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REPORT

of

SOUND MEASUREMENTS AND RECOMMENDATIONS

at

PROPOSED NEW RESIDENTIAL CARE HOME, LAND OFF OLD ROW / WHALLEY ROAD, BARROW, CLITHEROE, BB7 9AZ

Dates of measurements:	28th November & 30th November – 1st December 2022
Date of report:	23rd January 2023
Prepared for:	LNT Construction
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Members of the Association of Noise Consultants (ANC) & Institute of Acoustics (IOA)
Originally established in 1981. Company number 4688174.

CONTENTS

1.0 **Summary and Conclusions**

1.1 A new care home is proposed on land off Whalley Road / Old Row, Barrow near Clitheroe. The A59 passes to the east of the site and it is close to Barrow Primary School and an existing food processing plant. As part of the application, the client has commissioned an acoustic survey of the site.

1.2 The design targets for indoor sound level adopted in this report are:

- **30 dB LA_{eq}** in bedrooms from 2300-0700 hours,
- **35 dB LA_{eq}** in all habitable rooms from 0700-2300 hours
- **45 dB $LA_{max,f}$** in bedrooms from 2300-0700 from regular events
- **NR 30** during the daytime and **NR 25** at night from non traffic sources. A more onerous / desirable target is discussed of NR 25 daytime and NR 20 at night.

1.3 A sound survey was undertaken using attended measurements during several reasonable worst-case periods that included all of the various sources of sound at the site. Sound levels were measured with a calibrated type I sound level meter, full details of which are given in the appendices of this report.

1.4 Daytime outdoor ambient sound levels at the site were generally in the range 49 – 57 dB LA_{eq} during the daytime and 45 – 52 dB LA_{eq} at night. Short duration maxima at night were typically 60 – 66 dB $LA_{max,f.}$

1.5 Sound from fixed plant has been measured directly and assessed using BS 4142 : 2014. Fixed plant sound is clearly audible at the proposed development site and mitigation is proposed in the form of an imperforate noise barrier at the south east of the site, and an enhanced acoustic specification for the building envelope. The measurements, recommendations and conclusions are in broad agreement with the acoustic report prepared for the previously permitted development of residential dwellings.

1.6 Measurements were taken at the site during school dinner playtime and afternoon PE sessions. An acoustic specification for the care home is given so that predicted internal sound levels comply with the relevant guidance for the preservation of living amenity, including the avoidance of sleep disturbance for maximum preservation of residents amenity.

1.7 The suggested acoustic specification is summarised overleaf and an annotated site plan is shown on page 17.

- **Living Rooms and Bedrooms to North (Including Inside 'H' Shape)**

  Glazing comprising 4mm float glass and 6.8mm acoustic glass

  Acoustic trickle ventilators with a high level of mid frequency attenuation such as Greenwood 5000EAW.AC2 or Titon SFX V75 range (likely Dn,e,w at least 40 dB when open)

- **Living Rooms and Bedrooms to North East**

  Glazing comprising 4mm and 6mm float glass. Recommended option to increase one leaf of glazing to being 6.8mm acoustic glass as mitigation against future business park sound.

  Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, Dn,e,w at least 36 dB when open

- **Living Rooms and Bedrooms to South East**

  Glazing comprising 6mm float glass and 6.8mm acoustic glass

  Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, Dn,e,w at least 36 dB when open

- **Other Living Rooms and Bedrooms to South West and West**

  Glazing comprising 4mm and 6mm float glass

  Trickle ventilators with Dn,e,w at least 35 dB when open

A visual plan has been included to assist with the specification of individual rooms.

1.8 Predicted sound levels in the communal residents' garden areas are predicted to generally comply with the guidance issued by the WHO

1.9 The developer of the care home normally uses a hybrid ventilation strategy for the building that draws air in from outside through a system in corridors and/or bathrooms that then provides the required ventilation without the need to open windows. Acoustic trickle ventilators are proposed in window frames as part of the recommendations contained in this report to complete the ventilation strategy.

2.0 Introduction

. The site is currently open land and shares a boundary with:

- Barrow Primary School to the north,
- Open land to the east that is subject to a planning application for extension of Ribble Valley Enterprise Park
- Existing dwellings and a food processing plant to the south,
- Whalley Road and a small public open car park to the east.

The site of the proposed care home was subject to a previous planning application with consent granted for development of 23 dwellings.

As part of the planning application for the new care home, the applicant has commissioned this acoustic survey for submission to the Local Planning Authority. The previous residential application also benefitted from an acoustic survey, the results of which are publicly available and discussed in this report as an additional datapoint

The relevant policies, guidance and standards relating to this development are described in the following subsections. There are several types of sound source at this site and so a number of different guidance documents are used in this report.

2.1 Central Government Policies

The government's planning policies are described in the National Planning Policy Framework (NPPF) which includes consideration of potential adverse impacts of noise on new development. The NPPF makes reference to the Noise Policy Statement for England (NPSE) which includes three incremental categories of noise impact:

- No Observed Effect Level (NOEL) being the situation below which no effect caused by noise can be detected,
- Lowest Observable Adverse Effect Level (LOAEL) being the situation above which adverse effects caused by noise can be detected,
- Significant Observed Adverse Effect Level (SOAEL) being the level above which significant adverse effects caused by noise occur.

Stated objectives of the NPSE are:

1. Avoid significant adverse impacts, usually interpreted as calling for sound levels above SOAEL to be avoided.

2. Mitigate and minimise adverse impacts, usually interpreted as calling for noise mitigation to be used within the bounds of practicality for situations between LOAEL and SOAEL.

3. Where possible contribute to the improvement of health and quality of life, usually interpreted as calling for noise reductions to be made where possible for situations between NOEL and LOAEL.

Although introducing these subjective concepts for the assessment of noise impact, the NPPF and NPSE documents do not provide quantitative values against which the suitability of a site for development can be assessed in terms of sound levels.

2.2 **BS 8233: 2014**

BS 8233 provides guidance on interior sound levels inside various building interiors caused by external sources of an anonymous nature, for example flowing road traffic. It is recommended that the internal ambient sound levels in dwellings do not exceed:

Living rooms	35 dB LA_{eq}	from 07.00-23.00
Dining rooms	40 dB LA_{eq}	from 07.00-23.00
Bedrooms	35 dB LA_{eq}	from 07.00-23.00
	30 dB LA_{eq}	from 23.00-07.00
Gardens	50 dB LA_{eq}	is the desirable limit
	55 dB LA_{eq}	is the upper guideline value.

The above sound limits are described in BS 8233 as applying to “steady external noise sources”. A note in paragraph 7.7.1 of the same document states that “Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate.”

BS 8233 describes a ‘More Rigorous’ calculation procedure for the prediction of internal sound levels and this guidance is adopted for this report.

2.3 **World Health Organisation: 2000**

Guidance from the WHO gives additional guidance to BS 8233 on the interior sound levels in bedrooms at which sleep disturbance can be expected to occur:

Bedrooms	30 dB LA_{eq} }	to avoid sleep
	45 dB LA_{max}}	disturbance

The guidance on LA_{max} is usually intended to apply to sound from regular and typical events only. The definition of 'regular and typical' is open to some interpretation and depends on the context and sources being considered.

2.4 Noise Rating (NR) Curves

An alternative method of describing indoor sound levels is using Noise Rating (NR) curves that take into account the frequency (or musical pitch) of sound. These can be especially useful when quantifying non-road traffic sources. It is common for guidance issued by the Institute of Acoustics (IOA) as part of recommendations on pubs and clubs to be adopted.

The design guidance for dwellings is that sound levels are advised to not exceed the following limits inside residential properties:

Non-music sources

NR 25 in bedrooms between 2300 and 0700 hours
NR 30 in habitable rooms between 0700 and 2300 hours.

Music sources (often also applied to typically annoying sources)

NR 20 in bedrooms between 2300 and 0700 hours
NR 25 in habitable rooms between 0700 and 2300 hours.

In our experience, these NR criteria are often adopted by LPAs for the assessment of indoor sound caused by a variety of non-traffic outdoor sources, using the more stringent criteria for typically annoying sources. These criteria are used in this survey when considering indoor sound levels caused by school and fixed plant sources.

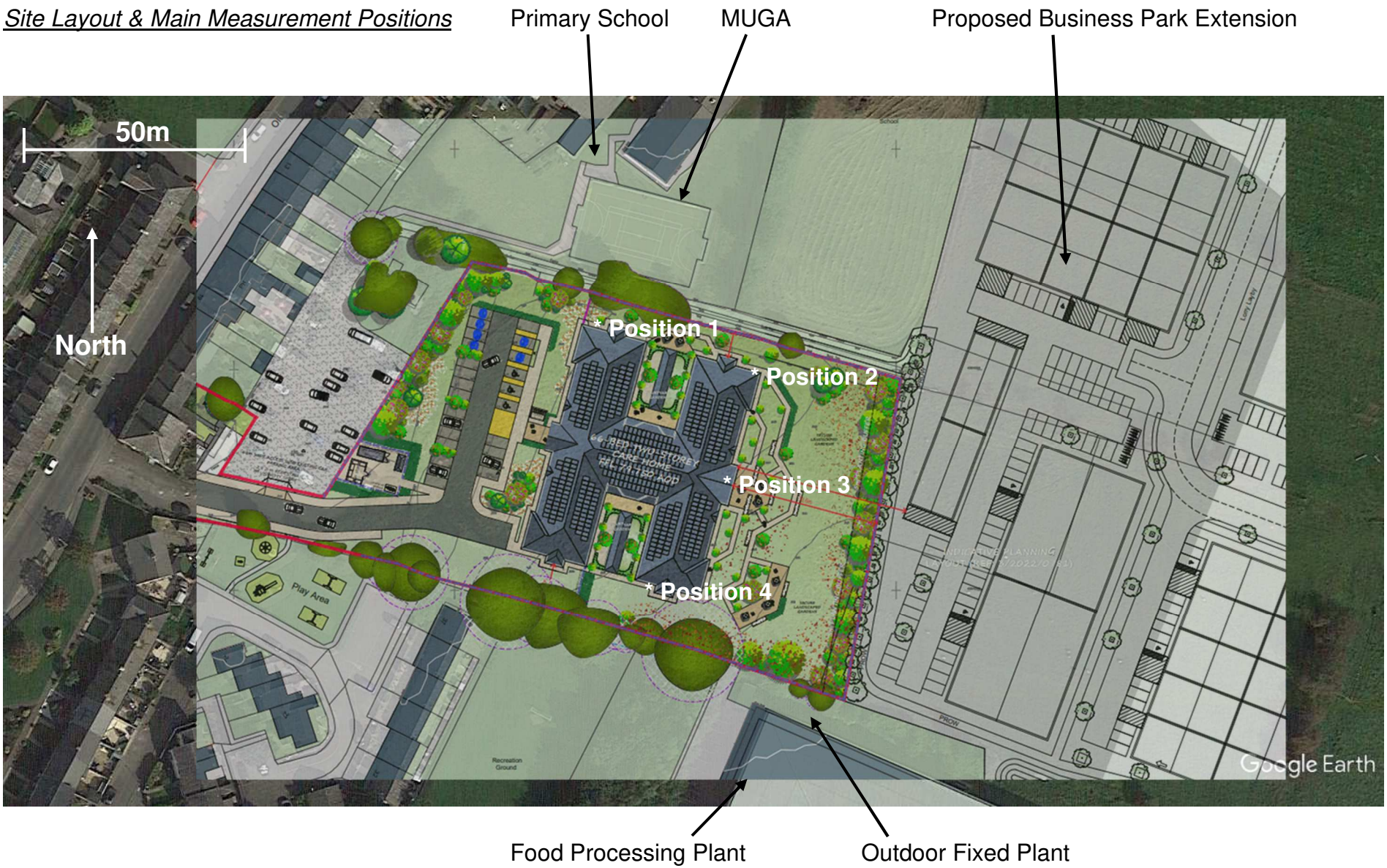
2.5 BS 4142:2014

Outdoor sound from fixed plant associated with the adjacent food processing factory is assessed using BS 4142: 2014 + A1:2019, 'methods for rating and assessing commercial and industrial sound.' This is a highly prescriptive standard for which full details are given in the relevant section of this report

