawn Chorus, traffic distant
14/09/2022 08:30	00:15:00	43.8	55.9	45.2	41.8	Dawn Chorus, traffic distant
14/09/2022 08:45	00:15:00	44.7	59.2	45.8	42.5	
14/09/2022 09:00	00:15:00	44.9	53.0	45.9	43.4	
14/09/2022 09:15	00:15:00	45.3	60.0	46.5	43.1	
14/09/2022 09:30	00:15:00	43.8	59.0	45.1	42.1	
14/09/2022 09:45	00:15:00	42.8	52.7	44.0	41.0	
14/09/2022 10:00	00:15:00	44.5	59.7	47.1	41.3	
14/09/2022 10:15	00:15:00	43.1	57.1	44.0	41.4	
14/09/2022 10:30	00:15:00	44.2	61.1	44.9	41.4	
14/09/2022 10:45	00:15:00	45.3	58.1	46.8	42.4	
14/09/2022 11:00	00:15:00	44.4	58.1	46.1	42.5	
14/09/2022 11:15	00:15:00	45.5	56.5	48.1	42.3	
14/09/2022 11:30	00:15:00	43.1	54.0	44.3	41.5	
14/09/2022 11:45	00:15:00	45.1	69.7	44.7	41.7	
14/09/2022 12:00	00:15:00	47.6	65.6	47.2	42.1	
14/09/2022 12:15	00:15:00	53.2	75.6	46.6	42.5	
14/09/2022 12:30	00:15:00	50.2	70.8	46.5	42.5	

Start Time	Elapsed Time	L_{Aeq}	L_{AFmax}	L_{AF10}	L_{AF90}	Comments
14/09/2022 12:45	00:15:00	47.3	65.3	46.5	42.9	
14/09/2022 13:00	00:15:00	43.8	63.2	44.5	41.7	
14/09/2022 13:15	00:15:00	43.3	54.2	44.8	41.2	
14/09/2022 13:30	00:15:00	42.7	54.7	44.0	40.8	
14/09/2022 13:45	00:15:00	42.3	57.2	43.8	40.2	
14/09/2022 14:00	00:15:00	43.6	51.4	44.7	42.3	
14/09/2022 14:15	00:15:00	44.9	58.5	46.3	43.1	
14/09/2022 14:30	00:15:00	45.6	56.8	47.4	43.4	
14/09/2022 14:45	00:15:00	45.3	52.5	46.9	42.6	
14/09/2022 15:00	00:15:00	45.6	59.8	47.1	42.5	
14/09/2022 15:15	00:15:00	44.9	64.9	46.5	42.4	
14/09/2022 15:30	00:15:00	47.8	64.5	47.8	41.7	
14/09/2022 15:45	00:15:00	44.7	56.8	46.0	42.6	
14/09/2022 16:00	00:15:00	47.9	64.5	50.0	42.6	
14/09/2022 16:15	00:15:00	43.7	52.3	45.0	42.0	
14/09/2022 16:30	00:15:00	44.3	62.3	45.4	41.4	
14/09/2022 16:45	00:15:00	44.5	57.8	45.6	41.9	
14/09/2022 17:00	00:15:00	53.1	70.6	54.1	43.5	
14/09/2022 17:15	00:15:00	43.6	54.6	44.6	41.8	
14/09/2022 17:30	00:15:00	43.2	51.7	44.4	41.9	
14/09/2022 17:45	00:15:00	42.4	56.9	43.2	40.7	
14/09/2022 18:00	00:15:00	42.6	56.0	43.5	40.9	
14/09/2022 18:15	00:15:00	43.1	54.1	44.1	41.3	
14/09/2022 18:30	00:15:00	43.1	61.1	44.0	41.7	
14/09/2022 18:45	00:15:00	45.3	62.0	47.2	42.9	
14/09/2022 19:00	00:15:00	44.0	61.1	44.8	42.6	
14/09/2022 19:15	00:15:00	45.0	66.3	46.4	41.8	
14/09/2022 19:30	00:15:00	44.1	65.1	44.8	42.1	
14/09/2022 19:45	00:15:00	43.7	63.4	44.4	42.4	
14/09/2022 20:00	00:15:00	43.5	53.5	44.4	41.9	
14/09/2022 20:15	00:15:00	43.9	50.9	45.2	42.4	
14/09/2022 20:30	00:15:00	44.2	58.8	45.6	42.5	
14/09/2022 20:45	00:15:00	44.2	57.9	45.7	42.5	
14/09/2022 21:00	00:15:00	43.5	48.5	44.9	42.2	
14/09/2022 21:15	00:15:00	44.8	54.9	46.1	42.5	
14/09/2022 21:30	00:15:00	45.6	52.6	46.7	44.4	
14/09/2022 21:45	00:15:00	45.5	56.7	46.8	43.8	
14/09/2022 22:00	00:15:00	45.1	53.7	46.5	43.2	
14/09/2022 22:15	00:15:00	43.8	52.1	45.2	42.2	
14/09/2022 22:30	00:15:00	42.9	58.2	44.2	40.7	
14/09/2022 22:45	00:15:00	41.6	47.8	43.0	39.9	
14/09/2022 23:00	00:15:00	40.8	50.2	42.3	38.8	
14/09/2022 23:15	00:15:00	38.8	45.4	40.2	37.0	

