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Proposed Residential Development
Dry Hill Farm, Dry Hill Lane, Denby Dale, Huddersfield, HD8 8YN

Noise Impact Assessment

For:
L'Arche Developments

22nd August 2023

Ref: NIA-10970-23-11263-v1 Dry Hill Farm
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Contents

1 Introduction 1

1.1 Overview 1

1.2 Site Description and Development Proposals 2

2 Policy Context and Assessment Guidance 4

2.1 National Planning Policy Framework 4

2.2 Noise Policy Statement for England 4

2.3 Planning Practice Guidance on Noise 5

2.4 ProPG Planning and Noise: New Residential Development 5

3 Noise Survey 7

3.1 Overview 7

3.2 Summary 7

4 Noise Assessment 10

4.1 Design Noise Levels 10

4.2 Scheme of Sound Attenuation 10

4.3 External Amenity 11

5 Summary and Conclusions 12

Appendix 1 – Abbreviations and Definitions 13

Appendix 2 – Noise Measurement Positions 14

1 Introduction

1.1 Overview

Environmental Noise Solutions Ltd (ENS) has been commissioned by L'Arche Developments to undertake a noise survey and assessment for a proposed residential development at Dry Hill Farm, Dry Hill Lane, Denby Dale, Huddersfield, HD8 8YN (hereafter referred to as 'the site').

Outline planning permission for the development is currently sought under Planning Application ref: 2021/60/93287/E, which was submitted to Kirklees Council in August 2021. A consultation response from Environmental Health at Kirklees Council was subsequently received in May 2023. The following comments relate to noise at the site:

'The proposed development plans to introduce new sensitive receptors to the site. Further to our comments dated November 2021, the agent has added:

> *'The business next door is called Buckley Dairy LTD, but there are no cows on site, the milk is brought in/taken out by tankers, arctic lorries'*

After confirmation of the adjacent commercial activities and liaising with Food Safety colleagues, we understand there are early morning deliveries and despatches. Noise from which is likely to have the potential to cause an adverse impact on the residential amenity of the proposed development. For that reason, we revise our previous recommendations and require additional information before the application is determined.

Before the application can be determined, details of an assessment of all significant noise sources likely to affect the proposed development including commercial premises by a suitably competent person (see note) must be submitted in writing to the Local Planning Authority. The report shall:

> *a) Determine the existing noise climate*
>
> *b) Predict the noise climate in the living rooms and gardens (daytime), bedrooms (night-time) and other habitable rooms of the development*
>
> *c) Detail the proposed attenuation/design necessary to protect the amenity of the occupants of the new residences. If the noise attenuation measures include windows being kept closed, then details of alternative ventilation over background ventilation will be required.*

If the levels predicted in the report are unacceptable, it may be necessary to refuse the application. Otherwise, it may be necessary to specify attenuation measures as conditions of consent.'

The objectives of the noise impact assessment were therefore to:

- Determine external noise levels at the site
- Assess the potential impact of the external noise climate on the proposed residential development with reference to relevant guidelines
- Provide recommendations for a scheme of sound attenuation works, as necessary, to protect future occupants of the proposed residential development from a loss of amenity due to noise

This report details the methodology and results of the assessment and provides recommendations for the building envelope (fenestration and ventilation). It has been prepared to accompany Planning Application ref: 2021/60/93287/E submitted to Kirklees Council.

The report has been prepared for L'Arche Developments for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties referring to the report should consult L'Arche Developments and ENS as to the extent to which the findings may be appropriate for their use.

A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

1.2 Site Description and Development Proposals

The site is located at Dry Hill Farm, near Denby Dale, and comprises a number of derelict farm sheds (to be demolished) and areas of hardstanding. The site boundary is shown (highlighted in red) in Figure 1.1.