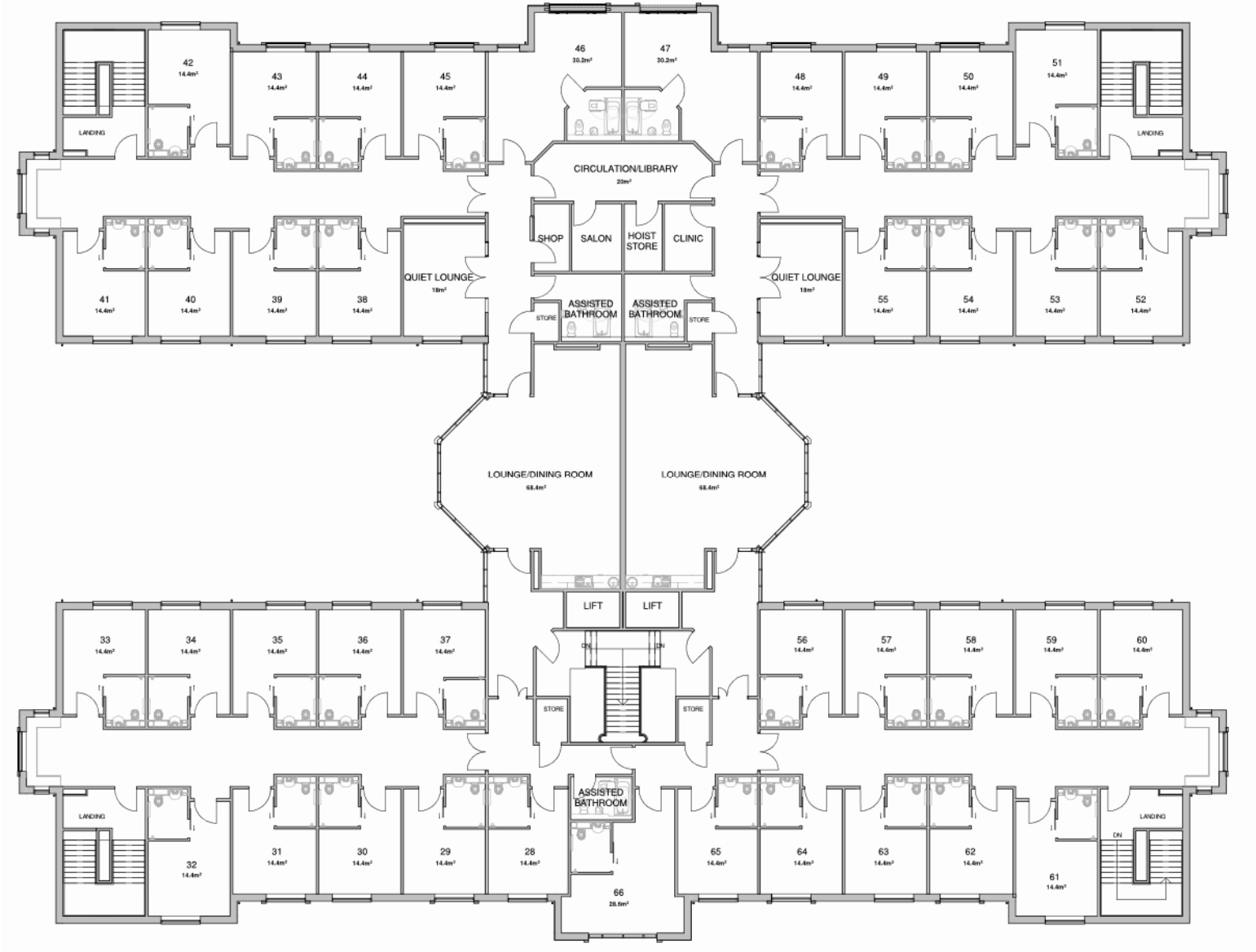
3.0 **Site Location, Layout & Typical Floorplans**

Google Earth Location Plan

Site Layout & Main Measurement Positions



Typical Floor Plan



4.0 **Outdoor Sound Survey**

The existing site is grassland, which is open and publicly accessible. There is a dirt path around the edge of the land, which we observed was popular with dog walkers. It was immediately apparent that the site is not suitable in its current state for sound monitoring equipment to be left unattended.

For this reason, the sound survey was undertaken using attended measurements during several reasonable worst-case periods that included all of the various sound sources. Comparisons can also be drawn with the previous acoustic survey undertaken for the site.

Measurements were taken on Monday 28th November & Wednesday 30th November to Thursday 1st December 2022.

Sound levels were measured with a calibrated type I sound level meter, full details of which are given in the appendices of this report. Measurements were logged every 15 minutes.

A total of four measurement positions were used around the site. One position at the north closest to the primary school, two positions to the east and north-east where road traffic sound is greatest, and a fourth position towards the south-east, closest to the food processing factory fixed plant

4.1 **Road Traffic Sound Measurements**

The measurement of road traffic sound is often undertaken using long duration unattended survey methods, but this was not suitable at this site due to the open and insecure nature of it. Instead, the most accurate and practicable methodology was to take measurement using shorter attended survey periods during the likely worst-case times of day, early night and the last hour of night, where early commuting traffic can cause sound levels to approach those of typical daytime periods.

All measurement data, including frequency spectra are given in the appendices of this report.

The table overleaf shows a summary of mean / average overall dBA measurements of road traffic sound taken at the proposed development site. The daytime levels reported in this section for road traffic sound are those taken when sound from the school was at a minimum.

Sound Pressure Levels, dBA

Position	Daytime Ambient dB $LA_{eq,15\ min}$	Night Time Ambient dB $LA_{eq,15\ min}$
Position 1	53 - 57	48 - 52
Position 2	49 - 53	45 - 49
Position 3	50 - 51	46 - 50

The highest short duration maxima measured at night was 66.0 dB LA_{max} from road traffic, with most of the 15 minute measurement periods showing individual maxima at 64 dB LA_{max} or less.

Our ambient measurements of road traffic sound are in broad agreement with those taken for the previous survey.

4.2 Sound From Adjacent Primary School

Measurement was chosen at the north of the site representing the location of the care home elevation closest to the primary school.

The school has an outdoor playground and sports area that faces the boundary of the site. Measurements of sound were taken during school dinner playtime and also afternoon PE sessions.

When these outdoor areas were in use, sound from the school generally provided the dominant sound source at the northern measurement position. Typical sound levels were 61 – 65 dB $LA_{eq,15mins}$ during dinnertime play and 56 – 61 dB $LA_{eq,15mins}$ during PE teaching.

The technical possibility exists to reduce sound levels from the school affecting the care home site by constructing a 2m high imperforate timber fence along the site boundary. However, it is generally the preference of care home residents and the experienced developer undertaking these works to maximise inclusion with the surrounding environment and community, rather than automatically implementing measures that may improve the acoustic environment at the expense of inclusivity.

The option remains to construct an imperforate timber fence along this boundary in the future if the care home team desire, but it is thought most likely that the preference of all parties involved will be to maintain an open boundary to maximise the feeling of inclusion and integration for residents with the surrounding environment.

4.3 Fixed Plant Sound

Fixed plant affecting the site consists of a line of outdoor fan based chiller units mounted at ground floor level along the north boundary of the adjacent food processing factory.

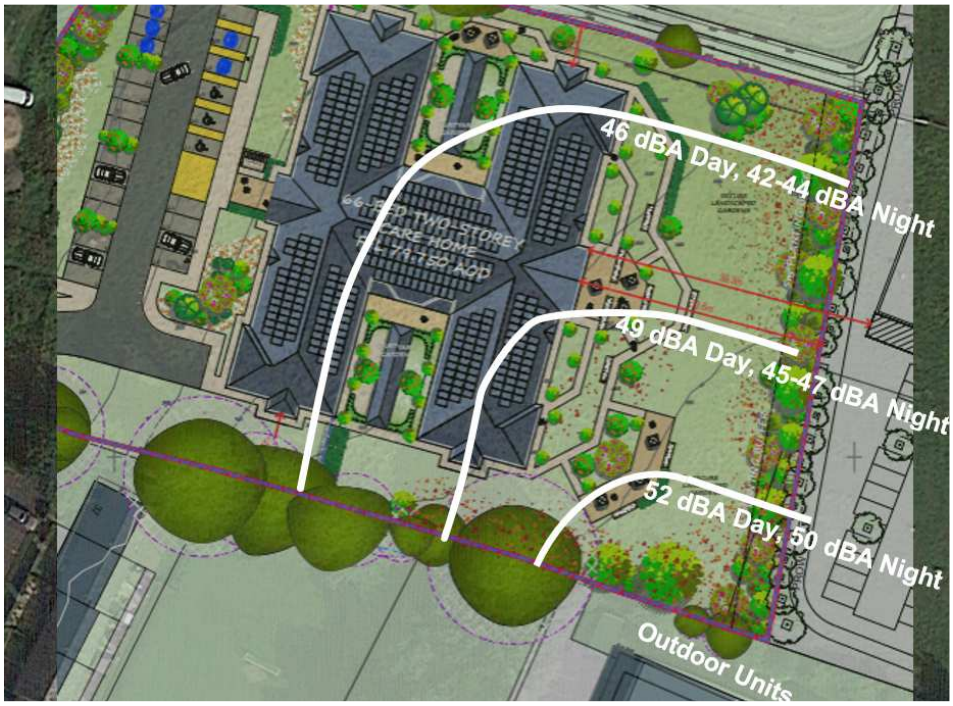
A full assessment of sound from these units to BS4142: 2014 is included in section 9 of this report. A summary is given here for ease of reading.

