A Noise Assessment
for Land to the West of Chilgrove Drive, North of Camp Road and adjoining former RAF Upper Heyford, Upper Heyford, incorporating former MOD gymnasium

On behalf of E.P. Barrus Limited

November 2014

resound acoustics

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Appendices

1 INTRODUCTION

1.1 This noise assessment has been prepared in support of a hybrid application comprising:

1) application for full planning permission for Phase One works comprising erection of 9,837 sq.m. warehouse with associated service yard and access; and

2) outline application for Phase Two works comprising office and training school, and manufacturing, storage and distribution buildings with associated parking and landscaping.

1.2 Resound Acoustics Limited has been appointed by E.P. Barrus Ltd to prepare this noise assessment.

1.3 The scope of this assessment includes consideration of the existing noise climate at noise-sensitive receptors around the site, and the likely noise emissions from E.P. Barrus Ltd, whose activities have been measured at their current location.

1.4 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, an introduction to noise and vibration and an explanation of the terminology used in this report is contained in Appendix A.

2 SITE DESCRIPTION

Existing Site Conditions

2.1 The site is situated within the urban boundary of Upper Heyford in Oxfordshire to the north-west of the junction of Camp Road and Chilgrove Drive, with the approximate Ordnance Survey Grid Reference of SP5215725867 (WGS84 Geoid Lat/Long: 51.928885,-1.242885). The nearest post code is OX27 7PH.

2.2 The current site covers approximately 5.7ha and is bounded:

- to the north and north-west by the former RAF Upper Heyford airbase;
- to the east by Chilgrove Drive and agricultural land;
- to the south by Camp Road, with a mobile home site 90 metres to the south-west; and
- to the west by a field and residential properties some 150 metres from the site boundary.

2.3 A site location plan is shown in Figure B.1 in Appendix B.

Proposed Development

2.4 E.P. Barrus Ltd manufactures a range of engines for marine, gardening and industrial uses, and they intend to relocate their operations from their current base in Bicester to the application site. The relocation will take place over two phases:

- Phase 1 is the relocation of the storage and distribution facilities;
- Phase 2 is the relocation of the production facilities, offices and training school.

2.5 The proposed site layout is shown in Lyons+Sleeman+Hoare Architect's drawing *Proposed Site Plan – Phases 1 and 2* (drawing number 13087/P-20, revision B, dated 12/09/14), which is contained in Figure B.2 in Appendix B.

2.6 E.P. Barrus will undertake the manufacture and assembly of engines using a variety of hand tools and small machines. The completed engines will be tested in dedicated engine test cells within the production facility. Forklifts will also be used at the site, and it is understood that E.P. Barrus operate electric forklifts only. The forklifts operate mainly within the warehouse building, although may on occasion operate outside in the service yard area.

2.7 It is understood that E.P. Barrus Ltd will operate during daytime hours only, i.e. not outside 07:00 to 19:00 hours, although three members of staff are anticipated to arrive just before 06:00 hours, with up to three heavy goods vehicles leaving the site before 06:30 hours.

2.8 Other than vehicle movements and loading/unloading activities, it is understood that E.P. Barrus will not undertake any regular activities outside the proposed buildings at the site.

2.9 Large engines may be tested outside on occasion, but it is understood that this is a rare occurrence.

2.10 It is understood that the wall construction of the proposed buildings at the site will comprise 70mm core thickness trapezoidal Kingspan insulated sound panels. Data provided by the manufacturer states that this should provide a sound reduction of 25dB R_W.

2.11 It is understood that the ceiling construction of the proposed buildings at the site will comprise a twin skin PVC fabric Thermohall roof with 100mm thick Rockwool insulation. Data provided by the manufacturer states that this should provide a sound reduction of 13dB R_W.

2.12 The engine test cells within the production building are to be located within high performance enclosures, such that there is little engine noise outside the structure. This is the same as at E.P. Barrus' existing facility.

2.13 Although the layout of the Phase 2 development has not yet been finalised, it is understood that the external plant, including the cooling plant and generators, will be located adjacent to the south-western corner of the Phase 2 building.

3 GUIDANCE

Local Authority Consultation

3.1 The Environmental Health department of Cherwell District Council was consulted to ensure that their views were taken into account in this assessment. The following scope of work was agreed:

- baseline noise measurements over 24 hour weekday and weekend to establish the existing noise levels at and around the site;
- noise from the proposed activities at the site to be calculated based on measurements of the intended end-user's existing operations at another site;
- noise from the proposed activities at the site assessed using BS4142: 2014;
- assessment outcomes to be compared with the guidance in the National Planning Policy Framework, the Noise Policy Statement for England, and the Planning Practice Guidance for noise;
- assessing night-time maximum noise levels from the site against the guidance in the World Health Organisation's *Guidelines for Community Noise*; and
- assessment of construction noise and vibration.

National Planning Policy Framework

3.2 The Department for Communities and Local Government published the *National Planning Policy Framework* (NPPF) on 27th March 2012 and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance (PPG) 24 *Planning and Noise*, which until the emergence of the NPPF, set out the Government's position on how noise should be dealt with in the planning system.

3.3 The guidance set out in PPG24 has been replaced in the NPPF by four aims, which are set out at paragraph 123 in Section 11 of the document, titled *Conserving and enhancing the natural environment*:

"Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

3.4 There are two footnotes to the above guidance. The first footnote refers to the *Explanatory Note of the Noise Policy Statement for England*, which defines both *"significant adverse impacts on health and quality of life"* and *"adverse impacts on health and quality of life"* as described in the first two bullet points.

3.5 The second footnote indicates that the third bullet point is *"subject to the provisions of the Environmental Protection Act 1990 and other relevant law"*.

Noise Policy Statement for England

3.6 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE) in March 2010. The explanatory note of NPSE defines the terms used in the NPPF:

"2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

3.7 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

"2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

3.8 There is no local or national guidance on how the three terms should be defined numerically.

3.9 There are three aims in the NPSE, which match, and expand upon, the first two bullet points in paragraph 123 of the NPPF and add a third aim that relates to a wider improvement in health and quality of life (the bold text is in the NPSE):

"The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.25 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

National Planning Practice Guidance

3.10 In March 2014, the Government released Planning Practice Guidance (PPG) on noise, titled *Noise*. This document sets out a number of principles in the form of questions and answers, and reinforces the guidance set out in the NPPF and the NPSE.

3.11 The noise PPG notes that:

"Noise needs to be considered when new development may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."

3.12 It goes on to note that:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *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; and*
- *whether or not a good standard of amenity can be achieved."*

3.13 The noise PPG broadly repeats the NPSE definitions of the NOEL, LOAEL and SOAEL and it provides a summary table to explain how the terms relate to each other and to typical human reactions to sound. The table is replicated below in Table 3.1.