Figure 1.1: Location of Proposed Development

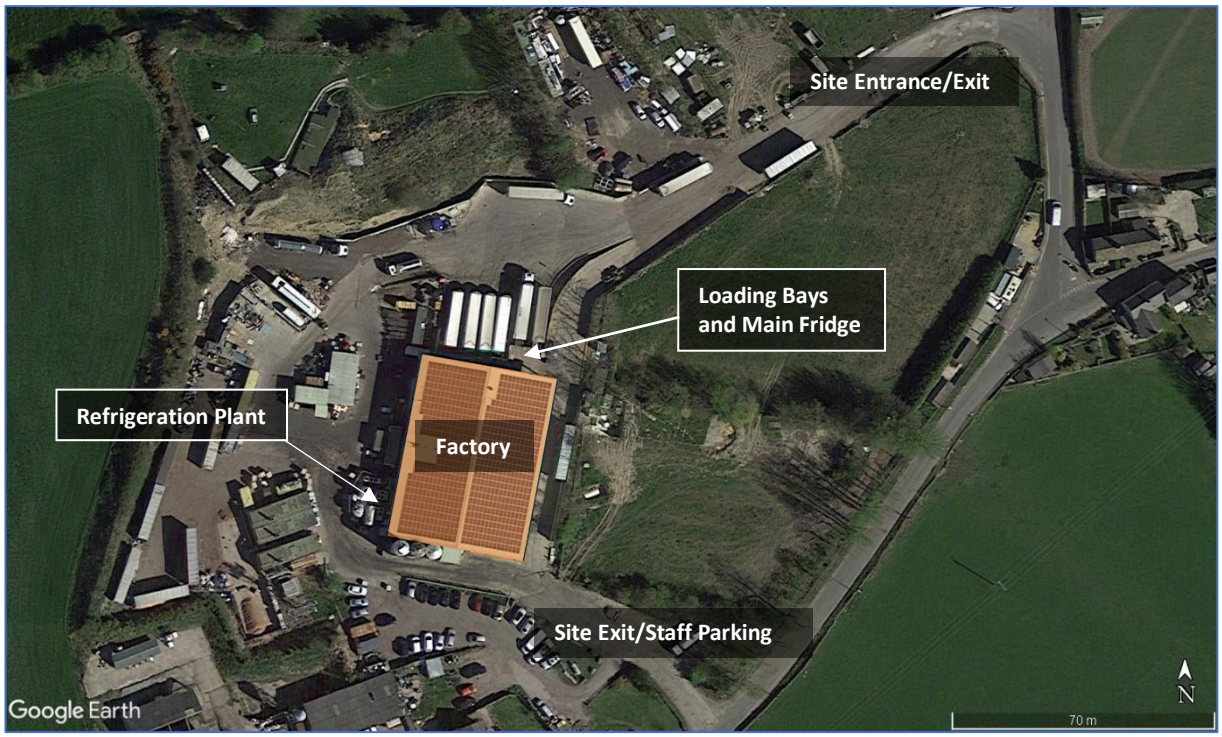
The site is bound by:

- Buckley's Dairy to the north
- Dry Hill Lane to the south
- Existing residential dwellings to the east
- Open farmland to the west

Buckley's Dairy includes a main factory building, loading bays/service yard, external refrigeration plan, access roads and parking.

The loading bays at the dairy are located at the northern elevation of the factory and are therefore significantly screened from the proposed dwellings at the site. The refrigeration plant is located at the south-western corner of the factory building and dominates the noise climate at the northern boundary of the development site. Figure 1.2 contains an annotated site plan.

Figure 1.2: Annotated Site Plan



As noted, Buckley Dairy may have deliveries throughout the night.

The ambient noise climate at the site is due to continuous plant noise from Buckley's Dairy, distant road traffic noise on the A635, and intermittent vehicles along Dry Hill Lane.

Development proposals are for the demolition of the derelict buildings on site and for the erection of 4 no. residential dwellings with associated landscaping and access roads. Layout plans indicate that the residential footprint is set back circa 45 metres from Dry Hill Lane.

2 Policy Context and Assessment Guidance

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[1] was updated in 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

Where issues of noise impact are concerned the NPPF provides brief guidance in paragraph 174 where it states that planning policies and decisions should contribute to and enhance the natural and local environment by:

'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of.....noise pollution'.