Sound levels taken at the boundary of the development site showed results of 55 - 56 dB $LA_{eq,T}$, at a distance of 9m – 10m from the closest unit.

The specific daytime sound levels at the nearest point of the proposed care home are:

- 48 – 50 dB $LA_{eq,T}$ by direct measurement
- 50 – 51 dB $LA_{eq,T}$ by calculation.

At night, sound levels from the fixed plant items appear to be generally around 2 – 4 dBA lower than during the daytime. The sound levels from fixed plant are in agreement with the previous survey prepared for this site. The care home elevation is further from the factory site than the closest previously proposed dwellings, so the assessment at the building elevations is slightly more favourable than the previously permitted development An annotated site drawing is shown below with contours representing different sound levels from the fixed plant items.



4.4 **Business Park Extension**

An extension to the Ribble Valley Enterprise Park is proposed to the east of the new care home, the current planning application number is 3/2022/0781.

The online planning details includes a memo from Environmental Health that asks for noise to be considered as part of this development, as follows:

> *6. Noise attenuation scheme Prior to the first use of the development, a noise-mitigation scheme shall be submitted in writing and approved in writing by the local planning authority detailing measures that will be implemented to ensure that any noise associated with the development does not cause detriment to amenity of local residents or a nuisance, especially to those living and working in the vicinity. Consideration of the following noise sources shall be made on the assessment: Forklift truck movements, noise from deliveries, noise from vehicles visiting the site, any external plant as part of the development, break out sound from the internal use of the buildings, noise from the building fabric and from ventilation and openings in the building fabric. The noise assessment shall provide details of an appropriate layout of the site so that it protects nearby residential properties, these shall be submitted to the LPA for approval. Reason: To protect the amenity of the locality, especially for people living and/or working nearby.*

Implementation of this condition should help to ensure that the acoustic environment within the care home site remains acceptable.

If, at a future date it is deemed necessary or desirable, an imperforate noise barrier could be constructed along the eastern boundary of the care home site to provide some mitigation against ground based sources at the new Enterprise Park extension. It is not thought necessary at this point in time and as discussed, the default position is to maximise the integration and feeling of involvement with care home residents and the community.

The option exists to provide an enhanced acoustic specification for bedrooms on the east elevation of the care home that overlooks the proposed Enterprise Park extension to provide additional preservation of living and sleeping amenity against future commercial sound. This would be prudent if commercially feasible and is included in the suggested building specification.

5.0 Suggested Building Specification

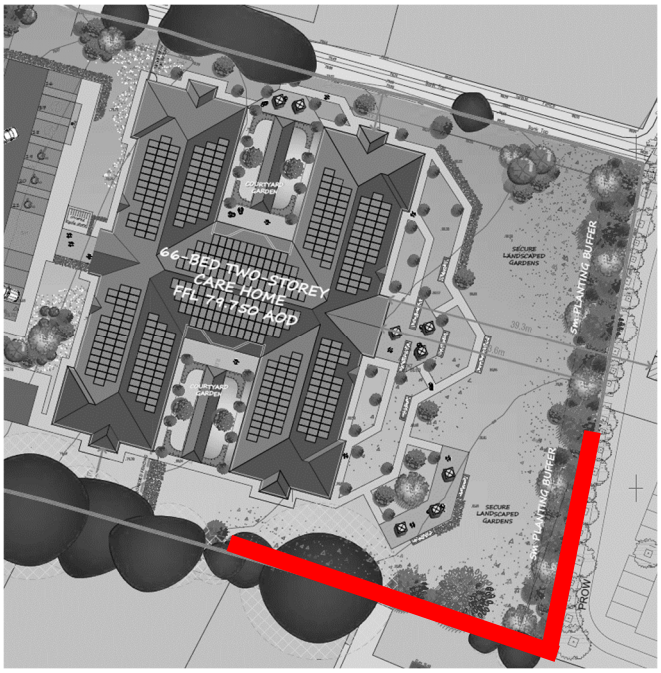
Internal sound levels are predicted to comply with the requirements outlined in section 2 of this report if the suggested acoustic specification shown in this section is followed. An annotated plan is also given. Suggested models of trickle ventilator are given. If a different model of ventilator is preferred, calculations can be undertaken by us to advise suitability.

Calculations are based on building details typical of many care homes constructed by this developer, with each bedroom window being around 2.2m^2. If very large windows with significantly larger surface area than this are proposed then this may affect the standard of glazing required. If any patio or Juliet doors are proposed as part of the final design, the fit and seal of them must be very good to preserve the standard of sound insulation required and there may be some implication on glazing specification, depending on their location and size. We can provide further assistance if this becomes part of the proposed development.

Outdoor Barriers

It is recommended that a barrier is constructed at the boundary of the site with the food processing plant. The barrier should extend part of the way along the east and south boundary of the care home site, as shown by the red line on the plan below.

It is likely that the noise barrier will comprise a 1m – 2m high bund (the higher the better) with a 2m high imperforate timber fence constructed on top of the bund. The timber fence should be entirely imperforate with no gaps or sightlines through it. Overlapped or tightly buttered close board fence panels constructed to a good standard are generally acceptable.



The interface between the bund and the fence must be similarly imperforate with no gaps underneath the fence. Pea gravel can be used to ensure that any small gaps are filled.

The suggested acoustic specification for the building envelope is shown below, assuming the normal construction of external walls and single 12.5mm plasterboard horizontal ceilings on the top floor:

Living Rooms and Bedrooms to North (Including Inside 'H' Shape

- Glazing comprising 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon with a 12 to 16mm airgap between, eg 4-16-6.8.

- Acoustic trickle ventilators with a high level of mid frequency attenuation such as Greenwood 5000EAW.AC2 or Titon SFX V75 range (likely Dn,e,w at least 40 dB when open

Living Rooms and Bedrooms to North East

- Glazing comprising 4mm and 6mm float glass.

- Recommended option to increase one leaf of glazing to being 6.8mm acoustic glass as mitigation against future business park sound

- Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, with Dn,e,w at least 36 dB when open

Living Rooms and Bedrooms to South East

- Glazing Comprising 6mm float glass and 6.8mm acoustic glass separated by a 12 – 20mm airgap

- Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, with Dn,e,w at least 36 dB when open

Other Living Rooms and Bedrooms to South West and West

- Glazing comprising 4mm and 6mm float glass separated by a 12-20mm gap.

- Trickle ventilators with Dn,e,w at least 35 dB when open, eg. Greenwood 5000EAW.AC1 or Titon SFX V25 range

5.1 Plan Summary of Acoustic Specification

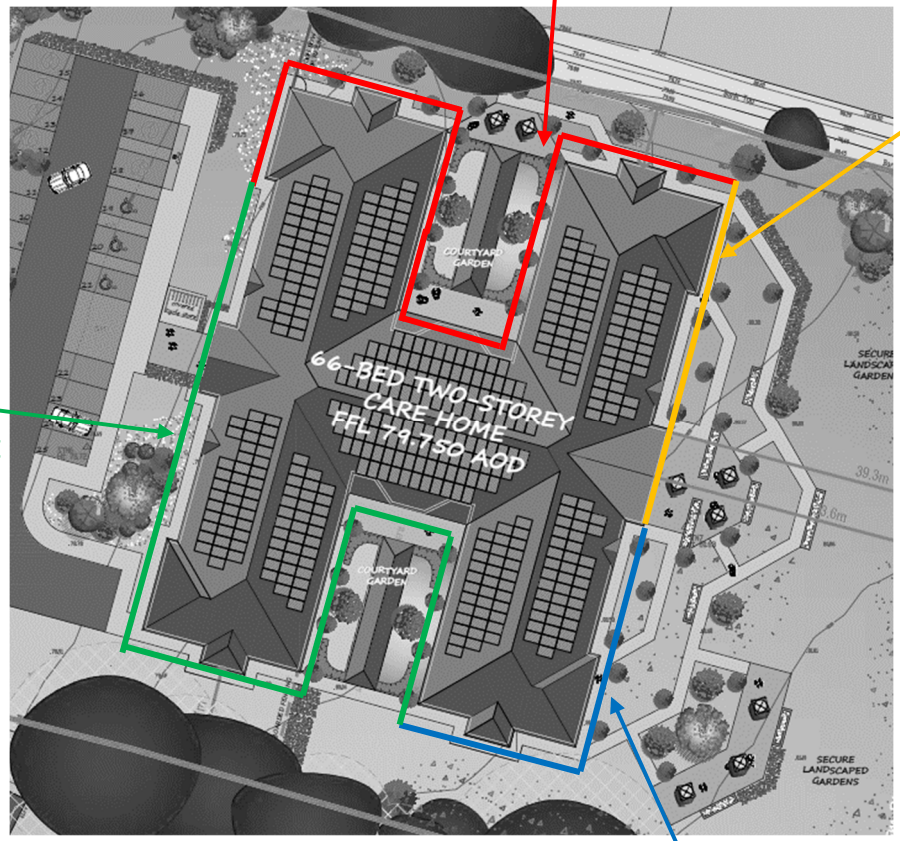
Glazing Comprising 4mm float glass and 6.8mm acoustic glass separated by a 12 – 20mm airgap
Acoustic trickle ventilators with a high level of mid frequency attenuation such as Greenwood 5000EAW.AC2 or Titon SFX V75 range (likely $D_{n,e,w}$ at least 40 dB when open)

Glazing comprising 4mm and 6mm float glass. Recommended option to increase one leaf to being 6.8mm acoustic glass as mitigation against future business park sound.

Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, with Dn,e,w at least 36 dB when open

Glazing comprising 4mm and 6mm float glass separated by a 12-20mm gap.

Trickle ventilators with $D_{n,e,w}$ at least 35 dB when open, eg. Greenwood 5000EAW.AC1 or Titon SFX V25 range



Glazing Comprising 6mm float glass and 6.8mm acoustic glass separated by a 12 – 20mm airgap
Acoustic trickle ventilators such as Greenwood 5000EAW.AC1 or Titon SFX V25 or V50 range, with Dn,e,w at least 36 dB when open

6.0 Interior Sound Levels

The design targets summarised in 2.0 of this report are that the external fabric of the building must reduce the outdoor sound from road traffic and general sources to indoor sound levels not exceeding:

- 30 dB LA_{eq} in bedrooms from 2300-0700 hours,
- 35 dB LA_{eq} in all habitable rooms from 0700-2300 hours
- 45 dB $LA_{max,f}$ in bedrooms from 2300-0700 hours from regular events
- Sound from school activity and fixed plant, limit of NR 30 during the daytime in habitable rooms, NR 25 at night in bedrooms. Desirable target of NR 25 daytime, NR 20 night time.