Table 3.1: Planning Practice Guidance summary of noise exposure hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No observed effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
		Lowest observed adverse effect level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
		Significant observed adverse effect level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable adverse effect	Prevent

Local Planning Policies

3.14 Cherwell District Council is currently preparing its new Local Plan, which will replace the current plan. Until it is adopted, the retained policies in the *Cherwell Local Plan*, which was adopted on 6th November 1996 remain valid for development control purposes.

3.15 Policy ENV1 *Pollution Control* is the only retained policy that relates to noise emissions from a development site. It states:

"Development which is likely to cause materially detrimental levels of noise, vibration, smell, smoke, fumes or other type of environmental pollution will not normally be permitted."

British Standard 5228

3.16 Part 1 of British Standard (BS) 5228: 2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites (including Amendment 1)*, titled *Noise*, sets out a method for predicting, assessing and controlling noise levels arising from a wide variety of construction and related activities and sets out tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.

3.17 Noise levels generated by a construction site will depend upon a number of variables, the most significant of which are:

- the amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
- the periods of operation of the plant at the development site, known as the "on-time";
- the distance between the noise source and the receptor, known as the "stand-off";
- the attenuation due to ground absorption or barrier screening effects; and
- the reflection of noise due to the presence of hard vertical faces such as walls.

3.18 The prediction method set out in Part 1 of BS5228 takes account of each of these variables, and provides typical source emission levels for a range of construction plant undertaking specific construction activities.

3.19 The predicted construction noise levels have been assessed against criteria derived using the "ABC Method" as described in Section E.3.2 of BS5228, which states:

"Table E.1 shows an example of the threshold of potential significant effect at dwellings when the site noise level, rounded to the nearest decibel, exceeds the listed value. The table can be used as follows: for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5dB. This is then compared with the site noise level. If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect."

3.20 Table E.1 of BS5228 is reproduced here as Table 3.2.

Table 3.2: Threshold Of Significance Effect At Dwellings

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value, dB		
	Category A[(A)]	Category B[(B)]	Category C[(C)]
Night-time (23:00 to 07:00)	45	50	55
Evenings and weekends[(D)]	55	60	65
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75

Notes:
[(A)] Category A: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are less than these values.
[(B)] Category B: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values.
[(C)] Category C: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values.
[(D)] 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays

3.21 There are further notes to the table in BS5228, which state:

"Note 1: A potential significant effect is indicated if the L_{Aeq} noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total L_{Aeq} noise level for the period increases by more than 3dB due to site noise.

Note 3: Applied to residential receptors only."

3.22 Part 2 of BS5228: 2009, titled *Code of practice for noise and vibration control on construction and open sites Part 2: Vibration*, relates to vibration that may be impulsive, such as that due to hammer-driven piling; transient, such as that due to vehicle movements along a railway; or continuous, such as that due to vibratory driven piling. The primary cause of community concern generally relates to building damage from both construction and operational sources of vibration, although the human body can perceive vibration at levels that are substantially lower than those required to cause building damage.

3.23 BS5228 indicates that vibration might be just perceptible at 0.14mm/s (peak particle velocity or ppv) in the most sensitive situations for most vibration frequencies associated with construction. The standard goes on to note that at 0.3mm/s vibration might be just perceptible in residential environments, at 1.0mm/s vibration in residential environments is likely to cause complaint although it can be tolerated if prior warning and explanation has been given to the residents and at 10mm/s vibration is likely to be intolerable for any more than a very brief exposure.

3.24 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce cosmetic damage such as a crack in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during the construction works, is associated with perceptibility.

3.25 For cosmetic damage to residential properties in good condition, i.e. without any specific structural weaknesses, BS5228 repeats the guidance contained in BS7385: Part 2: 1993 *Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from groundborne vibration*. It indicates that cosmetic damage may occur at peak particle velocities of 15mm/s and above.

British Standard 4142

3.26 British Standard (BS) 4142: 2014: *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

3.27 The industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes, upon which sound is incident.

3.28 The procedure contained in BS4142 is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

3.29 The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

3.30 The penalty for tonal elements is between 0dB and 6dB, and the standard notes:

"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."

3.31 The penalty for impulsive elements is between 0dB and 9dB, and the standard notes:

"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

3.32 The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15 minute intervals. The standard states that:

"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

3.33 The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

"a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

3.34 The standard goes on to note that:

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

3.35 BS4142 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

British Standard 8233

3.36 The scope of British Standard (BS) 8233: 2014 *Guidance on sound insulation and noise reduction for buildings* is the provision of recommendations for the control of noise in and around buildings. The standard suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate.

3.37 However, BS4142 does note that in certain situations, for example where the background sound levels are low, the absolute sound levels may be as relevant. Therefore, the guideline values in BS8233 have been used as a point of reference for the absolute sound levels.

3.38 BS8233 suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 3.3.

Table 3.3: BS8233 recommended internal noise levels, dB

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

3.39 BS8233 contains the following relevant guidance in footnotes to the above information:

"Note 4: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.

Note 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level.

Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

3.40 Although Note 4 above refers to setting a guideline value for maximum noise levels, BS8233: 2014 does not provide any guidance on a suitable criterion.

3.41 To estimate the noise levels within a property, it is necessary to allow for the reduction provided by the external building fabric of the building itself. It is generally accepted that a window will reduce external noise levels by 10dB even when its open. To illustrate this, BS8233: 2014 notes that the reduction from a partially open window can be taken to be 15dB. To provide some context, the reduction will be closer to 25 to 30dB when the window is closed.

3.42 To ensure a robust approach, the reduction from an open window is taken to be 10dB in this assessment.

World Health Organisation Guidelines

3.43 The World Health Organisation (WHO) *Guidelines for Community Noise* (1999) set out guidance on suitable internal and external noise levels in and around residential properties. The WHO guidelines state:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night."

3.44 The internal target noise level of 45dB L_{AFmax} translates to an external target noise level of 60dB L_{AFmax} when a correction of 10 to 15dB is taken into account, which is the correction that the WHO guidance states is the effect of an open window.

Design Manual for Roads and Bridges

3.45 Potential impacts associated with off-site operational traffic have been considered against the guidance set out in the Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7 Noise and Vibration.

3.46 DMRB provides guidance on how to assessment noise and vibration from road schemes in the UK. DMRB gives guidance and interpretation on the magnitude of noise impact from road traffic sources and it includes example impact scales for classifying the magnitude of short-term and long-term impacts, as shown in Tables 3.4 and 3.5.