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2106836

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 3007000	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 3022866	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 23929	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.5.2	Pattern Approval:	PTB1.63-40478500 / 1.63-4078502
Instruction manual:	BE1712-22		

CUSTOMER

Enfonic Ltd
Unit 2A, Century Business Park
Dublin
D11 T0HV
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC6162-1:2013 class 1. Proceedures from IEC 61672-3:2013 were used perform the periodic tests. The accreditation assures the traceability of the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 7.3 - DB: 7.30) by using procedure B&K proc 2250, 4189 (IEC61672:2013)

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2021-09-14

Date of issue: 2021-09-14

M. Önder

Mikail Önder
Calibration Technician

Susanne Jørgensen

Susanne Jørgensen
Approved Signatory

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [x] Sean Furlong [ ]
Gary Phillips [ ] Danny McCaul [ ]

acoustic calibration laboratory
The University of Salford, Salford, Greater Manchester, M5 4WT, UK
http://www.acoustics.salford.ac.uk
t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk

UKAS CALIBRATION
0801

University of Salford MANCHESTER

Certificate Number: 05619/1 Date of Issue: 14 February 2022

CALIBRATION OF A SOUND CALIBRATOR

FOR:	Enfonic Ltd Unit 2A Century Business Park Dublin D11 T0HV
FOR THE ATTENTION OF:	Bruna Barros
DESCRIPTION:	Calibrator with housing for one-inch microphones and adaptor type UC 0210 for half-inch microphones.
MANUFACTURER:	B&K
TYPE:	4231
SERIAL NUMBER:	3011175
DATE RECEIVED:	27 January 2022
DATE OF CALIBRATION:	31 January 2022
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford.
TEST PROCEDURE:	CTP06 (Laboratory Manual)

Test Engineer (initial):	GP	Name:	Gary Phillips

Results in this certificate relate only to instruments tested.

Certificate Number: 05619/1 Date of Issue: 14 February 2022

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in this certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The results have been corrected to the reference pressure of 101.325 kPa using manufacturer's data.

RESULTS

Coupler configuration:	Half-inch
Microphone type:	B&K 4192
Output level (dB re 20μPa):	94.29 dB ± 0.09 dB
Frequency (Hz):	999.97 Hz ± 0.12 Hz
Total Distortion (%):	0.21 % ± 0.22 %*

*Negative values of distortion are not realistic and are not included in the confidence interval.

Average environmental conditions at the time of measurement were:

Pressure:	101.902 kPa ± 0.015 kPa
Temperature:	22.2 °C ± 0.4 °C
Relative humidity:	43.2 % ± 2.1 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

Attachment 4

NMP1

Start: 2020-03-18 11:20:44

End: 2020-03-19 10:58:46

Location on eastern site boundary near canal.
Sources: birds, motorway traffic and muffled construction noise during daytime
Occasional aircraft