6.1 Predicted Internal Sound Levels

Internal sound levels have been calculated using the more rigorous method of BS 8233: 2014, full details of which are given in the appendices of this report.

Road Traffic / Mixed Sources

Predicted sound levels are well within the normal criteria given in BS 8233, partly due to the enhanced acoustic specification suggested for preservation of living and sleeping amenity from other sources.

Sound Pressure Levels, dBA

Position	Daytime Ambient	Night Time Ambient	Night Time Maxima
	dB $LA_{eq,15\ min}$	dB $LA_{eq,15\ min}$	dB LA_{max}
Position 1	14 - 23	18 - 19	26 - 29
Position 2	22 - 24	17 - 19	30 - 34
Position 3	19 - 23	19 - 22	29 - 35

Predicted sound levels within living rooms are 14 – 27 dBA depending on position and source.

School

Internal levels from the highest measurements of school sound are predicted as being NR 18 in bedrooms and up to NR 21 in living rooms.

These predictions are comfortably within the internal sound level criteria to not exceed NR 30 and also within the more stringent target of NR 25 daytime, with a significant comfort margin to allow for the variability of sources. The school is not open at night, but the internal sound level predictions also comply with sleep disturbance criteria, further protecting residents amenity.

Fixed Plant

Sound levels inside bedrooms and living rooms caused by fixed plant sound are predictd as being 19 – 22 dBA based on direct measurements and 26 – 27 dBA based on worst case calculations.

The noise rating levels are up to NR 15 based on measurements and NR 21 based on worst case calculations.

All of these sound levels comfortably comply with the various internal sound level criteria.

7.0 **Purge Ventilation & Thermal Comfort**

Background ventilation can be provided by in frame trickle ventilators, as described in this report. During times when purge ventilation is required or flow rates above background ventilation are desired for control of thermal comfort, the default method is to open windows.

7.1 **Acoustics, Ventilation and Overheating**

The Acoustics, Ventilation and Overheating (AVO) guide seeks to provide guidance on the interaction between these three factors. This is a guidance document and not regulatory, but the new Part O of the Building Regulations provides up-to-date regulatory requirements for overheating and sound. Building Regulation requirements are normally beyond the scope of an acoustic survey report intended for submission to the Local Planning Authority, but some outline guidance on this new document is given in this section.

The conventional way of controlling overheating is to open window casements, but this leads to an increase in indoor sound levels. It may be accepted that slightly elevated sound levels are permissible during the control of overheating, and a relatively low chance of adverse impact exists if internal conditions remain reasonable.

High levels of outdoor sound may result in unacceptable acoustic conditions inside dwellings with open windows, forcing a decision from the resident to have either acoustic or thermal comfort. Depending how often these conditions occur, significant adverse effect may be caused to living amenity.

If the various recommendations in the AVO guide are followed, the table below gives the level of risk to acoustic comfort during overheating conditions, if a partially open window casement is used.

These are not fixed thresholds and use the full day and night time averaging periods of 16 and 8 hours, but give an indication as to the suitability of open windows to be the sole method of controlling overheating.

Likely suitability of using windows to control overheating

Risk Level	**Daytime $LA_{eq,16\ hour}$**	**Night $LA_{eq,8\ hour}$**	**Night Maxima $LA_{max,f}$**	**Overheating Control**
High	Above 63 dB	Above 55 dB	Regularly exceeds 78 dB	Overheating Control with open windows unlikely to be possible without adverse impact.
Medium	53 - 63 dB	48 - 55 dB		Risk of adverse impact with open windows, suitability depends on overheating regularity.
Low	48 - 53 dB	43 - 48 dB		Reasonable conditions with open windows
Negligible	Under 48 dB	Under 43 dB	Does not regularly exceed 58 dB	Open windows with no adverse impact

The measurements taken at site suggests that it falls into the **low risk** or **medium risk** category during the daytime and at night depending on position around the site.

If open windows are relied upon for ventilation, the conclusion is that internal conditions across the site will be reasonable with some risk of adverse impact, depending on overheating regularity. The AVO guide does not pass comment on non-traffic sources such as school noise (which in any case only occurs during part of the daytime).

The developer of the care home normally uses a ventilation strategy for the building that draws air in from outside through a system in corridors and/or bathrooms that then provides Building Regulations compliant ventilation without the need to open windows and generally provides sufficient control of overheating. Acoustic trickle ventilators are proposed in window frames as part of the recommendations contained in this report to complete the ventilation strategy.

7.2 **Building Regulations Part O**

The new Part O of The Building Regulations deals with overheating and also the noise implications of relying on open windows for control of thermal comfort.

This is a brand-new piece of regulation, so may take some time full adoption. It forms part of Building Regulations compliance, which is generally beyond the scope of requirements for planning application submissions. However, there are instances where the inclusion of ventilation systems other than open windows may have some influence on details submitted with a planning application, so it is prudent to bear these potential requirements in mind from the early stages of a development proposal.

Paragraph 2.0 of Approved Document O lists four methods for removing excess heat:

- Opening windows,
- Ventilation Louvres in external walls,
- A mechanical ventilation system
- A mechanical cooling system

The document states that reasonable provision must be made to limit unwanted solar gains in summer and provide an adequate means to remove heat from the indoor environment.

In meeting these obligations, account must be taken of the safety of any occupant and reasonable enjoyment of a residential property. ADO states that mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

ADO gives two methods of compliance; a simplified method and a dynamic thermal modelling method.

Simplified Method

Paragraph 3.3 of ADO states that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds:

- 40 dB $LA_{eq,8hours}$
- 55 dB $LA_{max,f}$ more than 10 times per night.

If open windows are proposed as mitigation for controlling overheating, the internal sound level predictions should be within the above limits with windows open. If an open window will result in these limits being

exceeded, one of the alternative methods should be adopted. ADO notes that it may be possible to increase the above values and still satisfy the requirements of the simplified method if acoustically specified balconies are used.

A useful approximation is that an outside to inside level difference for a window open to the extent that satisfies the simple method is 9 dBA for medium risk areas (which covers most areas of the country apart from some parts of London).

It follows that the following external sound levels are the limit at which the simplified method can be used and above which dynamic thermal modelling should be used to demonstrate compliance:

- 49 dB $LA_{eq,8hours}$
- 64 dB $LA_{max,f}$ more than 10 times per night.

Assessment At This Site

Full assessment to Part O requires overnight measurements. The data gathered during our shorter duration attended survey suggests that the site is likely to be around the borderline for compliance with the simplified method.

It is reiterated that this is a Building Regulations requirement rather than planning, but these requirements should be borne in mind by the design team and is included here for information.

To accurately assess compliance with the simplified method at this site, the best method is likely to be to take overnight logging measurements once the shell of the care home has been constructed and the boundary treatment for mitigation of fixed plant sound has been completed.

It is also worth noting that construction of the enterprise park extension will place structures between the A59 and the care home site, which is likely to further affect the environmental soundscape.

We can provide this further assessment if required as the project progresses.

8.0 **Sound Levels in Private Gardens**

There are no individual private gardens at the development, but the layout is likely to include areas of communal residents garden.

In absence of sound from the school, sound levels across the site fluctuate around the desirable target of 50 dB and generally remain within the upper limit of 55 dB

It is likely that there will be outdoor areas of the site where the desirable target of 50 dB can be achieved at most times for road noise, excluding contributions from the school.

It is concluded that imperforate boundary fences are not required for the control of traffic sound within guidelines issued by the WHO.

9.0 **Assessment of Fixed Plant Sound to BS 4142: 2014**

The noise rating method of BS 4142 is to measure the outdoor sound levels at noise-sensitive premises during the emission of noise from the industrial or commercial premises under investigation and measure the background sound level typical of that location in the absence of the industrial or commercial noise. A correction factor is applied if appropriate to the measured levels for some acoustic features which affect its acceptability, described as tonal, impulsive or other characteristic features which are distinctive against the residual acoustic environment. The corrected measured level, the rating level, is compared with the background.

- If the rating level exceeds the background by around +10 dB or more then this is an indication of a significant adverse impact, depending on the context.

- A difference of around +5 dB is an indication of an adverse impact, depending on the context.

- The lower the rating level is relative to the background, the less likely it is that the industrial / commercial source will have an adverse impact.

- Where the rating level does not exceed the background, this is an indication of the industrial / commercial source having a low impact, depending on the context.

Situations where a noise impact assessment may need to be modified due to the context include those where:

- The residual sound levels in the absence of the industrial / commercial source are particularly high or low.

- The character of the residual sound has acoustic features comparable to those of the industrial / commercial sound.

- The sensitivity of the receptor is significant, and whether residential properties incorporate design measures that secure good internal or outdoor acoustic conditions.

Section 12 of BS 4142 lists information that is to be reported in an assessment. This report follows the same order as the standard.

9.1 BS 4142: 2014 Assessment

(a) Qualifications and Experience

S & D Garritt Ltd are members of the Association of Noise Consultants (ANC). All work related to this report was undertaken by David Garritt.

David Garritt has been a member of the Institute of Acoustics since 2005 and holds an honours degree in Electronic and Computer Systems Engineering.

David teaches acoustics at post graduate level on a part time basis for the Institute of Acoustics and sits on the ANC Communications and PR Committee. David has extensive experience in the preparation of surveys involving industrial sound sources directly comparable to the subject of this report.

(b) Sources Being Assessed

Sound levels were measured at the proposed event site and we also had discussions with the food processing plant operator to ensure that our measurements were representative of their normal operation.

The sound sources being assessed are a line of outdoor Copeland Eazycool fixed plant units/chillers, mounted on the north east wall of the food processing plant that shares a boundary with the development site. These units were the only source audible or measurable from the food processing plant, all internal operations being subjectively inaudible during all periods of our survey.

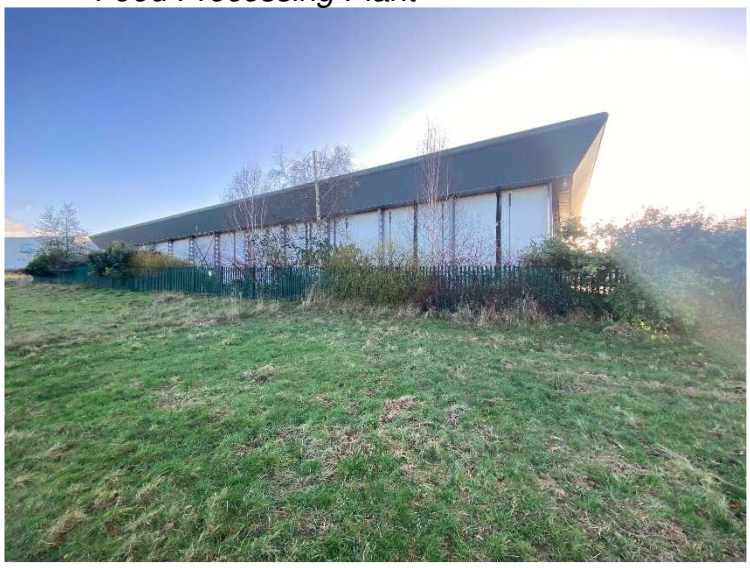
Sound levels taken at the boundary of the development site and food processing plant showed results of 55 - 56 dB $LA_{eq,T}$, at a distance of 9m – 10m from the closest unit.