Table 3.4: DMRB Short-Term Impact Scale

Change in Noise Level dB(A)	Magnitude of Impact
0	No change
0.1 - 0.9	Negligible
1.0 – 2.9	Minor or low
3.0 – 4.9	Moderate or medium
5+	Major or high

Table 3.5: DMRB Long-Term Impact Scale

Change in Noise Level dB(A)	Magnitude of Impact
0	No change
0.1 - 2.9	Negligible
3.0 – 4.9	Minor or low
5.0 – 9.9	Moderate or medium
10+	Major or high

3.47 The criteria above reflect key benchmarks that relate to human perception of sound. A change of 1dB is classed in DMRB as the smallest change that is considered perceptible in the short term, a 3dB change is considered to be the smallest change in noise that is perceptible in the long term, and a 10dB change is approximately a halving or doubling of loudness.

3.48 The short-term criteria specified in Table 3.4 have been used to assess the potential impacts from operational traffic associated with the proposed development.

3.49 To calculate the level of noise generated by traffic on a road, DMRB refers to the *Calculation of Road Traffic Noise* (CRTN), albeit with some additional guidance included in DMRB to allow for advances in road technology since the publication of CRTN. None of the modifications to the CRTN method contained in DMRB are relevant to the proposed development.

3.50 CRTN, published in 1988 by the former Department of Transport and The Welsh Office, sets out standard procedures for calculating noise levels from road traffic. The calculation method uses a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy goods vehicles, type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground, to predict the $L_{A10,18hour}$ or $L_{A10,1hour}$ noise level for any receptor point at a given distance from the road.

3.51 CRTN is only valid for traffic flows of more than 50 vehicles per hour or 1,000 vehicles per 18 hours. Below 100 vehicles per hour or 4,000 vehicles per 18 hours, a specific correction must be applied to account for the low traffic volumes.

3.52 Where required, the prediction method set out in CRTN has been used to determine the magnitude of impacts from off-site traffic noise.

ISO9613

3.53 The noise levels generated by the operation of the dust extract unit have been calculated using the proprietary noise modelling software CADNA, which implements the common European methods of noise prediction. In this instance, the noise predictions have been undertaken in accordance with the noise prediction framework set out in ISO 9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation*.

3.54 The ISO 9613 noise prediction model assumes that individual noise sources act as either point sources, where the noise level reduces by 6dB for every doubling of distance, as line sources, where the noise level reduces by 3dB for every doubling of distance or plane sources, where the noise level reduces by between 0 and 6dB for every doubling of distance, depending on the dimensions of the plane source and the proximity of the receptor.

3.55 The model takes into account the distance between the sources and the receptors and the amount of attenuation due to atmospheric absorption. The model assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3.56 The inherent uncertainty in the calculation method is stated in the standard as being accurate to ±3dB for distances of up to 1km, with an average height of propagation of up to 30 metres.

4 NOISE SURVEYS

4.1 Baseline noise measurements have been undertaken to establish typical weekday and weekend noise levels in the area. The baseline noise measurements were undertaken between Thursday 9th and Monday 13th October 2014.

4.2 Measurements of E.P. Barrus Ltd's current operations were undertaken on Thursday 9th October 2014.

4.3 The survey methodology and results are set out below.

Baseline Noise Survey

4.4 The baseline noise measurements were carried out using the equipment listed in Appendix C. The sound level meter was calibrated before the measurements using the listed acoustic calibrator and the calibration checked upon completion of the survey. No calibration drifts were found to have occurred. The sound level meter and acoustic calibrator were both calibrated to a traceable standard by a UKAS-accredited laboratory within the year preceding the survey.

4.5 The measurements were carried out at a single position, as shown in Appendix D, and described as follows:

- Position 1: on the western boundary of the site, approximately 50 metres north of Camp Road and considered representative of the noise-sensitive receptors closest to the site.

4.6 The microphone was set at a height of 1.5 metres above ground level under free-field conditions at both positions, i.e. at least 3.5 metres from any reflecting surfaces, other than the ground.

4.7 Measurements were undertaken between 14:00 hours on Thursday 9th and 07:00 hours on Monday 13th October 2014.

4.8 The dominant noise source at the measurement position was road traffic noise on local and more distant roads. Other noise sources included birdsong and occasional aircraft flying overhead. There were intermittent periods of very distant construction noise during the survey. These are not considered to have unduly affected the measured noise levels.

4.9 The weather during the survey was generally suitable for noise measurement, it being mainly dry with light winds of up to 5 m/s. There were periods of rain during the survey, however, these did not significantly affect the measured noise levels, particularly the background noise levels.

4.10 The baseline noise survey results are summarised in Table 4.1 and set out in full in Appendix E. The results summarised below have been averaged over the daytime (07:00 to 19:00 hours), evening (19:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) periods.

Table 4.1: Summary of measured baseline noise levels, Position 1, free-field dB

Day	Period	Duration (T)	$L_{Aeq,T}$	L_{A90} (1)	L_{A10} (1)	L_{AFmax}
Thursday 9th October 2014	Day	5 hours	53.0	45.7	56	63.5 to 71.0
	Eve	4 hours	49.1	34.5	51.7	64.0 to 73.3
	Night	8 hours	44.7	28.6	45.5	57.9 to 64.5
Friday 10th October 2014	Day	12 hours	50.9	43.1	54.0	62.5 to 70.4
	Eve	4 hours	45.1	31.6	48.9	59.3 to 65.0
	Night	8 hours	38.7	25.5	39.2	54.7 to 61.6
Saturday 11th October 2014	Day	12 hours	47.0	36.9	50.7	59.8 to 74.9
	Eve	4 hours	44.0	32.0	48.2	57.9 to 60.4
	Night	8 hours	40.0	31.1	40.5	56.5 to 65.8
Sunday 12th October 2014	Day	12 hours	46.7	41.9	48.6	58.5 to 69.7
	Eve	4 hours	45.4	43.1	47.0	56.2 to 60.1
	Night	8 hours	49.3	43.2	50.0	57.5 to 68.7

Notes:
(1) - The L_{A90} and L_{A10} values presented were calculated from the arithmetic mean of the $L_{A90,1hour}$ and $L_{A10,1hour}$ measurements for each period.

4.11 The lowest L_{Aeq} and the representative L_{A90} values for use in the assessment are shown in Table 4.2.

4.12 The L_{Aeq} noise levels are the lowest one hour values measured for each period of a weekday or weekend.

4.13 The L_{A90} data has been quantified in 15 minute periods to match the advice set out in BS4142. The L_{A90} values shown are the overall ranges of 15 minute values that occurred for each period at each position, and the representative value used in the assessment. The fifteen minute L_{A90} data is included in Appendix E.

4.14 The night-time L_{A90} values are for the period 05:30 to 07:00 hours, which is representative of the period of potential operational activity. The L_{A90} values have all been rounded to the nearest whole number, as required in BS4142: 2014.