Configuration

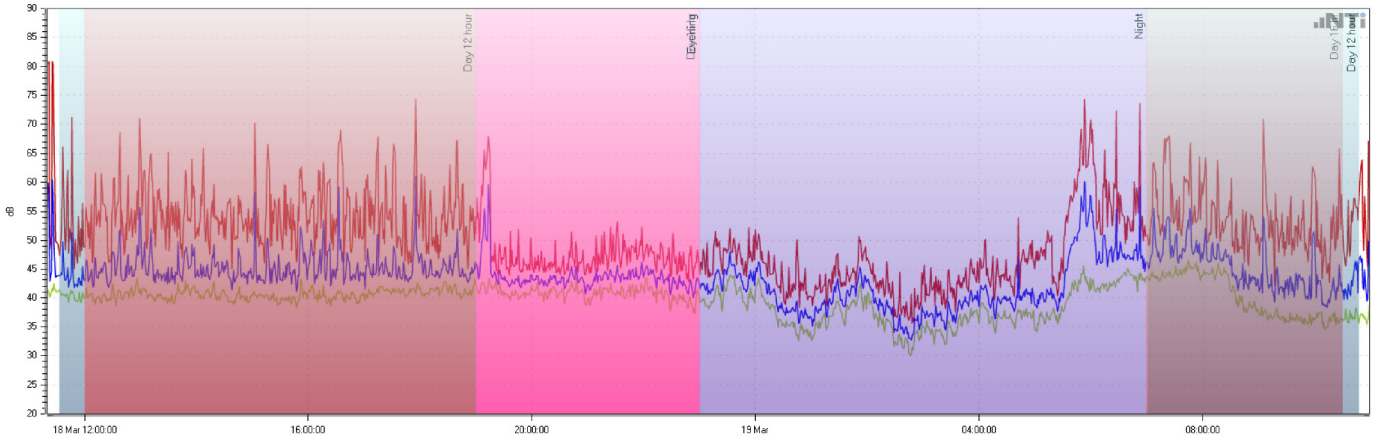
Device Info: XL2, SNo. A2A-16311-E0, FW4.20

Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2020-03-18 11:16

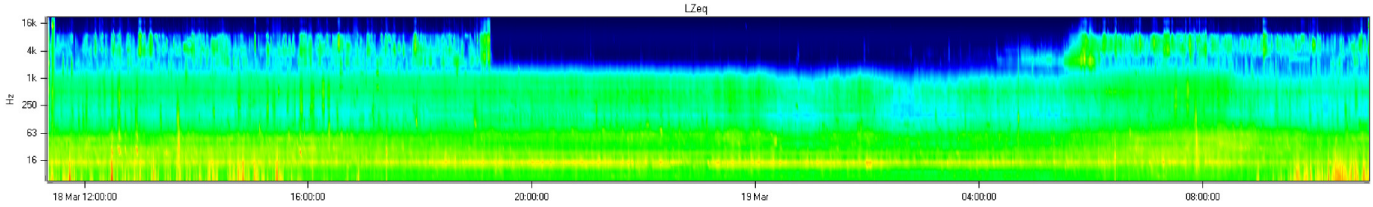
Mic Sensitivity: 39.6 mV/Pa

Range: 0 - 100 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 11:20:44**	**23:38:02**	**46.1**	**80.8**	**30.0**		
Project Result		**23:38:02**	**46.1**	**80.8**	**30.0**	**47.7**	**38.0**

Markers

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Day 16 hr (2)		**14:30:00**	**46.3**	**74.3**	**34.6**	**48.1**	**41.0**
Evening (1)		**04:00:00**	**45.1**	**67.9**	**37.2**	**45.3**	**41.5**
Night (1)		**08:00:00**	**45.4**	**74.3**	**30.0**	**46.9**	**36.0**
Day 12 hour (2)		**11:15:00**	**46.6**	**74.3**	**34.6**	**48.6**	**40.6**

NMP2

Start: 2020-03-19 11:42:06

End: 2020-03-20 12:08:50

Mostly motorway noise. Less birds.
Occasional aircraft including helicoptors
LAmax mainly due to crows cawing.

Configuration

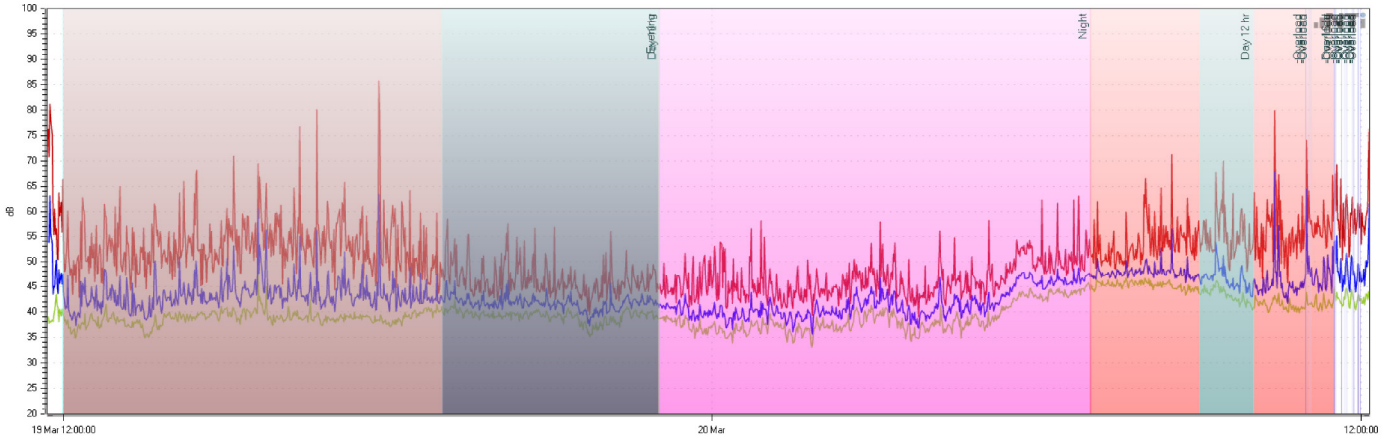
Device Info: XL2, SNo. A2A-16311-E0, FW4.20

Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2020-03-19 11:37

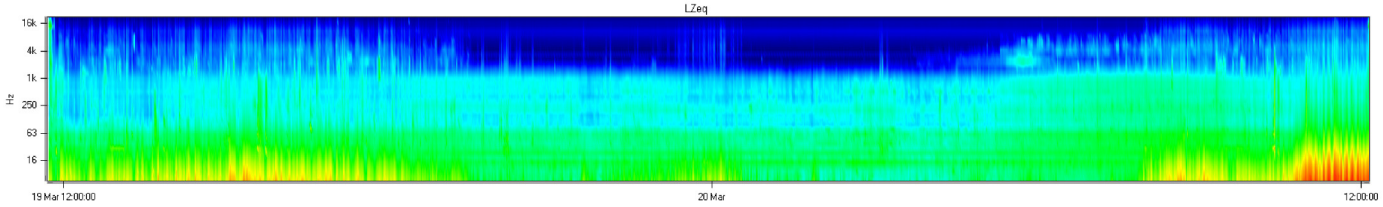
Mic Sensitivity: 40.5 mV/Pa

Range: 0 - 100 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-19 11:42:06**	**1 00:26:44**	**46.1**	**85.7**	**33.1**		
-Overload (18)		**00:00:22**	**57.5**	**67.4**	**46.4**	**61.6**	**50.8**
Project Result		**1 00:26:22**	**46.1**	**85.7**	**33.1**	**47.5**	**39.0**

Markers

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Day 16 hr (2)		**15:31:56**	**46.7**	**85.7**	**34.9**	**47.9**	**39.8**
Night (1)		**07:59:00**	**42.6**	**63.0**	**33.1**	**46.1**	**38.1**
Evening (1)		**04:00:00**	**41.9**	**58.5**	**35.2**	**43.2**	**39.7**
Day 12 hr (2)		**12:03:00**	**44.9**	**85.7**	**34.9**	**46.1**	**39.6**

NMP3 #1

Start: 2020-03-18 11:50:50

End: 2020-03-18 12:05:50

Configuration

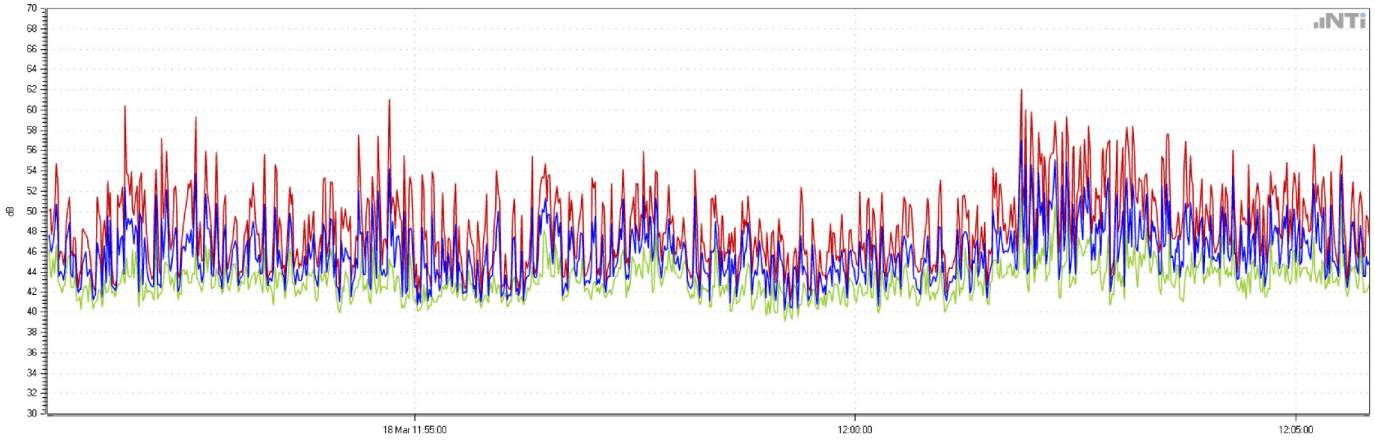
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