Paragraph 185 advises that:

'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should.....mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life'.

The NPPF also refers to the 2010 DEFRA publication, the Noise Policy Statement for England (NPSE) which reinforces and supplements the NPPF.

2.2 Noise Policy Statement for England

The Noise Policy Statement for England[2] (NPSE) sets out the long-term vision of promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. This long-term vision is supported by the following aims:

- Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life
- Where possible, contribute to the improvement of health and quality of life

The NPSE describes the following levels at which noise impacts may be identified:

- NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise
- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected
- SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur

According to the explanatory notes in the statement, where a noise level falls between the lowest observable adverse effect level (LOAEL) and a level which represents a significant observable adverse effect level (SOAEL):

'....all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.'

1 National Planning Policy Framework. Ministry of Housing, Communities and Local Government (2021)
2 Government Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. March 2010.

2.3 Planning Practice Guidance on Noise

Planning Practice Guidance[3] (PPG) is an online resource which provides additional guidance and elaboration on the NPPF. It advises that the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur
- Whether or not an adverse effect is occurring or likely to occur
- Whether or not a good standard of amenity can be achieved

In line with the Explanatory Note of the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

'…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation'.

The PPG also provides general advice on the typical options available for mitigating noise, suggesting that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

'Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed'.

With regard to the mitigation of extant environmental noise at a proposed residential development, the guidance states that:

'… consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations'.

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation. The following guidance documents provide some meaningful context.

2.4 ProPG Planning and Noise: New Residential Development

ProPG Planning and Noise: New Residential Development (ProPG)[4] was published in 2017 by the Association of Noise Consultants, Institute of Acoustics and the Chartered Institute of Environmental Health.

Stage 2: Element 2 of ProPG sets indoor ambient noise levels for residential dwellings based on the guidance contained in British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'[5] (BS 8233), see Table 2.1.

3 Planning Practice Guidance on Noise: http://planningguidance.planningportal.gov.uk/blog/guidance/noise/

4 'ProPG Planning and Noise: New Residential Development (ProPG)', 2017. Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH)

5 British Standards Institution (2014). *British Standard 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.*

Table 2.1: Indoor Ambient Noise Levels in Dwellings

Activity	Location	Good Indoor Ambient Noise Levels	
Resting	Living Room	35 dB $L_{Aeq\ (0700\text{-}2300)}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq\ (0700\text{-}2300)}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq\ (0700\text{-}2300)}$	30 dB $L_{Aeq\ (2300\text{-}0700)}$ 45 dB $L_{AFMax\ (2300\text{-}0700)}$

Note 4 to the above table states:

'A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.'

Note 5 to the above table states:

'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 L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7'.

This is consistent with the guidance contained within the PPG, which states that:

'… consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations'.

In addition to the above, Annex B of BS 8233 describes methods for assessing the acceptability of a noise spectrum for a given application through the use of Noise Rating (NR) curves. This is a graphical method for assigning a single-number rating to a noise spectrum, and many local authorities have a requirement to comply with NR25 in habitable rooms during the daytime and NR20 in bedrooms at night where commercial noise may be present.

On the basis of the above, the following criteria (with windows closed and an alternative means of ventilation provided) are considered appropriate for the proposed development and considered to represent good resting and sleeping conditions:

- ≤ 35 dB $L_{Aeq\ (0700\text{-}2300)}$ and NR25 in habitable rooms during the daytime
- ≤ 30 dB $L_{Aeq\ (2300\text{-}0700)}$ and NR20 in bedrooms during the night-time
- 45 dB L_{AFMax} not regularly exceeded in bedrooms during the night-time

With regard to external amenity, ProPG reflects the advice given in BS 8233 as follows:

'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 $L_{Aeq,16hr}$.'

'These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces.'

3 Noise Survey

3.1 Overview

In order to determine the level of external noise affecting the proposed development, noise monitoring was carried out on Thursday 22nd June through to Friday 23rd June 2023, and on Friday 18th August 2023.