Table 4.2: Summary of lowest measured noise levels, Position 1, free-field dB

Day	Period	$L_{Aeq, 1hour}$	$L_{A90, 15mins}$	
			Range of Values	Representative Value
Weekday	Day	49.4	39 to 50	40
	Eve	42.0	27 to 43	28
	Night	31.5	27 to 44(1)	28(1)
Weekend	Day	44.6	34 to 50	36
	Eve	42.0	29 to 44	30
	Night	36.3	32 to 50(1)	32(1)

Note: (1) – L_{A90} data is for the period 05:30 to 07:00 hours, which is representative of the period of proposed operation

Operational Noise Survey

4.15 Noise measurements were undertaken in and around E.P. Barrus Ltd's current operational base in Bicester to establish their existing noise emission levels.

4.16 It is understood that all of the activities currently undertaken at the existing site will be moved to the new site, so the noise data gathered can be considered representative of their future operations.

4.17 The operational noise measurements were carried out using the equipment listed in Appendix C. The sound level meter was calibrated before the measurements using the listed acoustic calibrator and the calibration checked upon completion of the survey. No calibration drifts were found to have occurred. The sound level meter and acoustic calibrator were both calibrated to a traceable standard by a UKAS-accredited laboratory within the year preceding the survey.

4.18 The measurements were made at various locations in and around the E.P. Barrus facility, as appropriate for the noise sources being monitored.

4.19 All of the measurements were made at a height of 1.5 metres. The noise levels measured for the various noise sources measured are listed in Table 4.3.

Table 4.3: Measured operational noise levels, free-field dB

Source	Distance (metres)	Duration (seconds)	$L_{Aeq,T}$ (1)	L_{AFmax}
Engraving machine	2	16	85.3	89.7
Air blast coolers	2	134	88.0 (2)	92.1 (2)
Cooling tower fan	3	60	70.1	71.8
Forklift picking up pallet	3	13	69.4	80.7
Forklift reversing with pallet	6	7	71.4	82.0
Forklift putting down pallet	2.5	9	75.3	88.7
Forklift putting down pallet	2	10	76.3	90.4
Forklift reversing	8	6	68.5	77.4
Forklift past with horn	1	13	77.4	92.2
Forklift reversing	1	5	75.0	85.2
Pallet truck past	7	13	80.5	91.5
Forklift picking up pallet	3	13	69.4	80.7
Angle grinder	2	32	87.7	92.4
Band saw	2	29	85.8	91.2
Guillotine press	2.5	24	87.8	95.7
Dynamometer test cell, engine throttle at standard run in level	1	253	86.1	86.6
Dynamometer test cell, engine throttled up to 90%	1	265	89.0	89.9
Outboard test cell, engine starting	1	6	85.0	89.0
Outboard test cell, engine throttling up	1	8	95.4	100.8
Outboard test cell, engine at full throttle	1	17	105.6	113.1
Outboard test cell, general reverberant level no engines operating	-	30	74.4	75.3

Source	Distance (metres)	Duration (seconds)	$L_{Aeq,T}$ (1)	L_{AFmax}
General reverberant level in main assembly/warehouse area(3)	-	600	63.8-66.0	81.1-86.3

Notes:
(1) – Stated noise levels have been determined by subtracting contributions from other noise sources
(2) – Stated noise levels have been corrected from façade to free-field values. Measurements of noise from air blast coolers was affected by other nearby plant
(3) – In total, two 10 minute measurements were undertaken. The stated noise levels are the range of values measured.

4.20 It was noted that the activities at the site involved hand tools and small machines only. There were no items of heavy machinery present.

4.21 The engine test cells were within high performance enclosures, and there was very little audible engine noise outside the enclosures.

4.22 It was not possible to measure within the existing plant room, due to preparations for an engine test.

5 ASSESSMENT

Construction Noise

5.1 An assessment of the likely construction noise emissions has been undertaken to give an indication of the potential impact of the proposed works.

5.2 Detailed information is not available at this stage on the proposed construction methods, nor on the construction phasing. Notwithstanding this, the works are anticipated to involve the following elements:

- site preparation works, involving excavators, dump trucks, loaders and lorries;
- foundation works, involving concreting plant, trucks and lorries;
- building erection works, involving lorries, tracked cranes, manual tasks such as hammering, nail guns and erection of scaffolding, generators and compressors; and
- road surfacing, including asphalt paving equipment and lorries; and
- landscaping works, involving dump trucks, lorries, compaction plant, excavators and tarmacing plant.

5.3 It is understood that piling is not required for the proposed development.

5.4 The items of plant assumed to be used during each phase of works are set out in Appendix F.

5.5 The calculations have been undertaken for two situations; an 'average' case where the construction plant are assumed to be at the approximate centre of the Site, and a 'worst-case' where the construction plant are assumed to be at the part of the Site closest to the receptor under consideration. This gives a range of values representing the average and worst-case noise levels likely to be generated during the works.

5.6 Construction noise has been predicted at the receptor locations listed in Table 5.1, and shown in Figure F.1 in Appendix F.

Table 5.1: Receptors for construction noise assessment

Receptor	Distance to Site Boundary	Distance to Closest Proposed Building	Distance to Centre of Site
Heyford Grange	240m / 270m	265m / 290m	330m / 370m
Letchmere Farmhouse	270m / 330m	300m / 350m	370m / 430m
Mobile Home Park	290m / 95m	300m / 220m	390m / 270m
Larsen Road	245m / 245m	260m / 270m	320m / 320m

Note: Distances quoted are for Phase 1 / Phase 2

5.7 The assessment criteria for each of the receptor groups are as determined in accordance with Table 3.2 of this assessment, whereby the ambient noise level, rounded to the nearest 5dB, defines the assessment level. The existing noise levels at each of these assessment positions are taken to be as measured during the daytime noise measurements, as the construction works will be limited to this period. To ensure a robust assessment, the lowest measured value has been used.

5.8 In this instance, the lowest existing ambient noise level was below 65dB, so the most stringent daytime criterion of 65dB applies at all locations.

5.9 Table 5.2 sets out the predicted unmitigated construction noise levels for each assessment location for the Phase 1 development. Where the construction noise levels are predicted to exceed the 65dB criterion, the cells are highlighted blue.

Table 5.2: Predicted construction noise levels – Phase 1, free-field dB

Receptor Location	Phase of Construction Works[1]				
	1	2	3	4	5
Heyford Grange	50.9 - 53.7	48.4 - 50.3	54.9 - 56.8	47.8 - 50.6	52.6 - 55.4
Letchmere Farmhouse	49.9 - 52.7	47.4 - 49.3	53.9 - 55.7	46.8 - 49.6	51.6 - 54.4
Mobile Home Park	49.5 – 52.0	47.0 - 49.3	53.4 - 55.7	46.4 - 48.9	51.2 - 53.8
Larsen Road	51.2 - 53.5	48.7 - 50.5	55.2 – 57.0	48.1 - 50.4	52.9 - 55.2

Note:
[1] Phases of work as follows: Phase 1 = Site preparation works; Phase 2 = Foundation works; Phase 3 = Building erection works; Phase 4 = Road construction works; and Phase 5 = Landscaping works.