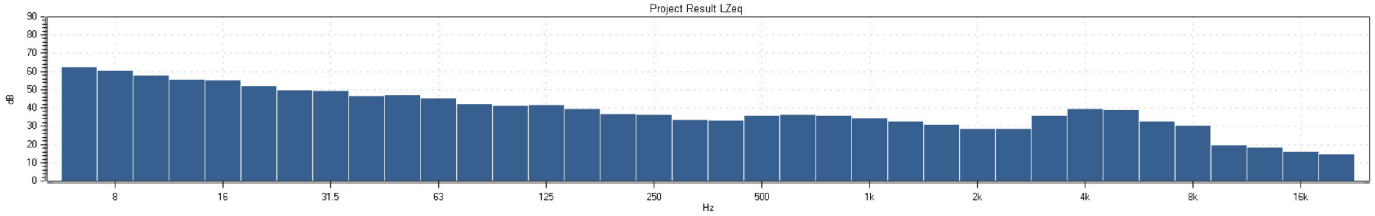
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 11:50:50**	**00:15:00**	**46.8**	**62.0**	**39.1**		
Project Result		**00:15:00**	**46.8**	**62.0**	**39.1**	**49.7**	**42.4**

NMP3 #2

Start: 2020-03-18 12:06:58

End: 2020-03-18 12:21:58

Configuration

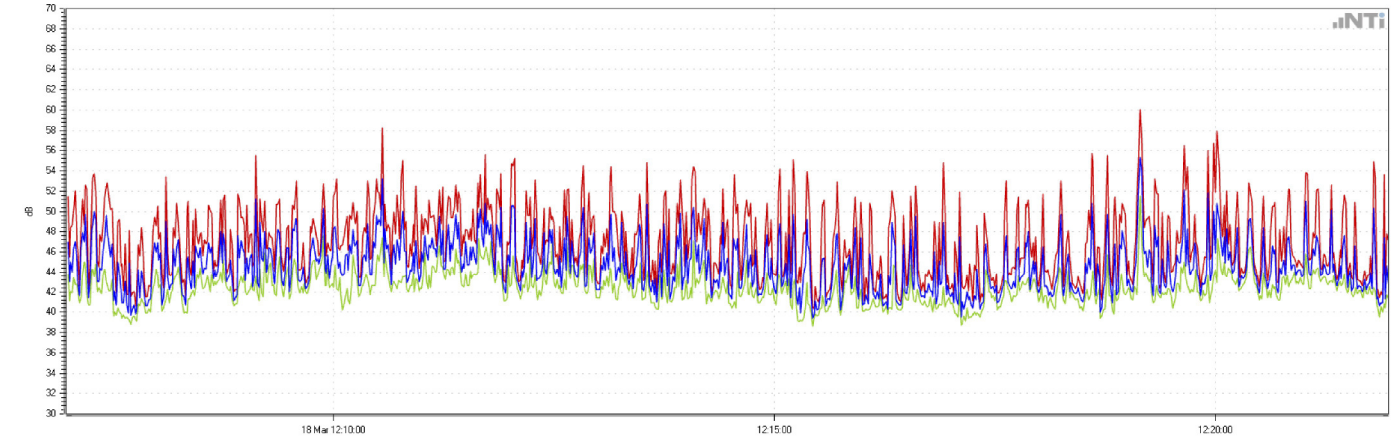
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

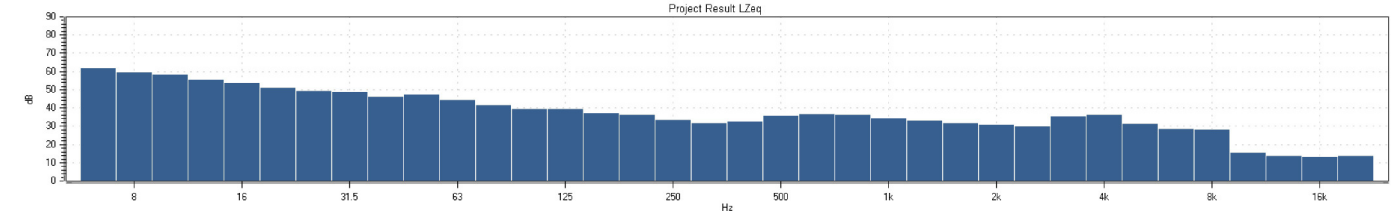
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 12:06:58**	**00:15:00**	**45.4**	**60.0**	**38.6**		
Project Result		**00:15:00**	**45.4**	**60.0**	**38.6**	**48.2**	**41.5**