The adopted noise monitoring positions (shown in Appendix 2) were as follows:

- MP1 was located at the northern site boundary, in the vicinity of Buckley's Dairy, at 4 metres above ground level (AGL)
- MP1A was located at the northern site boundary, in the vicinity of Buckley's Dairy, at 1.5 metres AGL
- MP2 was located at the southern development footprint, at circa 45 metres from Dry Hill Lane, at 4 metres AGL

Noise measurements were undertaken in free field conditions using Bruel & Kjaer 2250 and NTi XL3 Type 1 integrating sound level meters. Each meter was connected to a windshield covered microphone positioned at the locations detailed above.

The measurement system calibration was verified immediately before and after the survey period using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration levels greater than 0.5 dB was noted.

Measurements consisted of A–weighted broadband parameters including L_{Aeq}, L_{A10} L_{A90}, and L_{AFmax} together with 1/3rd octave band data.

The noted weather conditions during the survey were dry with wind speeds < 5 m/s. Weather conditions were therefore considered appropriate for noise monitoring.

3.2 Summary

Noise at the northern boundary of the site was primarily due to continuous refrigeration plant noise at Buckley's Dairy, and were consistently **52–53 dB $L_{Aeq\ (15\ min)}$** at MP1. Maximum noise levels were up to **60 dB L_{AFMax}** during the night-time.

Table 3.1 presents the worst-case octave band frequency data at MP1, rounded to the nearest decibel.

Table 3.1: MP1 Octave Band Frequency Data

Octave Band L_{eq}								dB L_{Aeq}
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
54	54	52	50	50	42	37	29	53

Noise levels at MP1A (1.5 metres above ground level) were circa 5 dB lower due to existing boundary screening, at circa **48 dB $L_{Aeq\ (15\ min)}$.**

Table 3.2 overleaf presents a summary of the noise data for each measurement session, at each measurement position, rounded to the nearest decibel. Where feasible, noise from birdsong in close proximity to the microphone has been excluded using Bruel & Kjaer Evaluator software.

Table 3.2: Summary of Noise Measurement Data

Position	Date	Time	$L_{Aeq,T}$ (dB)	L_{AFmax} (dB)	L_{A90} (dB)	L_{A10} (dB)	Comment
MP1	22/06/23	1124–1130	52	58	52	54	Constant refrigeration plant at Buckley's Dairy, occasional FLT movements, no HGV movements noted, birdsong
		1130–1145	52	61	51	53	
		1145–1200	52	58	52	53	
		1200–1215	52	60	52	54	
		1215–1230	52	60	52	54	
		1230–1245	52	62	52	53	
		1245–1300	52	62	52	54	
		1300–1315	52	59	52	53	
		1315–1330	51	58	51	53	
		1330–1345	51	62	51	53	
		1345–1400	51	61	51	53	
		1400–1415	51	60	50	53	
		1415–1425	52	61	51	55	
	23/06/23	0415–0430	52	55	52	54	Constant refrigeration plant at Buckley's Dairy (no HGV movements or external yard activity), birdsong
		0430–0445	53	57	53	54	
		0445–0500	53	58	53	54	
		0500–0515	53	59	52	54	
		0515–0530	52	58	52	54	
		0530–0545	53	59	52	54	
		0545–0600	53	58	52	54	
		0600–0615	53	57	53	54	
		0615–0630	53	56	53	54	
		0630–0645	52	60	52	54	
		0645–0700	52	58	52	54	
MP1A	18/08/23	1020–1034	48	58	46	49	Constant refrigeration plant at Buckley's Dairy, occasional FLT movements, no HGV movements noted, birdsong
		1039–1054	48	59	47	49	
MP2	22/06/23	1135–1235	43	61	34	46	Occasional vehicles along Dry Hill Lane (circa 80 vehicles/hour during the daytime), distant traffic noise from the A635, birdsong
		1235–1335	43	64	34	46	
		1335–1435	44	64	34	47	

Whilst no tanker movements were noted during the monitoring, it is acknowledged that there may be deliveries during the night-time period. The nearest proposed dwelling (Plot 3) is set back circa 22 metres from the dairy site exit access road. There are 6 loading bays at the dairy, and a site speed limit of 5 MPH.