5.10 It can be seen from Table 5.2 that the Phase 1 construction noise levels are predicted to be below the 65dB threshold at all of the receptors. No significant adverse effects are therefore likely.

5.11 Table 5.3 sets out the predicted unmitigated construction noise levels for each assessment location for the Phase 2 development. Where the construction noise levels are predicted to exceed the 65dB criterion, the cells are highlighted blue.

Table 5.3: Predicted construction noise levels – Phase 2, free-field dB

Receptor Location	Phase of Construction Works[1]				
	1	2	3	4	5
Heyford Grange	49.9 - 52.7	47.4 - 49.6	53.9 – 56.0	46.8 - 49.6	51.6 - 54.4
Letchmere Farmhouse	48.6 - 50.9	46.1 - 47.9	52.6 - 54.4	45.5 - 47.8	50.3 - 52.6
Mobile Home Park	52.7 - 61.7	50.2 – 52.0	56.6 - 58.4	49.6 - 51.3	54.4 - 63.5
Larsen Road	51.2 - 53.5	48.7 - 50.2	55.2 - 56.6	48.1 - 50.4	52.9 - 55.2

Note:
[1] Phases of work as follows: Phase 1 = Site preparation works; Phase 2 = Foundation works; Phase 3 = Building erection works; Phase 4 = Road construction works; and Phase 5 = Landscaping works.

5.12 It can be seen from Table 5.3 that the Phase 2 construction noise levels are predicted to be below the 65dB threshold at all of the receptors. No significant adverse effects are therefore likely.

5.13 Although the construction noise levels are predicted to be below the assessment threshold, a number of general measures to reduce the construction noise levels are included later in this report.

Construction Vibration

5.14 British Standard 5228 Part 2 contains a number of formulae that may be used to estimate vibration levels for specific types of activity, such as the use of a vibratory roller. The activities likely to generate vibration during the construction in this instance are likely to be ground works and the movement of heavy vehicles.

5.15 Experience in monitoring such equipment suggests that vibration falls below the level of perception, which is taken to be 0.3mm/s, at distances greater than 20 to 50 metres for ground works and heavy vehicle movements, although the exact distances will depend on the exact activities and the ground conditions.

5.16 The vibration-sensitive receptor closest to the site is the mobile home park, which is approximately 95 metres from the site boundary. The properties to the west of the site are all at least 240 metres from the site boundary. On this basis, perceptible levels of vibration are possible at these receptors.

5.17 It should be noted that significantly larger levels of vibration are required to cause any sort of damage to buildings than those likely to be perceptible. Considering the items of plant likely to be required for the construction of the site, particularly close to the site boundaries where less intensive ground works are likely, and the distances involved, damage to existing dwellings due to vibration is considered unlikely.

5.18 Mitigation measures are not considered necessary.

On-Site Noise

5.19 Noise from the operations at the proposed site have been calculated, based on the noise data gathered at E.P. Barrus Ltd's current facility in Bicester, supplemented with calculations of vehicle noise based on typical values for such activities.

5.20 The number of vehicle movements expected during each of the daytime, evening and night-time periods has been determined using information provided by E.P. Barrus Ltd and the traffic consultants Royal Haskoning.

5.21 The peak hourly vehicle movements are shown in Table 5.4. The number of movements for each period is based on data for the year 2018, which is understood to be a higher set of values than will the case in the first year of operation at the site.

Table 5.4: Peak hourly vehicle movements

Phase of Development	Period	Cars	Heavy Goods Vehicles
Phase 1	Daytime (07:00-19:00)	6	6
	Evening (19:00-23:00)	0	0
	Night-time (23:00-07:00)	3	3
Phase 2	Daytime (07:00-19:00)	63	10
	Evening (19:00-23:00)	0	0
	Night-time (23:00-07:00)	3	3

5.22 It is understood that the night-time activities will be limited to the arrival of three cars and the departure of up to three heavy goods vehicles. The timing of these is unlikely to coincide, with the cars arriving before the heavy goods vehicles depart. However, for the purposes of this assessment, it is assumed that the cars and heavy goods vehicles arrive/depart during the same 15 minute night-time period.

5.23 No cars or heavy goods vehicles were measured during the operational noise survey, so typical noise levels for these sources are shown in Table 5.5, taken from similar but unrelated developments.

Table 5.5: Typical source noise levels associated with distribution centre operations, free-field dB

Source	Distance (metres)	L_{AE}	L_{AFmax}
HGV air brakes	10	77	81
HGV start up and pull away	10	76	74
HGV reversing alarm	10	82	73
HGV pass-by	10	89	-
Car door slam	10	65	72
Car engine starting	10	62	66
Car pulling away	10	67	64
Car pass-by	5	86	-

5.24 Each of the vehicle movements in Table 5.4 is assumed to give rise to each of the relevant noise generating events set out in Table 5.5, to derive the overall vehicle noise emissions.

5.25 The assessment periods are taken as one hour for the daytime period and fifteen minutes for the night-time period, consistent with the approach recommended in BS4142: 2014.

5.26 Since the vehicle movements into and out of the site had been provided in terms of hourly totals, it has been assumed that the night-time fifteen minute period includes all of the one hour movements.

5.27 Noise within the warehouse and the main assembly area of the production building is taken to be 70dB, based on the noise levels measured within E.P. Barrus Ltd's current facility. This value includes a single cycle of operation of the engraving machine, and operation of the band saw, angle grinder and guillotine press in the production building, and forklift operations in the warehouse building.

5.28 It is understood that the engine test cells in the production building will be designed with sufficient sound proofing to ensure that there is little noise outside of the enclosures, as is the case with E.P. Barrus' current site.

5.29 The walls of both buildings are assumed to have a sound reduction performance of 25dB R_w, and the roofs are assumed to have a sound reduction performance of 13dB R_w. The walls and roof of the external plant room are assumed to have a higher sound reduction performance of 35dB R_w.

5.30 The cooling tower, pump room, eight air blast coolers and two generators are assumed to operate continuously at full duty during the daytime once the Phase 2 development is complete.

5.31 Noise levels for the two generators, the air blast coolers and the plant within the plant room have been provided by E.P. Barrus Ltd, as follows:

- bank of eight air blast coolers generate 81.3dB(A) at a distance of 3 metres;
- each of two generators generate 68dB(A) at a distance of 3 metres;

- the compressor within the plant room generates a noise level of 77.9dB(A) (reverberant level);
- the four circulating pumps within the plant room generate a total noise level of 79.2dB(A) (reverberant level); and
- the air blast cooler circulating pumps within the plant room generate a total noise level of 71.1dB(A) (reverberant level)

5.32 It has been assumed that a single forklift will operate in the service yard area for one quarter of every hour during the daytime. The heavy goods vehicles that depart prior to 07:00 hours are assumed to be loaded during the daytime shift the day prior to their departure.