Plant items may run at any time of day or night and were at their normal operational rates during our survey periods. It has been assumed that the plant items may run continuously for the assessment periods of one hour during the daytime and fifteen minutes at night.

Plant items are mounted at ground level a short distance from the north elevation of the food processing plant building. The units represent several fixed point sources with a reflective surface behind them. During calculations, the effect of the reflective building has been taken into account and that for propagation to the north, sound is likely to decay at a rate that falls between point and line source behaviour.

Fixed Plant Items

Food Processing Plant



(c) **Subjective Impressions**

At the measurement position at the boundary of the site and food processing plant, sound from a fixed plant units was subjectively dominant over other audible environmental sound.

At the closest elevation of the care home, fixed plant sound was still clearly audible and it was concluded could be measured directly during lulls in other environmental sources.

The subjective audibility diminishes across the proposed development site is distance to the food processing plant increases.

Subjective impressions of the existing noise climate in the absence of fixed plant sound was predominantly road traffic as may be expected for the location, with clearly audible contributions from the primary school when children were outside for break times or PE lessons.

(d) **Existing Context**

The site is currently open grassland in a mixed-use area that comprises a business park to the south/south east, a primary school to the north, open land to the east that is subject to planning permission for a business park extension, the remaining surrounding uses being well established existing dwellings.

The food processing plant is clearly visible from the proposed site and the fixed plant runs continuously, which should provide immediate information for prospective residents that the area is mixed-use and that some audibility of commercial or industrial sound may be expected.

The nearest proposed care home elevation lies at a greater distance from the food processing plant than the previously permitted development of dwellings.

It is proposed as part of the development plans that a noise barrier will be constructed on land between the care home and the fixed plant, which will provide practicable reduction of outdoor sound. It remains of significant importance at the indoor acoustic environment is consummate for the preservation of living and sleeping amenity.

Residents of these care homes generally prefer a feeling of being included within the community and environment, rather than excluded from it by a series of acoustic measures that prevent visual inclusion, but maintaining a view of the rear of industrial premises is not thought to have particular merit. The care home developer has considerable experience and generally the residents are less sensitive to particular characteristics of the outdoor sound environment, but the preservation of indoor living and sleeping amenity should not be overlooked.

(e) **Measurement Locations**

Receptors

The receptor location is the proposed care home. The grid reference of the site centre is SD 73891 38433. The grid reference of the closest item of fixed plant to the site is SD 73923 38377. The distance between the closest part of the care home building and the nearest item of fixed plant is approximately 30m.

The site is currently open grassland and relatively flat. The food processing plant building provides a reflective surface behind the fixed plant items, which as noted above has been taken into consideration in the calculations of distance decay.

Background sound level measurements were taken on site. Some contribution was noted from fixed plant items at the majority of locations, so some short duration measurements were taken further away from the factory and details including the previously submitted acoustic report have been considered in the assessment of background sound level.

Location plans are given earlier in this report.

(f) Instrumentation

Equipment Description	Type number	Manufacturer	Date of expiration of Calibration	Calibration Certificate Number
Sound Level Meter	XL2 TA s/n A2A-10019-EO	NTi Audio	14.08.2023	178637
Microphone	MK 224 s/n 213144A	Cirrus Research	14.08.2023	178634
Calibrator	4231 s/n 2402706	Bruel & Kjaer	20.07.2023	177551

(g) Operational Tests

1. The reference level of the calibrator is 94 dB SPL at 1000 Hz.

2. The meter readings with the calibrator before and after measurements were also 94.0 dB SPL. No drift was apparent during any measurements.

(h) Weather Conditions

Weather conditions during the survey were ideal for the measurement of outdoor sound. Temperatures were 8 – 10 ^{O}C during daytime periods, falling to 4 – 7 ^{O}C at night. There was very little wind evidence during our survey periods, with wind speeds generally less than 2 – 3 ms^{-1}. Cloud cover was minimal and there was no precipitation.

(i) Date and Time of Measurements

Source sound levels were measured on Monday 28th November. Background sound levels were measured using attended on Monday 28th November and the evening / night of Wednesday 30th November – Thursday 1st December.

(j) Measurement Time Intervals

Background sound levels were measured over continuous 15 minute intervals in accordance with BS 4142: 2014. Measurements of fixed plant items were taken over time periods that allowed the measured results to settle to a constant value.

(k) Reference Time Interval

The reference time interval is 1 hour during the daytime and 15 minutes at night in accordance with 3.8 of BS 4142.

(l) Specific Sound Levels

Specific sound levels as received at the nearest care home elevation were ascertained using direct measurements at that location and also measurements at the site boundary with appropriate calculations for distance decay.

Fixed plant was in continuous operation, so it was not possible to directly measure residual sound levels at the measurement locations in the absence of fixed plant sound. The subjective impression was that measurements taken at the site boundary were dominated by fixed plant sound, and it still provided a main source in measurements at the nearest care home elevation, especially when taken during lulls and other environmental sound.

The sound levels measured at the boundary with the food processing plant were 55 – 56 dB $LA_{eq,T}$, at a distance of approximately 9 – 10m from the nearest plant item.

The specific daytime sound levels at the nearest point of the proposed care home are:

- 48 – 50 dB $LA_{eq,T}$ by direct measurement
- 50 – 51 dB $LA_{eq,T}$ by calculation.

These two datapoints agree with each other within the normal tolerance expected of environmental sound measurement. The calculation method uses a series of worst-case assumptions, so it would be expected that this result is slightly higher than that obtained using the method of direct measurement. It is concluded that a reasonable worst-case, suitable overall figure for the specific sound level at the nearest care home elevation is 50 dB $LA_{eq,T}$.

At night, sound levels from the fixed plant items appear to be generally around 2 – 4 dBA lower than typical daytime levels, possibly due to reduced operating loads likely to be evident at night. When determining potential indoor sound levels, the higher daytime levels have been used for all times to provide a reasonable worst-case scenario and so that mitigation seeks to preserve living and sleeping amenity under all reasonably expected conditions.

It is concluded that a reasonable worst-case, suitable overall figure for the specific sound level at the nearest care home elevation is 50 dB $LA_{eq,T}$ daytime and 47 dB LA_{eq} at night. Contours showing the typical specific sound level across the site are shown on page 13 of this report.

(m) Background Sound Level

As noted earlier in the report, the background sound level at positions closest to the food processing plant are affected by sound from the units themselves.

In order to determine the reasonable, typical background sound level in the absence of fixed plant sound the results obtained at other positions on the development site, additional measurements further away and data obtained for the publicly available previous acoustic survey have all been considered.

It is concluded that the typical background sound level in the absence of fixed plant sound would be 44 dB $LA_{90,15mins}$ during the daytime and 37 dB $LA_{90,15mins}$ at night.

(n) Rating Levels

The fixed plant items are assumed to run continuously during the full assessment periods to provide a worst case scenario with no time correction, so no penalty is appropriate for intermittency. The operation of the units is not impulsive.

The objective assessment of tones (containing the appendices of this report) shows the presence of a tone in source measurements, which dissipates over the distance to the nearest care home elevation, where objective methods show no tone evident.

Despite the objective assessment method, it was judged that a tone was slightly perceptible at some points around the nearest care home elevation. A correction or penalty of 3 dB (half of the available 6 dB) has

been added to the specific sound level to take account of this.

The BS 4142 Rating Levels become up to 53 dB during the daytime and 50 dB at night

(o) **Background Comparisons**

Comparisons between the Rating Levels and the typical background sound levels are:

- Rating Level 9 dB above daytime background
- Rating Level 13 dB above night time background

The estimation of impacts is that the Rating Level exceeding the background by around +10 dB or more is an indication of a significant adverse impact, depending on the context.

(p) **BS 4142 Conclusions**

It is proposed to construct a 2 m high imperforate timber fence on top of a 1m to 2m earth bund at the corner of the proposed development site facing the food processing plant.

The attenuation offered by a barrier is generally around 10 dBA (according to the approximation given in BS 5228 and the theory of Maekawa for the physics of this site situation). There may be some sound reflected from the building elevation of the food processing plant, though approximations have been included in the distance decay assumed as part of the predictions.

It remains likely that a significant reduction in fixed plant sound can be achieved by the implementation of this noise barrier, with a corresponding reduction of likely noise impact.

Internal sound levels have been calculated within living rooms and bedrooms that show compliance with the normal criteria given in BS8233 and the more stringent frequency dependent Noise Rating levels for potentially annoying sources. These calculations have been undertaken assuming no barrier effect to first floor windows facing the fixed plant. It appears likely that some benefit at first floor level may be realised from the barrier, depending on precise sight-lines and so these represent worst-case calculations. This provides comfort that living and sleeping amenity can be preserved irrespective of the outdoor situation.

It is noted that the previous application for dwellings obtained planning permission with similar mitigation measures for private dwellings at closer proximity to the food processing plant, the conclusion being that mitigation measures were adequate for the predicted noise impact.

With the barrier in place it is likely that there will be significant areas of the care home grounds where the Rating Level will approximate to the background and be below the point at which the BS4142 assessment would be adverse impact.

It is concluded that mitigation can be applied that preserves internal amenity and improves external amenity compared to the open site situation and also represents a slightly more favourable scenario than the previously permitted residential development.

Comments on uncertainty for the overall survey are given in the appendices of this report.

APPENDIX 1

UNCERTAINTY

The uncertainties apparent in this acoustic survey and how they have been minimised are considered in this section.

Measurements of the existing sound climate have been undertaken on site using attended measurements over reasonable worst case daytime and night time periods, including from adjacent school and industrial premises. Predictions have been undertaken on each 15 minute logged measurement to more accurately allow for the perception of sound, as opposed to predictions that rely on time averaging over longer periods. Multiple datapoints have been used where possible to increase confidence and reduce uncertainty in measurements, including consideration of previously prepared acoustic reports for the site.

The procedures used for the calculation of sound levels at the different elevations are based on fundamental principles of acoustics. Sound decay with distance from the sources has been calculated using the principles and methods recommended in BS 5228, including the method of Rathe that takes account of the size of the building elevation and the decay characteristics of it. Internal sound levels have been calculated using the more rigorous method of BS 8233 : 2014, which considers transmission through each of the building elements.

The addition and subtraction of sound levels was done logarithmically on an energy basis, which is the correct method for decibel calculations. It is anticipated that this method would be considered by other suitably qualified acousticians to be relevant, correct and appropriate for this survey and is a method examined by the Institute of Acoustics on their post graduate diploma course.