In order to consider the impact of deliveries during the night-time, the Sound Exposure Level (SEL) is used. The SEL of a single discrete noise event is the level which if maintained constant for a period of one second would contain as much A-weighted sound energy as is contained in the actual noise event.

The SEL of HGV movements at low speed has previously been measured by ENS at circa **86 dB(A)** at 5 metres.

Assuming point source propagation (–6 dB per doubling of distance), this equates to an SEL of **73 dB(A)** at 22 metres (considered representative of Plot 3).

Assuming all 6 bays are used in a single hour during the night-time, the following formula may be used for calculating the L_{Aeq} level from the SEL:

$L_{Aeq,\,T} = 10 * \log_{10} [(n \times 10^{SEL/10}) / T]$ where:

- SEL is the worst case Single Event Level (73 dB(A))
- n is the number of occurrences (6)
- T is the time period in seconds (3600)

Processing the above formula, the resultant sound pressure level is **45 dB $L_{Aeq\ (1\ hour)}$** at Plot 3.

Such levels are significantly below the continuous plant noise level of **53 dB $L_{Aeq\ (15\ min)}$** as measured at MP1. It is therefore considered that the mitigation measures required to control plant noise ingress will readily control noise from HGV movements.

Noise at the southern boundary of the site (MP2) was primarily due to local and distant road traffic, and birdsong, with daytime ambient noise levels of circa **43 dB $L_{Aeq,\,T}$**. Such levels are relatively low.

4 Noise Assessment

4.1 Design Noise Levels

Noise levels at the location of Plot 3 (adjacent to/fronting towards Buckley's Dairy) are as follows:

- **≤ 53 dB $L_{Aeq\ (15\ min)}$**
- **≤ 60 dB L_{AFMax}** during the night-time

Noise levels throughout the remainder of the site (set back from Buckley's Dairy) were circa **43 dB $L_{Aeq,T}$** during the daytime.

4.2 Scheme of Sound Attenuation

In order to calculate the sound insulation requirements of the building envelope for habitable rooms throughout the development, the Building Research Establishment (BRE) building envelope insulation calculation spreadsheet was used. This spreadsheet is based on the calculation methodology advocated in BS 8233. The spreadsheet allows input of external noise levels, typical room dimensions and reverberation time together with parameters for the various elements of the building envelope and calculates the internal noise level in terms of the external noise level metric (L_{Aeq} and L_{AFMax} in this case).

As a precaution against potential noise from Buckley's Dairy, it is recommended that Plot 3 is provided with a mechanical ventilation strategy. Appropriate ventilation solutions include:

- A fully ducted mechanical ventilation system with heat recovery (MVHR)
- A System 3 mechanical extract ventilation (MEV) system

In dwellings where the air permeability is tighter than (<) 5m³/(h.m²), 5000 mm² EA background ventilators may be required where MEV are proposed. In this instance, it is recommended that acoustic wall vents rated at least **40 dB $D_{n,e,w}+C_{tr}$** per 8000 mm² EA (vent open), such as the Ryton AAC125HP, or equivalent, are provided. Background ventilators are not required where an MVHR system is used.

Habitable rooms of Plot 3 should be fitted with double glazing rated at least **28 dB R_w+C_{tr}** (such as 6 mm glass / 6-20 cavity / 4 mm glass).

Adopting octave data from the worst-case noise level of **53 dB $L_{Aeq\ (15\ min)}$** as detailed in Table 3.1, the following BS 8233 calculation spreadsheet demonstrates that bedrooms of Plot 3 will readily achieve compliance with the noise rating target of NR 20. Ambient noise levels are also at least 7 dB below the night-time criteria contained in BS 8233.