5.33 The total noise emissions from E.P. Barrus' operations have been calculated assuming all of the internal processes, external noise sources, forklift movements and vehicle movements occur simultaneously.

5.34 The noise levels generated by the activities have been calculated using the prediction framework set out in ISO9613 as implemented by the noise modelling software CADNA/A.

5.35 The activities in and around the application site have been modelled as acoustic point or line sources. The self-screening that would occur as a result of the occupation of the site has been ignored to present a worst-case. The acoustic screening effects of garden fences have been ignored.

5.36 The topography on and around the site has been modelled using OS mapping and observations made during visits to the site. The ground has been modelled as 100% acoustically soft and all buildings have been modelled as approximately 70% acoustically reflective.

5.37 One hour and fifteen minute L_{Aeq} values have been calculated as appropriate for the assessment period for each noise-generating event. The predicted noise levels from each event have been logarithmically summed to derive the overall noise levels from the proposed development.

5.38 The assessment of operational noise levels has been undertaken at the following locations, as shown in Figure F.1 in Appendix F:

- Heyford Grange;
- Letchmere Farmhouse;
- Mobile Home Park; and
- Larsen Road.

5.39 To allow a direct comparison with the measured noise levels, the noise predictions are free-field noise levels at the position of the property façade closest to, and facing, the development site. The predictions have been undertaken at 4 metres above ground level to represent the noise level at either the bedroom windows or simply an upper storey, except for the mobile home park, where a ground floor receptor has been adopted to reflect the smaller properties at this location.

5.40 The predicted specific sound levels are shown in Table 5.6 for Phase 1 and Phase 2. Since no operations will occur during the evening between 19:00 and 23:00 hours, only the daytime and night-time periods are considered. The night-time calculations represent the noisiest 15 minute period between 05:30 and 07:00 hours when the cars and heavy goods vehicles arrive and depart the site.

Table 5.6: Predicted specific sound levels, free-field $L_{Aeq,T}$ dB

Receptor	Period	Predicted Specific Sound Levels, $L_{Aeq,T}$	
		Phase 1	Phase 2
Heyford Grange	Day	31	39
	Night	28	28
Letchmere Farmhouse	Day	31	38
	Night	28	28
Mobile Home Park	Day	29	40
	Night	18	20
Larsen Road	Day	31	41
	Night	26	26

5.41 The specific sound levels from the proposed development have been assessed using the method set out in BS4142: 2014. The calculated values set out in Table 5.6 have been adjusted to account for potential acoustic characteristics associated with the proposed activities at the site.

5.42 It is considered appropriate to adjust the activities at the site by +2dB, to account for the very short periods where reversing alarms may be sounding, as these may be just perceptible. There are unlikely to be any other audible tones or any impulsive sounds from the site.

5.43 The predicted rating levels for Phase 1 have been compared with the background sound levels in Table 5.7.

Table 5.7: BS4142 assessment – Phase 1, free-field dB

Receptor	Period	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,Tr}$	Difference
Heyford Grange	Day	36	33	-3
	Night	28	30	2
Letchmere Farmhouse	Day	36	33	-3
	Night	28	30	2
Mobile Home Park	Day	36	31	-5
	Night	28	20	-8
Larsen Road	Day	36	33	-3
	Night	28	28	0

5.44 It can be seen from Table 5.7 that during the daytime, the rating levels are generally below the background sound level, which is indicative of a low adverse impact.

5.45 During the night-time, the rating levels at Heyford Grange and Letchmere Farmhouse are just above the background sound level. This outcome is below the level that BS4142 suggests is an adverse impact, but above the level that BS4142 suggests is indicative of a low impact.

5.46 Since the night-time specific sound levels would result in internal noise levels below the 30dB threshold in BS8233: 2014, it is considered that overall, the small excess of the rating levels over the background sound levels are not likely to result in adverse impacts.

5.47 The uncertainty in the Phase 1 calculations may be a factor since the outcome is close to the threshold values set out in BS4142. However, the uncertainty has been reduced as far as considered practicable through the implementation of high quality source data and a robust calculation process.

5.48 The predicted rating levels for Phase 2 have been compared with the background sound levels in Table 5.8.

Table 5.8: BS4142 assessment – Phase 2, free-field dB

Receptor	Period	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,Tr}$	Difference
Heyford Grange	Day	36	41	5
	Night	28	30	2
Letchmere Farmhouse	Day	36	40	4
	Night	28	30	2
Mobile Home Park	Day	36	42	6
	Night	28	22	-6
Larsen Road	Day	36	43	7
	Night	28	28	0

5.49 It can be seen from Table 5.7 that during the daytime, the rating levels are 5dB or more above the background sound levels at Heyford Grange, Larsen Road, and the mobile home park. BS4142 suggests that where the rating levels exceed the background sound levels by 5dB, an adverse impact is likely. The rating level at Letchmere Farmhouse is predicted to be close to 5dB above the background sound level.

5.50 The key noise sources that lead to this outcome are the external plant, such as the air blast coolers and generators. It is also noted that the noise-break-out through the roof of the production area is significant, albeit not as significant as the external plant.

5.51 The night-time rating levels for Phase 2 are likely to lead to the same outcome as for Phase 1 of the development.

5.52 The uncertainty in the Phase 2 calculations is not considered to be a factor since the outcome shows a clear adverse impact.

5.53 Mitigation to address the identified adverse impacts is considered in the next section of this report.

5.54 The maximum noise levels associated with the use of the site are likely to relate to the release of air from the heavy goods vehicle airbrake systems, or slamming car doors. The highest maximum noise levels associated with these events likely to be in the region of 81dB for heavy goods vehicle brake noise and 72dB for a car door slam, both at a distance of 10 metres.

5.55 On the basis of these values, any service yard or access road within 112 metres of an off-site receptor, and any car parking area within 40 metres of areas of an off-site receptor, has the potential to lead to maximum noise levels in excess of the 60dB criterion set out in the WHO *Guidelines for Community Noise* at sensitive receptors.

5.56 The site layout plan places service yards at least 300 metres from the closest receptors, and car parking areas at least 175 metres from the closest receptors. Maximum noise levels from vehicle movements at the site are unlikely to exceed the WHO criterion. On this basis, it is considered unnecessary to include mitigation to address this issue.

Off-site Traffic Data

5.57 Road traffic data for roads around the site have been supplied by Royal Haskoning, the traffic consultant for the project. The data has been supplied with and without traffic generated by the proposed development so that its effect on existing road traffic noise levels can be determined. The supplied traffic flows are set out in Table 5.9.