All sound level measurements were taken with a calibrated type 1 sound level meter, which represents the most accurate type of SLM available. Sound levels were measured to the nearest 0.1 dB, time periods were measured and recorded to the nearest second. No rounding was done in any calculations, the only rounding being done on final results. The sound level meter was calibrated before and after each survey period and no drift was apparent.

It is concluded that the uncertainty in this survey has been minimised as far as possible and is believed to be below the level at which it would have an impact on the assessment conclusions contained in this report.

APPENDIX 2

OUTDOOR SOUND LEVELS & INTERIOR SOUND CALCULATIONS

MORE RIGOROUS CALCULATION METHOD OF BS 8233: 2014

The method in BS 8233:2014 requires certain building parameters to be known or assumed as part of the calculation procedure. The interior layout and room dimensions have been taken from layouts supplied to us and included later in the appendices.

Living Room

Building Element	Value (m^2)
Reference absorption A_0	10
Total façade area S_f	31.2
Window area S_{wi}	14.4
External Wall area S_{ew}	16.8
Ceiling area S_{rr}	67.5
Total area $S = S_f + S_{rr}$	98.7

Bedrooms

Building Element	Value (m^2)
Reference absorption A_0	10
Total façade area S_f	9.9
Window area S_{wi}	2.2
External Wall area S_{ew}	7.7
Ceiling area S_{rr}	12.2
Total area $S = S_f + S_{rr}$	22.0

Standard absorption figures given in BS have been used for bedrooms. The communal living rooms at these care home sites are far larger than typical domestic living rooms and so custom absorption date is used based on the dimensions of room elements and absorption coefficients of the various room surfaces.

The sound reduction indices of the recommended building specifications are given below:

Sound reduction indices. dB

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
4-16-6 glazing	19	21	20	26	38	37	39	43
4-16-6.8 acoustic	19	20	26	34	45	45	50	54
6-16-6.8 glazing	21	21	28	37	48	48	54	57
5000EAW.AC1 ventilator	33	39	38	31	44	43	46	49
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Titon SFX V25 + C25	33	37.8	37.6	34.4	32.1	42.4	48.8	55.4
Titon SFX V50 / SFSA C25	34	37.9	37.7	33.4	36.3	47.1	49.2	57
Ceiling R (single 12.5mm)	29	34	40	45	49	46	48	50
Ceiling R (double board)	35	40	46	51	55	52	54	56

The overall outdoor-to-indoor sound level difference represented by the

building elements is calculated using the method in BS 8233:2014 as:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Living Room North Facing	20	24	25	29	43	45	49	47
Living Room South Facing	22	25	26	29	42	42	46	43
Bed, Facing North	21	23	30	30	44	46	50	54
Bed, Facing East	21	24	25	29	31	39	43	48
Bed, Facing East, Upgraded	21	23	29	32	31	40	47	53
Bed, Facing South	22	24	31	30	42	41	44	48

The calculations involved in obtaining the 'Overall Loss' are lengthy, so the workings are omitted from this report for conciseness and readability. The overall loss predictions of the building envelope are applied to the measured frequency spectra in each 15 minute measurement period.

The barrier effects to different elevations of the care home building are shown below.

The predicted overall dBA values and linear frequency spectra inside rooms at the care home are shown in the tables below and overleaf.

Internal Sound Level Predictions, dB(A), Linear L_{eq} and L_{max}

Facing North / School

		Bedroom			Living Room		Indoor Bedroom									Indoor Living Room									Indoor Bed Max							
Date	Time	Day L_{eq}	Night L_{eq}	Night L_{max}	Daytime L_{eq}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	11:16	17.5			18.3		41.3	26.3	11.2	11.7	5.0	1.6	0	0		41.8	25.8	16.1	12.9	6.1	3.0	0	0		45.6	30.5	15.8	15.3	12.7	8.1	0	0
28/11/2022	11:31	13.6			14.5		35.0	23.2	8.0	9.0	3.9	3.2	0	0		35.5	22.7	12.9	10.2	5.0	4.7	0	0		40.1	29.2	15.2	17.4	13.9	17.0	4.2	0
28/11/2022	11:46	15.7			16.8		35.2	24.5	10.6	12.5	7.8	6.5	0	0		35.6	24.1	15.5	13.8	8.9	8.0	0	0		49.8	38.7	29.8	37.3	29.7	30.1	18.0	1.7
28/11/2022	12:01	20.9			21.8		40.3	29.6	12.7	18.4	12.9	11.5	0	0		40.7	29.1	17.6	19.7	14.0	13.0	0	0		50.1	38.6	32.3	42.7	29.3	28.1	13.4	0
28/11/2022	12:16	21.1			22.1		40.7	29.7	13.1	18.7	13.4	11.1	0	0		41.2	29.3	18.0	20.0	14.5	12.6	0.9	0		50.3	41.3	31.9	42.9	29.1	27.6	17.6	9.4
28/11/2022	12:31	23.1			24.2		41.8	28.5	14.7	21.4	16.3	14.3	1.3	0		42.3	28.0	19.6	22.7	17.4	15.8	2.7	0		54.9	37.9	31.2	38.4	31.3	33.1	15.3	0
28/11/2022	12:46	22.9			24.1		41.3	27.8	13.2	19.5	17.6	15.3	1.8	0		41.8	27.4	18.1	20.7	18.7	16.8	3.1	0		48.8	38.6	26.2	31.8	32.3	32.2	16.3	1.0
28/11/2022	13:04	19.8			20.3		40.2	32.7	11.7	15.5	6.3	1.1	0	0		40.7	32.3	16.6	16.7	7.5	2.5	0	0		51.0	45.6	25.0	32.4	21.6	16.5	12.0	1.9
28/11/2022	13:19	18.6			19.5		38.8	28.5	13.2	16.5	9.3	4.3	0	0		39.2	28.0	18.1	17.7	10.4	5.8	0	0		49.2	44.5	28.7	37.1	27.5	23.1	13.7	7.8
28/11/2022	13:34	19.8			20.8		37.1	27.2	12.2	18.4	13.2	9.7	0	0		37.5	26.8	17.1	19.7	14.3	11.2	0	0		47.9	44.2	28.5	34.5	31.4	31.9	13.4	0
28/11/2022	13:49	18.7			19.7		38.3	27.5	11.9	17.2	10.7	5.4	0	0		38.8	27.0	16.7	18.5	11.8	6.9	0	0		47.7	39.8	24.5	37.7	31.7	30.0	18.6	0
28/11/2022	14:04	19.9			20.6		40.0	30.6	12.1	16.9	11.0	7.0	0	0		40.4	30.1	16.9	18.2	12.1	8.5	0	0		50.0	47.2	27.5	33.4	28.2	25.2	11.6	0
28/11/2022	06:12		18.6	26.1			41.9	30.9	6.2	5.6	1.2	0	0	0		42.4	30.5	11.1	6.9	2.3	0	0	0		50.4	35.3	10.8	16.5	12.3	11.5	0	0
28/11/2022	06:27		18.7	26.6			41.6	31.3	7.3	7.2	2.3	0	0	0		42.1	30.9	12.1	8.4	3.4	0	0	0		49.5	37.1	13.2	19.6	15.7	13.9	0	0
28/11/2022	06:42		18.5	28.9			41.8	30.7	7.7	7.7	2.5	0	0	0		42.2	30.2	12.6	8.9	3.6	0	0	0		50.1	40.8	22.8	24.2	15.8	15.2	2.8	0
28/11/2022	06:57		18.8	28.2			42.0	30.8	7.7	7.6	4.4	0.4	0	0		42.5	30.4	12.5	8.9	5.5	1.9	0	0		50.9	36.1	18.3	22.7	19.8	16.7	7.3	0

Living room levels from highest school sound equivalent to NR 21

Facing North East / Closest to A59

		Bedroom			Living Room		Indoor Bedroom									Indoor Living Room									Indoor Bed Max							
Date	Time	Day L_{eq}	Night L_{eq}	Night L_{max}	Daytime L_{eq}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	09:06	22.3			23.1		43.5	33.4	19.5	12.8	15.8	2.8	0	0		43.9	32.8	24.9	16.7	15.2	3.5	0	0		50.6	39.3	29.9	19.2	23.4	11.3	2.1	0
28/11/2022	09:21	22.2			23.1		41.6	34.6	20.4	12.9	15.1	2.3	0	0		42.0	34.0	25.8	16.7	14.5	3.0	0	0		50.1	42.3	33.7	23.4	26.9	16.7	1.3	0
28/11/2022	09:36	23.9			25.8		43.0	34.5	24.7	17.0	17.2	9.6	0	0		43.4	33.9	30.2	20.9	16.5	10.3	0	0		52.9	42.5	37.5	27.1	32.2	33.9	21.6	0
28/11/2022	09:51	22.4			22.9		41.8	34.3	16.4	13.3	17.0	7.1	0	0		42.2	33.7	21.8	17.1	16.3	7.8	0	0		50.6	47.1	31.9	29.6	28.6	27.7	12.9	0
28/11/2022	15:01	21.7			22.2		41.1	33.5	16.4	12.4	16.3	5.5	0	0		41.5	33.0	21.9	16.2	15.6	6.2	0	0		49.5	39.4	28.4	27.7	26.5	21.4	5.4	0
28/11/2022	15:16	22.6			24.2		41.8	33.3	22.6	16.2	16.4	4.5	0	0		42.2	32.7	28.1	20.1	15.7	5.2	0	0		52.2	39.5	35.4	26.7	27.4	21.3	2.8	0

		Bedroom			Living Room		Indoor Bedroom									Indoor Living Room									Indoor Bed Max							
Date	Time	Day L_{eq}	Night L_{eq}	Night L_{max}	Daytime L_{eq}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	17:04	23.8			24.6		44.1	35.3	21.3	13.2	17.7	6.7	0	0		44.6	34.7	26.7	17.1	17.1	7.4	0	0		50.3	40.9	34.5	19.6	25.0	22.7	7.8	0
28/11/2022	17:19	23.4			23.9		43.1	35.4	18.1	13.0	18.0	5.8	0	0		43.5	34.8	23.6	16.9	17.3	6.5	0	0		50.6	41.5	30.1	17.8	27.7	18.5	10.0	0
28/11/2022	17:34	22.7			23.1		43.1	34.9	15.4	12.4	15.9	8.5	0	0		43.5	34.3	20.9	16.2	15.3	9.2	0	0		47.2	37.2	20.4	18.8	21.9	25.3	10.6	0
01/12/2022	00:02		16.8	29.8			36.9	28.8	7.0	4.3	11.2	1.5	0	0		37.3	28.2	12.4	8.2	10.5	2.2	0	0		49.3	40.0	18.2	18.5	25.2	19.1	10.5	0
01/12/2022	00:17		18.0	33.4			37.7	29.7	8.3	6.2	13.4	1.3	0	0		38.1	29.1	13.7	10.0	12.7	2.0	0	0		51.5	46.5	22.0	21.2	26.4	21.8	8.4	0
01/12/2022	00:32		18.0	32.9			38.0	29.7	9.3	6.0	13.0	0	0	0		38.4	29.1	14.7	9.9	12.3	0.3	0	0		53.2	46.2	28.6	18.7	23.8	15.5	3.5	0
01/12/2022	00:47		16.5	30.3			36.2	26.3	10.3	5.4	12.8	0.5	0	0		36.6	25.7	15.7	9.2	12.1	1.2	0	0		49.2	37.8	25.0	20.1	26.7	20.6	4.8	0
28/11/2022	05:38		19.0	34.1			39.2	28.5	10.5	7.6	15.3	4.9	0	0		39.6	27.9	15.9	11.5	14.6	5.5	0	0		49.6	41.3	23.3	22.7	32.3	22.5	11.0	0
28/11/2022	05:53		18.2	33.8			38.6	27.8	9.7	5.3	14.3	4.8	0	0		39.0	27.2	15.1	9.2	13.6	5.5	0	0		50.9	35.0	19.6	22.3	32.2	23.2	9.1	0