NMP3 #3

Start: 2020-03-18 12:22:06

End: 2020-03-18 12:37:06

Configuration

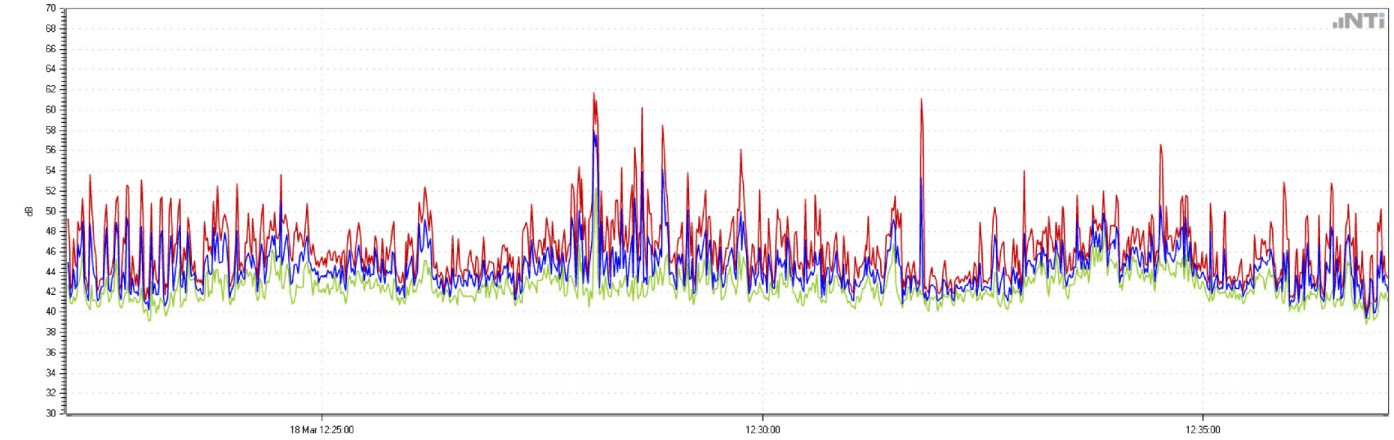
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

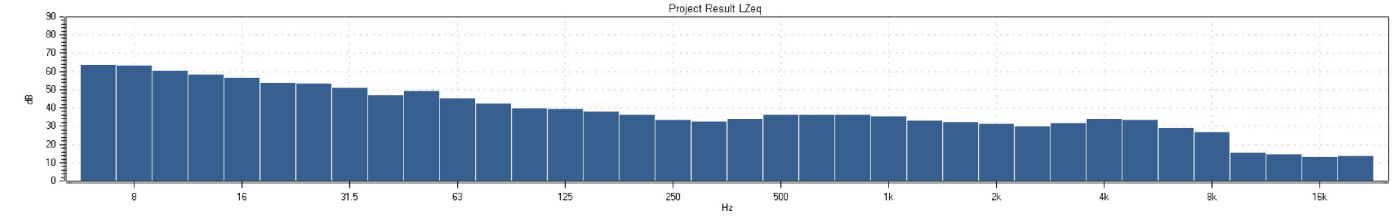
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 12:22:06**	**00:15:00**	**45.1**	**61.7**	**38.8**		
Project Result		**00:15:00**	**45.1**	**61.7**	**38.8**	**47.1**	**42.0**

NMP4 #1

Start: 2020-03-18 13:16:52

End: 2020-03-18 13:31:52

Configuration

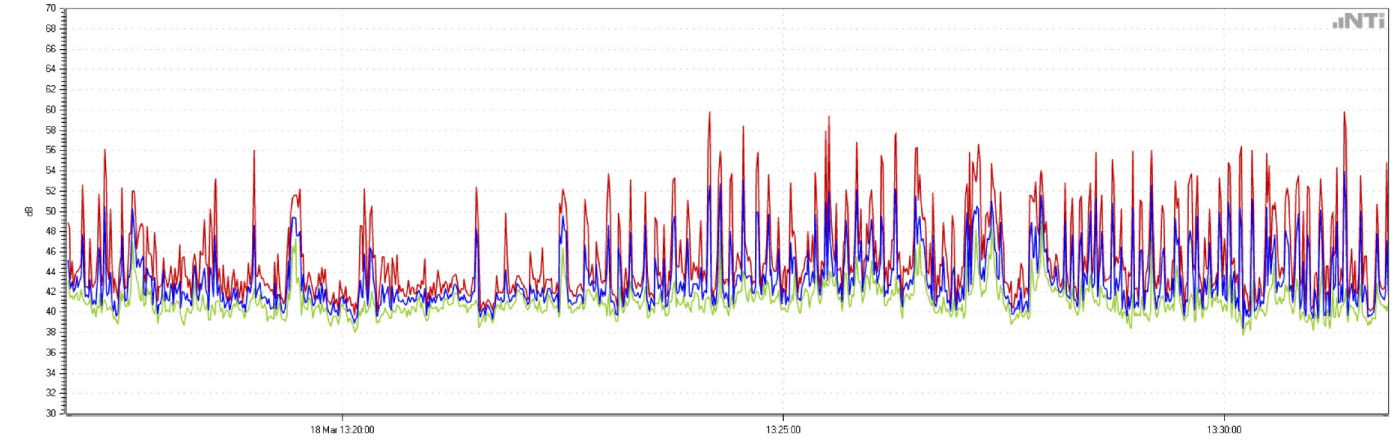
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