Table 5.9: Traffic flows

Road	Base	Base + Proposed Development Traffic
Camp Road West	4,868 / 6.4%	4,962 / 6.4%
Camp Road East	3,061 / 7.0%	3,289 / 7.0%
Camp Road South	1,044 / 9.0%	1,134 / 9.0%
Chilgrove Drive	9 / 1.4%	417 / 1.4%

Note: Flows are shown as: overall traffic flow / percentage of heavy goods vehicles

5.58 Traffic noise predictions have been carried out at a notional receptor location 10 metres from the edge of each carriageway and 1.5 metres above ground level. A notional receptor has been used because it is the change in traffic noise level that is of interest, not the absolute noise levels at any given receptor. The predicted changes in noise level will occur at noise-sensitive receptors along the road considered.

5.59 The vehicle speeds have been modelled in accordance with the guidance in CRTN, according to the class of road. Low flow corrections have been applied to all routes with a flow less than 4,000 as required in CRTN. It is noted that the flows on Chilgrove Drive are below CRTN's range of validity. The potential change in traffic noise along Chilgrove Drive has therefore been estimated without using the CRTN calculation methodology.

5.60 The predicted changes in road traffic noise levels as a result of the use of the proposed development are shown in Table 5.10.

Table 5.10: Calculated changes in road traffic noise, free-field $L_{A10,18hrs}$ dB

Road	Base	Base + Proposed Development Traffic[(1)]
Camp Road West	64.3	64.4 (+0.1)
Camp Road East	62.4	62.8 (+0.4)
Camp Road South	56.3	56.9 (+0.6)
Chilgrove Drive	-	(+16.7)[(2)]

Notes:
[(1)] - Figures denote the calculated noise level and the change from the baseline value in brackets.
[(2)] – Change in noise level estimated using the equation 10 x Log_{10}(base flow/base + development flow)

5.61 It can be seen from Table 5.10 that the changes in traffic noise along Camp Road are predicted to be no higher than 0.6dB, and as such would be classed as negligible impacts, when using the assessment criteria set out in Table 3.4.

5.62 The change in traffic noise along Chilgrove Drive is considered to be a major adverse impact, however, there are no receptors along this road, so the overall effect is negligible.

5.63 No mitigation is considered necessary to address changes in off-site road traffic noise levels.

6 MITIGATION

Construction Phase

6.1 The construction works are unlikely to generate noise levels above the adopted criterion at the receptors closest to the site. However, the following measures should be considered during the works:

- ensure that the works adhere to agreed working hours;
- where possible, use localised screening to reduce from noisy activities being undertaken close the site boundaries;
- controlling off-site parking of construction traffic on the public highway;
- implementing a traffic management system at site entrances at all times to control the traffic into the site and the discharge of trucks from the site to avoid congestion;
- using 'silenced' plant and equipment wherever possible;
- switching off vehicle engines where vehicles are standing for a significant period of time;
- operating plant at low speeds where possible and incorporating automatic low speed idling;
- selecting electrically driven equipment where possible in preference to internal combustion powered, hydraulic power in preference to pneumatic, and wheeled in lieu of tracked plant;
- maintaining all plant properly (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc); and
- making all contractors familiar with the guidance in BS5228 (Parts 1 and 2) which should form a pre-requisite of their appointment.

6.2 Adopting a neighbourly approach to the construction works will be key to maintaining good relations with the occupants of neighbouring properties. In particular, the local population should be given advance warning of any noisy or intensive operations.

Operational Phase

6.3 The Phase 1 development is not considered likely to lead to adverse impacts, and no mitigation measures are considered necessary.

6.4 Phase 2 is predicted to lead to adverse impacts, particularly as a result of the external plant, although noise breaking out through the roof of the production building is also a significant source of noise.

6.5 It is recommended that the external plant area be located on the eastern side of the Phase 2 building, not on the western side, where it faces the receptors to the west.

6.6 In addition, it is recommended that the roof be constructed from a material with a higher sound reduction performance than the 13dB R_w likely to be achieved by the proposed Thermohall material. A minimum sound reduction performance of 25dB R_w is suggested.

6.7 The inclusion of these mitigation measures will result in the rating levels shown in Table 6.1.

Table 6.1: Daytime BS4142 assessment – Phase 2 with mitigation, free-field dB

Receptor	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,Tr}$	Difference
Heyford Grange	36	29	-7
Letchmere Farmhouse	36	30	-6
Mobile Home Park	36	28	-8
Larsen Road	36	28	-8

6.8 Table 6.1 shows that, with the mitigation described above, the rating levels for Phase 2 are likely to be well below the background sound levels, indicating that impacts are unlikely.

7 CONCLUSION

7.1 This noise assessment has been prepared in support of a hybrid application comprising:

1) application for full planning permission for Phase One works comprising erection of 9,837 sq.m. warehouse with associated service yard and access; and

2) outline application for Phase Two works comprising office and training school and manufacturing, storage and distribution buildings with associated parking and landscaping

7.2 The assessment has shown that noise from the Phase 1 scheme is not likely to lead to adverse impacts and mitigation measures are not considered necessary.

7.3 Although only an outline application at this stage, the assessment has shown that adverse impacts are possible as a result of noise from the Phase 2 scheme. However, appropriate mitigation, such as that described in this report, will ensure that adverse impacts are avoided.

7.4 The assessment of the construction works suggests that neither noise nor vibration are likely to lead to adverse effects. Notwithstanding this, a number of best practice measures have been set out to minimise any effects during the construction works.

7.5 On the basis of the information set out in this report, it is considered that noise from the site does not pose a material constraint to the proposed development.

Appendices

Appendix A – Introduction to Noise and Vibration, and Glossary of Terminology

Noise is defined as unwanted sound. The human ear is able to respond to sound in the frequency range 18Hz (deep bass) to 18,000Hz (high treble) and over the audible range of 0dB (the threshold of perception) to 140dB (the onset of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting (filtering) mechanism is used. This reduces the importance of lower and higher frequencies, approximating the response of the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. Noise can be perceived to be louder or more noticeable if the source of the noise is observed; e.g. roads, trains, factories, building sites etc. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. Various noise indices have been derived to describe the fluctuation of noise levels that vary over time. Usually, these noise indices relate to specific types of noise, and as such different noise indices are used to describe road traffic noise, background noise, construction noise, etc.

The weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement and the levels are denoted as dB(A) or L_{Aeq}, L_{A10}, etc, according to the parameter being measured.

Noise is measured on the decibel scale, which is logarithmic rather than linear. As a result of this, a 3dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3dB(A) is generally regarded as the minimum difference needed to perceive a change. Table A.1 sets out examples of noise levels typically experienced during everyday activities. Table A.2 sets out an explanation of the terminology used in this report.