Facing East

		Bedroom			Living Room		Indoor Bedroom									Indoor Living Room									Indoor Bed Max							
Date	Time	Day L_{eq}	Night L_{eq}	Night L_{max}	Daytime L_{eq}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	10:09	21.8			23.6		43.7	32.0	16.9	10.1	16.4	2.2	0	0		44.1	30.6	27.1	16.9	16.0	4.7	0	0		48.7	36.8	30.7	27.2	26.1	15.3	0	0
28/11/2022	10:24	22.1			23.5		44.1	32.4	16.3	9.3	16.6	3.1	0	0		44.5	31.0	26.5	16.1	16.1	5.6	0	0		51.8	38.8	22.2	19.0	25.4	16.0	4.2	0
28/11/2022	10:39	22.2			23.5		44.0	32.5	15.7	9.1	17.2	3.6	0	0		44.4	31.1	25.9	15.9	16.7	6.1	0	0		50.4	40.9	21.3	16.2	28.8	20.2	7.1	0
28/11/2022	10:54	21.9			23.6		43.7	32.8	17.1	8.7	15.9	3.2	0	0		44.1	31.4	27.3	15.5	15.4	5.7	0	0		55.2	40.2	27.3	15.0	27.1	18.0	2.7	0
28/11/2022	14:24	22.3			23.7		44.1	32.5	16.6	8.3	17.1	4.9	0	0		44.5	31.1	26.8	15.1	16.6	7.4	0	0		52.9	38.3	24.8	20.0	27.1	17.7	6.7	0
28/11/2022	14:39	21.7			23.1		43.7	32.6	15.9	7.9	15.5	2.7	0	0		44.1	31.3	26.2	14.7	15.1	5.2	0	0		52.1	37.0	21.9	13.7	21.8	13.3	3.2	0
30/11/2022	22:56	18.9	18.9	28.8	20.2		40.4	29.8	12.9	5.2	13.3	0	0	0		40.8	28.5	23.2	12.0	12.8	2.3	0	0		51.0	39.6	22.6	17.1	21.9	12.6	3.0	0
30/11/2022	23:11		18.5	32.2			40.1	30.0	12.9	4.1	12.1	0	0	0		40.5	28.7	23.2	11.0	11.6	2.2	0	0		51.0	43.2	21.4	16.1	28.7	15.4	2.2	0
30/11/2022	23:26		18.4	29.5			40.4	29.1	12.5	4.6	12.5	0	0	0		40.8	27.7	22.8	11.4	12.0	1.9	0	0		51.1	39.3	20.8	13.0	24.2	16.4	12.9	0
30/11/2022	23:41		18.7	29.7			40.3	29.2	12.5	5.2	13.4	0.5	0	0		40.7	27.9	22.8	12.0	12.9	3.0	0	0		52.3	39.3	21.3	15.5	23.8	15.6	3.0	0
28/11/2022	06:02		20.1	31.9			41.9	30.4	14.5	6.5	14.9	2.4	0	0		42.3	29.0	24.7	13.3	14.4	4.9	0	0		51.3	36.1	21.6	13.6	29.8	20.3	7.8	0
28/11/2022	06:17		20.6	31.4			42.6	31.4	16.6	6.8	14.4	1.9	0	0		43.0	30.0	26.9	13.6	13.9	4.4	0	0		52.9	39.5	23.6	13.5	27.8	15.2	3.7	0
28/11/2022	06:32		21.5	34.9			42.4	33.1	16.6	7.2	15.8	2.9	0	0		42.9	31.7	26.8	14.0	15.3	5.4	0	0		54.8	47.9	23.0	21.1	28.2	18.7	6.3	0
28/11/2022	06:47		20.3	29.6			42.0	31.0	16.5	6.4	14.6	1.8	0	0		42.4	29.6	26.7	13.3	14.1	4.3	0	0		50.8	38.2	23.5	15.5	25.7	14.4	0.7	0

Facing South East Closest to Plant, Daytime Fixed Plant and Road Noise

Method	Bedroom	Living Room		Indoor Bedroom									Indoor Living Room							
	Day L_{eq}	Daytime L_{eq}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
Direct Measurement	21.1	21.3		45.4	30.9	14.4	12.5	2.1	0.4	0	0		45.6	30.4	18.9	13.1	2.1	0	0	0
Direct Measurement	18.8	19.1		42.5	28.6	12.7	11.8	3.1	3.3	0	0		42.7	28.1	17.3	12.4	3.0	2.0	0	0
Direct Measurement	22.0	22.1		45.5	34.0	13.4	12.1	2.8	0	0	0		45.7	33.4	18.0	12.8	2.7	0	0	0
Calculation	26.4	26.6		48.2	39.7	20.8	18.9	0.8	0	0	0		48.3	39.1	25.4	19.6	0.8	0	0	0
Calculation	26.9	27.1		49.4	39.5	22.1	18.3	1.2	0	0	0		49.6	39.0	26.6	19.0	1.1	0	0	0

Living Room and Bedroom levels are NR 15 based on measurements, NR 21 based on worse case calculations

Outdoor Sound Levels

North

			Outdoor dBA						Outdoor Leq (Hz)									Outdoor Lmax (Hz)							
Date	Time		*dB* LA_{eq}	*dB* LA_{max}	*dB* LA_{min}	*dB* LA_{10}	*dB* LA_{90}		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	11:16		52.9	57.9	49.3	55.4	50.0		62.0	49.5	40.7	42.0	49.0	48.0	41.0	37.7		66.3	53.7	45.3	45.6	56.6	54.6	45.5	47.2
28/11/2022	11:31		53.1	62.2	48.3	61.4	50.9		55.8	46.4	37.5	39.4	47.8	49.7	41.4	31.8		60.9	52.5	44.8	47.7	57.8	63.5	54.6	38.0
28/11/2022	11:46		56.6	76.5	48.1	64.8	52.6		55.9	47.7	40.1	42.9	51.7	53.0	44.9	31.0		70.5	62.0	59.3	67.7	73.6	76.5	68.5	55.6
28/11/2022	12:01		61.5	73.0	50.6	64.8	54.6		61.0	52.8	42.2	48.8	56.8	58.0	48.7	34.4		70.9	61.8	61.8	73.1	73.2	74.6	63.9	53.6
28/11/2022	12:16		61.7	72.3	50.4	64.7	55.4		61.4	53.0	42.6	49.1	57.3	57.6	50.0	40.2		71.0	64.5	61.4	73.3	73.0	74.0	68.1	63.3
28/11/2022	12:31		64.6	80.6	52.1	67.5	57.6		62.6	51.7	44.2	51.8	60.2	60.8	51.8	36.8		75.6	61.1	60.7	68.8	75.2	79.6	65.8	49.9
28/11/2022	12:46		65.4	78.0	53.5	71.2	59.3		62.0	51.1	42.7	49.8	61.5	61.8	52.3	40.6		69.6	61.8	55.7	62.1	76.2	78.6	66.8	54.8
28/11/2022	13:04		53.6	64.8	43.2	57.1	45.3		61.0	55.9	41.2	45.8	50.3	47.5	41.8	32.1		71.7	68.8	54.5	62.8	65.5	62.9	62.4	55.8
28/11/2022	13:19		56.4	71.2	43.5	59.8	46.6		59.5	51.7	42.7	46.9	53.2	50.8	44.4	32.8		70.0	67.7	58.2	67.4	71.4	69.6	64.2	61.7
28/11/2022	13:34		60.6	78.8	42.7	64.0	45.4		57.8	50.5	41.7	48.8	57.1	56.2	48.2	32.1		68.6	67.5	58.0	64.8	75.3	78.4	63.8	47.4
28/11/2022	13:49		57.6	77.7	40.4	60.8	44.5		59.1	50.7	41.4	47.6	54.6	51.9	45.5	29.6		68.5	63.0	54.0	68.1	75.6	76.5	69.0	50.3
28/11/2022	14:04		58.3	72.0	42.9	61.6	44.9		60.7	53.8	41.6	47.3	54.9	53.5	46.1	32.7		70.8	70.4	57.0	63.8	72.1	71.7	62.0	52.1
28/11/2022	06:12		48.4	58.1	41.1	51.5	42.5		62.7	54.2	35.7	36.0	45.1	42.8	34.0	24.7		71.2	58.6	40.3	46.9	56.3	57.9	47.6	41.5
28/11/2022	06:27		49.2	60.9	42.3	51.4	44.0		62.4	54.6	36.8	37.5	46.2	43.2	35.5	24.2		70.3	60.3	42.8	49.9	59.6	60.3	50.4	44.2
28/11/2022	06:42		49.7	63.3	41.2	52.0	43.7		62.5	53.9	37.2	38.1	46.4	44.4	35.0	25.7		70.9	64.0	52.3	54.6	59.8	61.7	53.3	51.9
28/11/2022	06:57		51.8	65.9	41.2	54.8	44.0		62.7	54.1	37.2	38.0	48.3	46.8	38.8	23.8		71.7	59.3	47.8	53.0	63.7	63.2	57.8	43.2