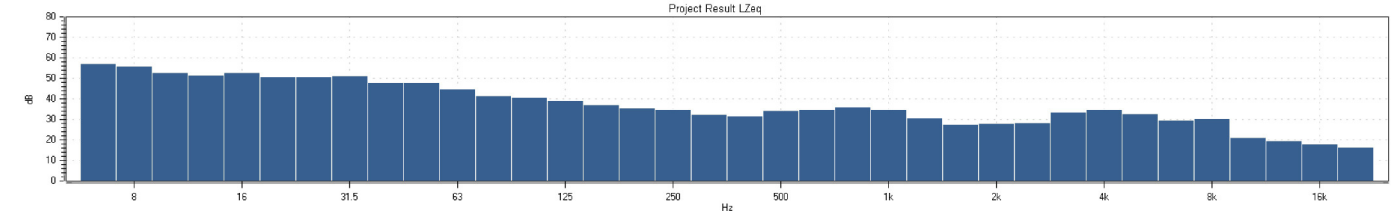
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 13:16:52**	**00:15:00**	**44.2**	**59.8**	**37.7**		
Project Result		**00:15:00**	**44.2**	**59.8**	**37.7**	**47.6**	**40.4**

NMP4 #2

Start: 2020-03-18 13:31:58

End: 2020-03-18 13:46:58

Configuration

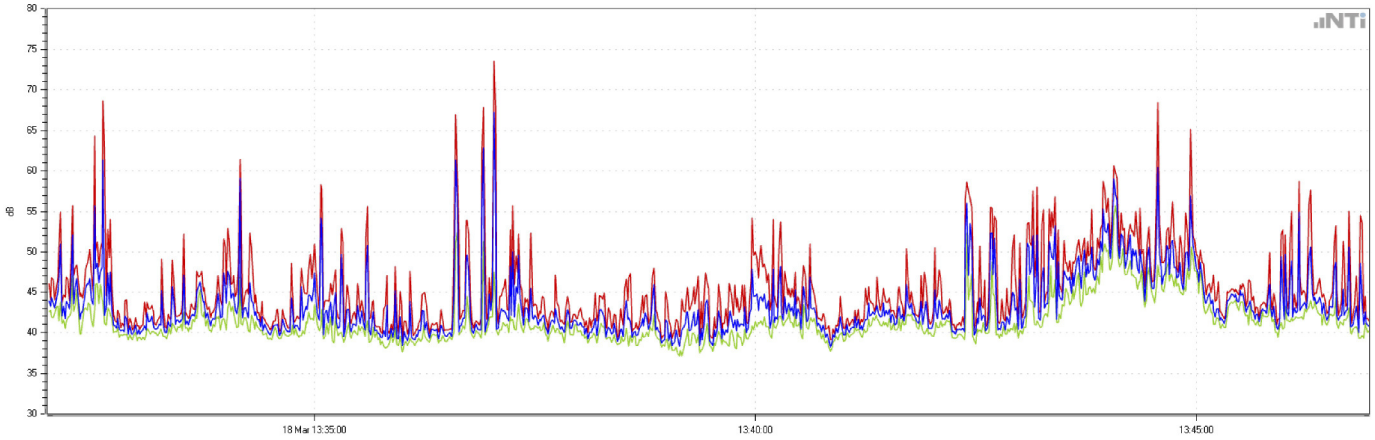
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