Figure 4.1 – NR20 Assessment for Plot 3 Bedroom (Volume = 25 m³)

	Octave Frequency Band (Hz)								L_{Aeq}
	63	125	250	500	1000	2000	4000	8000	
Worst Case Yard Noise (MP2)	54	54	52	50	50	42	37	29	53
External Wall (5.4 m²)	38	41	45	45	54	58	58	58	
6 / 6-20 / 4 double glazing (1.8 m²)	18	21	20	26	38	37	39	39	
Ryton AAC125HP (1 no.)	39	42	37	38	43	57	57	57	
Total Façade Reduction	-23.7	-26.7	-25.5	-30.6	-39.5	-42.7	-44.5	-44.5	
10 log (S/A)	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	
External to Internal Correction	+3	+3	+3	+3	+3	+3	+3	+3	
INTERNAL NOISE LEVEL	32	29	28	21	12	1	0	0	23
NR20	51	39	31	24	20	17	14	13	
Compliant	✓	✓	✓	✓	✓	✓	✓	✓	

Remaining plots at the development may be fitted with standard double glazing rated at least **25 dB R_w+C_{tr}** in conjunction with standard trickle vents rated at least **33 dB $D_{n,e,w}$** per 5000 mm² EA (vent open), such as the Greenwood 5000EA or equivalent (2 no. vents per habitable room).

The following points should be noted:

- The glazing recommendations apply to the window within a sealed unit. It is the responsibility of the window supplier to ensure that the window frame does not compromise the performance of the glazing.

- When selecting a glazing system to satisfy the requirements outlined above, it is important to ensure that the R_w + C_{tr} value is achieved (rather than simply the R_w value). Published R_w values tend to be higher than corresponding R_w + C_{tr} values; therefore, incorrect selection could result in an overestimation of sound reduction performance which in turn could result in higher internal noise levels.

- The opening and free area of the ventilation units should be checked by a mechanical service engineer before designs are finalised. Should the equivalent open area be insufficient to meet the minimum requirements of ADF, it may be necessary to increase the number of units per habitable room. Where this applies, the required sound reduction of the ventilation units may need to be increased accordingly

- Internal noise levels due to mechanical ventilation plant should not exceed 26 dB(A) in bedrooms and 30 dB(A) in living rooms

A detailed building envelope specification can be provided when the detailed layout is determined. The ambient noise climate at the site is, however, suitable for residential development.

With the provision of enhanced glazing and mechanical ventilation, the proposed development will not place any unreasonable constraints on Buckley's Dairy and is therefore in keeping with the aims of Paragraph 187 of the NPPF.

4.3 External Amenity

Daytime ambient noise levels at MP1 were measured at up to **53 dB $L_{Aeq\ (15\ min)}$**. However, noise levels at ground level (MP1A) were circa 5 dB lower due to screening between the site and the dairy plant, and were measured at circa **48 dB $L_{Aeq\ (15\ min)}$**. Such levels are below the desirable value described in ProPG/BS 8233 for gardens.

Further to this, the site layout indicates that Plot 3 will front towards the dairy, such that the garden of this plot will be screened by the dwelling itself.

Gardens of remaining plots are set further back from the dairy and are all set to the rear.

On this basis, there is no issue with respect to external amenity.

5 Summary and Conclusions

A noise impact assessment has been undertaken for the proposed residential development at Dry Hill Farm, Dry Hill Lane, Denby Dale, Huddersfield, HD8 8YN.

The noise environment at the site is due to fixed plant at Buckley's Dairy, distant road traffic noise on the A635, intermittent road traffic on Dry Hill Lane, and birdsong.

A scheme of sound insulation works has been developed to protect the development from the ambient noise climate.

With the provision of enhanced glazing and mechanical ventilation to Plot 3, the proposed development will not place any unreasonable constraints on Buckley's Dairy and is therefore in keeping with the aims of Paragraph 187 of the NPPF.

Appendix 1 – Abbreviations and Definitions

Sound Pressure Level (L_p)
The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$L_p = 20 \log_{10}(p/p_o)$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_o = reference sound pressure (20 µPa).

A-weighting
A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$
The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$
The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$
The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$
The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Single Event Level / Sound Exposure Level (SEL or L_{AE})
The energy produced by a discrete noise event averaged over one second, regardless of the event duration. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_W)
Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Appendix 2 – Noise Measurement Positions