North East

			Outdoor dBA						Outdoor Leq (Hz)									Outdoor Lmax (Hz)							
Date	Time		$dB\ LA_{eq}$	$dB\ LA_{max}$	$dB\ LA_{min}$	$dB\ LA_{10}$	$dB\ LA_{90}$		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	09:06		49.5	55.3	43.9	50.6	45.6		64.1	57.2	44.1	42.2	46.7	41.3	31.6	21.0		71.3	63.2	54.5	48.6	54.2	49.8	44.8	36.8
28/11/2022	09:21		49.1	58.2	42.8	50.9	44.5		62.2	58.5	45.0	42.2	46.0	40.9	31.9	21.3		70.7	66.2	58.3	52.8	57.8	55.2	44.0	38.3
28/11/2022	09:36		53.2	73.9	44.3	53.8	46.6		63.7	58.4	49.4	46.4	48.0	48.1	40.3	22.5		73.5	66.4	62.1	56.4	63.0	72.4	64.4	42.3
28/11/2022	09:51		51.3	65.3	43.8	52.5	45.7		62.4	58.2	41.0	42.6	47.9	45.6	35.9	20.4		71.2	71.0	56.5	59.0	59.5	66.2	55.6	38.2
28/11/2022	15:01		50.2	59.4	43.4	52.5	45.1		61.7	57.4	41.1	41.7	47.2	44.0	34.7	23.8		70.2	63.3	53.1	57.1	57.4	59.9	48.1	42.1
28/11/2022	15:16		50.6	60.1	44.2	52.2	46.5		62.5	57.2	47.2	45.6	47.3	43.0	33.8	21.5		72.8	63.3	60.1	56.0	58.3	59.8	45.5	41.2
28/11/2022	17:04		51.7	61.0	42.7	53.7	44.2		64.8	59.2	45.9	42.6	48.6	45.2	35.7	23.4		70.9	64.8	59.1	49.0	55.9	61.2	50.5	37.8
28/11/2022	17:19		51.5	58.7	43.8	52.9	45.1		63.8	59.3	42.7	42.4	48.9	44.3	35.1	22.1		71.2	65.4	54.7	47.2	58.5	57.0	52.7	37.9
28/11/2022	17:34		51.5	64.2	41.8	51.7	43.4		63.8	58.8	40.1	41.7	46.8	47.1	36.7	26.2		67.8	61.1	45.1	48.2	52.8	63.8	53.3	47.4
01/12/2022	00:02		45.3	57.1	42.3	48.5	42.8		57.5	52.7	31.6	33.7	42.1	40.1	28.2	16.9		70.0	63.9	42.8	47.9	56.0	57.6	53.2	42.6
01/12/2022	00:17		46.6	61.0	40.8	49.0	42.2		58.3	53.6	32.9	35.6	44.3	39.8	29.9	15.8		72.2	70.4	46.7	50.5	57.3	60.3	51.1	34.4
01/12/2022	00:32		45.9	55.4	42.3	49.0	44.0		58.7	53.6	33.9	35.4	43.9	38.1	27.5	14.7		73.9	70.1	53.2	48.0	54.6	54.0	46.2	33.2
01/12/2022	00:47		45.8	59.0	42.1	48.5	44.2		56.9	50.2	34.9	34.8	43.7	39.1	28.0	15.7		69.9	61.7	49.7	49.5	57.6	59.1	47.5	35.9
28/11/2022	05:38		49.0	61.8	43.3	50.6	44.2		59.9	52.4	35.1	37.0	46.1	43.4	34.5	18.2		70.3	65.2	47.9	52.1	63.1	61.0	53.7	34.5
28/11/2022	05:53		48.4	63.8	40.1	50.8	41.4		59.3	51.7	34.3	34.7	45.1	43.4	33.9	19.3		71.6	58.9	44.2	51.7	63.0	61.7	51.8	37.0

East

			Outdoor dBA						Outdoor Leq (Hz)									Outdoor Lmax (Hz)							
Date	Time		$dB\ LA_{eq}$	$dB\ LA_{max}$	$dB\ LA_{min}$	$dB\ LA_{10}$	$dB\ LA_{90}$		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000
28/11/2022	10:09		50.1	61.9	46.1	51.1	48.0		64.3	55.1	46.3	42.4	47.5	42.5	32.6	27.3		69.4	59.9	60.1	59.5	57.2	55.6	43.3	43.2
28/11/2022	10:24		50.4	59.3	44.5	52.5	47.2		64.7	55.5	45.7	41.7	47.6	43.5	35.1	25.1		72.5	61.9	51.6	51.4	56.4	56.3	50.7	42.8
28/11/2022	10:39		50.9	61.6	45.8	52.8	47.8		64.6	55.6	45.1	41.4	48.2	44.0	35.3	25.0		71.0	64.0	50.7	48.6	59.9	60.5	53.6	40.8
28/11/2022	10:54		50.1	58.3	45.6	51.8	47.8		64.3	55.9	46.5	41.0	46.9	43.5	36.4	25.5		75.8	63.3	56.7	47.4	58.2	58.4	49.2	44.0
28/11/2022	14:24		51.3	58.8	45.2	53.0	47.0		64.7	55.6	46.0	40.6	48.2	45.3	38.0	23.9		73.5	61.4	54.2	52.4	58.2	58.0	53.2	41.0
28/11/2022	14:39		49.7	56.6	46.8	50.7	48.2		64.4	55.7	45.4	40.2	46.6	43.0	36.5	27.1		72.7	60.1	51.3	46.0	52.9	53.6	49.7	42.6
30/11/2022	22:56		47.1	55.7	43.8	49.8	45.4		61.0	52.9	42.3	37.6	44.4	40.2	32.9	23.7		71.7	62.7	52.0	49.4	53.0	53.0	49.5	46.1
30/11/2022	23:11		46.4	59.6	43.3	49.2	45.3		60.7	53.2	42.4	36.5	43.1	40.0	32.7	18.7		71.7	66.3	50.8	48.5	59.8	55.7	48.7	35.6
30/11/2022	23:26		46.7	60.8	44.0	49.6	45.1		61.0	52.2	41.9	36.9	43.6	39.7	35.3	23.2		71.7	62.4	50.2	45.3	55.2	56.7	59.4	47.2
30/11/2022	23:41		47.3	57.3	44.6	50.3	46.1		60.9	52.3	41.9	37.5	44.4	40.9	32.4	23.2		73.0	62.4	50.7	47.8	54.8	56.0	49.5	48.0
28/11/2022	06:02		48.9	61.9	44.7	50.0	47.0		62.6	53.5	43.9	38.8	45.9	42.7	34.2	22.1		71.9	59.2	51.0	46.0	60.8	60.7	54.3	43.8
28/11/2022	06:17		48.8	59.4	45.0	50.6	46.8		63.2	54.5	46.0	39.1	45.4	42.3	34.8	23.5		73.6	62.6	53.0	45.9	58.9	55.6	50.3	43.2
28/11/2022	06:32		49.8	60.6	44.0	51.1	45.0		63.1	56.2	46.0	39.5	46.9	43.2	34.4	21.2		75.5	71.1	52.4	53.4	59.3	59.0	52.8	42.6
28/11/2022	06:47		48.7	57.4	45.0	50.3	45.9		62.7	54.1	45.9	38.8	45.6	42.2	33.6	24.5		71.4	61.3	52.9	47.8	56.8	54.7	47.3	43.3

Fixed Plant

At care home by measurement and calculation

		Outdoor dBA						Outdoor Leq (Hz)							
Date		*dB LA_{eq}*	*dB LA_{max}*	*dB LA_{min}*	*dB LA_{10}*	*dB LA_{90}*		63	125	250	500	1000	2000	4000	8000
Direct Measurement		48.5	51.1	46.8	49.6	47.2		67.1	54.9	45.2	42.2	44.3	41.5	35.7	31.0
Direct Measurement		49.6	57.2	46.0	51.4	46.8		64.2	52.6	43.5	41.5	45.2	44.4	37.5	33.2
Direct Measurement		48.3	51.0	46.8	49.3	47.3		67.2	57.9	44.2	41.8	44.9	38.5	33.7	25.1
Calculated		50.9	61.9	52.7	56.6	54.3		69.9	63.6	51.6	48.6	43.0	39.0	33.2	26.8
Calculated		50.8	58.2	53.3	57.1	54.2		71.1	63.5	52.8	48.1	43.3	38.1	32.1	25.0

Objective Tone Calculations

Site Boundary	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
Source Level	57.2	74.5	56.7	57.2	68.3	49.4	51.5	53	49.1	52	48.6	50.6	45.2	43.2	42.5	43.2	40.2	39	37.4	34.5	33.3	31.5	28.5	26.8	23.9
Diff to band lower		17.3	17.8	0.5	11.1	18.9	2.1	1.5	3.9	2.9	3.4	2.0	5.4	2.0	0.7	0.7	3.0	1.2	1.6	2.9	1.2	1.8	3.0	1.7	
Diff to band higher		17.8	0.5	11.1	18.9	2.1	1.5	3.9	2.9	3.4	2.0	5.4	2.0	0.7	0.7	3.0	1.2	1.6	2.9	1.2	1.8	3.0	1.7	2.9	
Tone?		Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	

Site Boundary (2)	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
Source Level	57.1	75.8	57.6	55	68.2	49.2	46.3	54.6	50.9	52.3	48.7	49.6	44.4	43	43.9	43	40	37.7	35.7	33.7	32.2	29.4	26.3	24.9	23.3
Diff to band lower		18.7	18.2	2.6	13.2	19.0	2.9	8.3	3.7	1.4	3.6	0.9	5.2	1.4	0.9	0.9	3.0	2.3	2.0	2.0	1.5	2.8	3.1	1.4	
Diff to band higher		18.2	2.6	13.2	19.0	2.9	8.3	3.7	1.4	3.6	0.9	5.2	1.4	0.9	0.9	3.0	2.3	2.0	2.0	1.5	2.8	3.1	1.4	1.6	
Tone?		Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	

Care Home	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
Source Level	66.8	51.6	52	54.4	43	40.8	42.7	39.6	37.1	33.9	39.5	37.1	39.1	40.5	38.7	38.3	37	33.6	32.7	31.1	27.6	26.7	27.2	24.3	21.8
Diff to band lower		15.2	0.4	2.4	11.4	2.2	1.9	3.1	2.5	3.2	5.6	2.4	2.0	1.4	1.8	0.4	1.3	3.4	0.9	1.6	3.5	0.9	0.5	2.9	
Diff to band higher		0.4	2.4	11.4	2.2	1.9	3.1	2.5	3.2	5.6	2.4	2.0	1.4	1.8	0.4	1.3	3.4	0.9	1.6	3.5	0.9	0.5	2.9	2.5	
Tone?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	

#REF!	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
Source Level	63.6	53.1	51.2	51.9	42.5	40	41.3	37.6	34.9	34.2	37.8	37.3	39.7	40.9	40.6	40	39.2	39.6	35.8	30.5	28.5	28.2	29.1	28	25.9
Diff to band lower		10.5	1.9	0.7	9.4	2.5	1.3	3.7	2.7	0.7	3.6	0.5	2.4	1.2	0.3	0.6	0.8	0.4	3.8	5.3	2.0	0.3	0.9	1.1	
Diff to band higher		1.9	0.7	9.4	2.5	1.3	3.7	2.7	0.7	3.6	0.5	2.4	1.2	0.3	0.6	0.8	0.4	3.8	5.3	2.0	0.3	0.9	1.1	2.1	
Tone?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