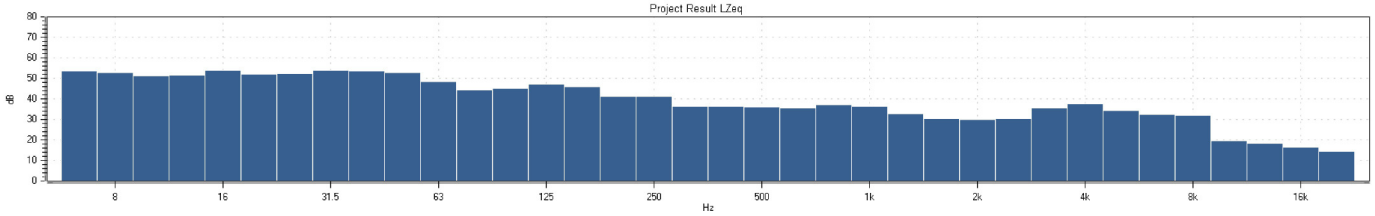
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 13:31:58**	**00:15:00**	**46.7**	**73.5**	**37.1**		
Project Result		**00:15:00**	**46.7**	**73.5**	**37.1**	**48.7**	**40.0**

NMP4 #3

Start: 2020-03-18 13:47:18

End: 2020-03-18 14:02:18

Configuration

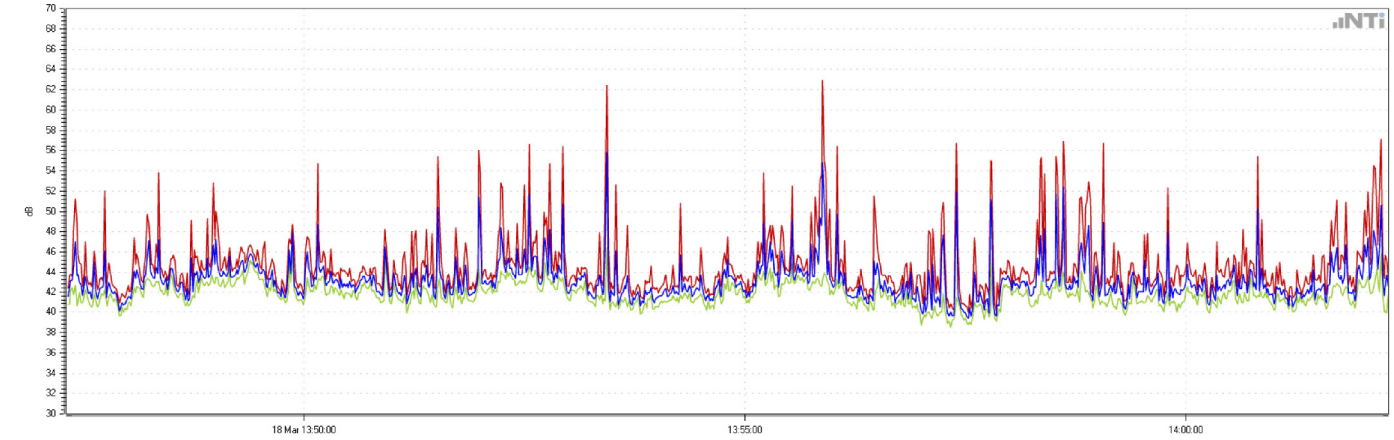
Device Info: XL2, SNo. A2A-08898-E0, FW3.11 Type Approved

Mic Type: NTi Audio M2230, SNo. 5062, User calibrated 2020-03-18 11:36

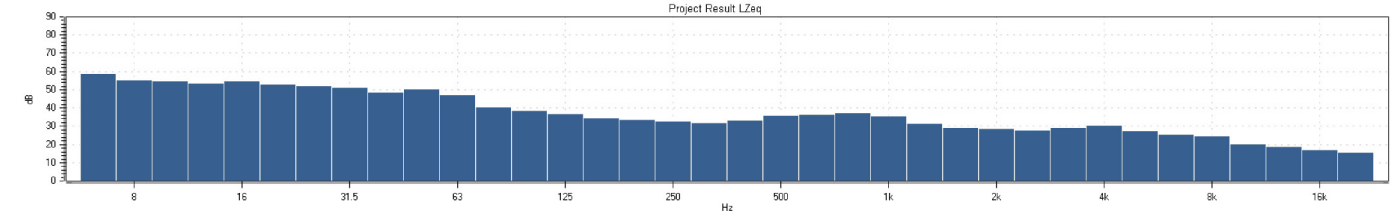
Mic Sensitivity: 43.3 mV/Pa

Range: 20 - 120 dB

Ln based on: LAeq_dt



LAeq_dt LAFmax_dt LAFmin_dt



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAFmin [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	**2020-03-18 13:47:18**	**00:15:00**	**43.7**	**62.9**	**38.5**		
Project Result		**00:15:00**	**43.7**	**62.9**	**38.5**	**45.4**	**41.3**