Table A.1: Typical sound levels found in the environment

Sound Level	Location
0 to 10dB(A)	Threshold of hearing
10 to 20dB(A)	Broadcasting studio
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside a factory or noisy pub
100 to 110dB(A)	Burglar Alarm at 1m
110 to 130dB(A)	Pneumatic drill at 1m away
140dB(A)	Threshold of Pain

Vibration is defined as a repetitive oscillatory motion. Groundborne vibration can be transmitted to the human body through the supporting surfaces; the feet of a standing person, the buttocks, back and feet of a seated person or the supporting area of a recumbent person. In most situations, entry into the human body will be through the supporting ground or through the supporting floors of a building. Vibration from road traffic can also be airborne. Such airborne vibration is transmitted as a low-frequency sound wave and is often perceived when the sound wave causes windows or other objects to rattle.

Vibration is often complex, containing many frequencies, occurring in many directions and changing over time. There are many factors that influence human response to vibration. Physical factors include vibration magnitude, vibration frequency, vibration axis, duration, point of entry into the human body and posture of the human body. Other factors include the exposed persons experience, expectation, arousal and activity.

Experience shows that disturbance or annoyance from vibration in residential situations is likely to arise when the magnitude of vibration is only slightly in excess of the threshold of perception.

The threshold of perception depends on the frequency of vibration. The human body is most sensitive to vibration in the frequency range 1 to 80Hz and especially sensitive to vibration in the range 4 to 8Hz. As with noise, a frequency weighting mechanism is used to quantify vibration in a way that best corresponds to the frequency response of the human body. In general, vibration is only perceptible in residential situations when the building is close to a railway, construction site or very close to a road that carries large and heavy vehicles.

Table A.2: Terminology relating to noise and vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20×10^{-6} Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L_w	The L_w, or sound power level, is a measure of the total noise energy of a source.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Façade	At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS EN 61672.
Displacement, Acceleration and Velocity Root Mean Square (r.m.s.) and Peak Values Peak Particle Velocity (PPV)	Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement (how far from the equilibrium position that something moves), velocity (how fast something moves), or acceleration (the rate of change of velocity). When describing vibration, one must specify whether peak values are used (i.e. the maximum displacement or maximum velocity) or r.m.s. / r.m.q. values (effectively an average value) are used. Standards for the assessment of building damage are usually given in terms of peak velocity (usually referred to as Peak Particle Velocity, or PPV), whilst human response to vibration is often described in terms of r.m.s. or r.m.q. acceleration.
Root Mean Square (r.m.s.)	The r.m.s. value of a set of numbers is the square root of the average of the squares of the numbers. For a sound or vibration waveform, the r.m.s. value over a given time period is the square root of the average value of the square of the waveform over that time period.
Root Mean Quad (r.m.q.)	The r.m.q. value of a set of numbers is the fourth root of the average of the fourth powers of the numbers. For a vibration waveform, the r.m.q. value over a given time period is the fourth root of the average value of the fourth power of the waveform over that time period.

Appendix B: Plans

Figure B.1: Site location plan

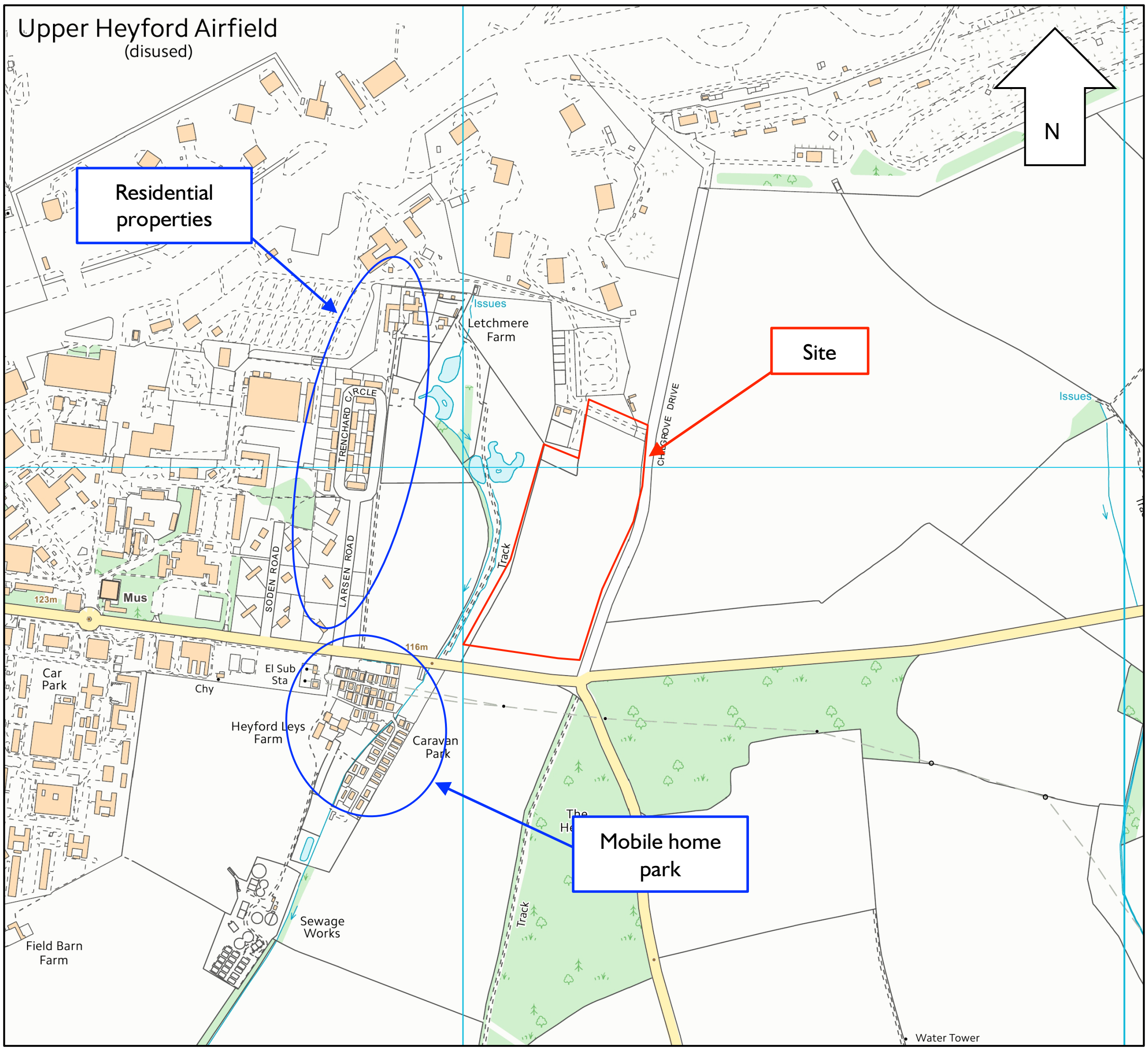
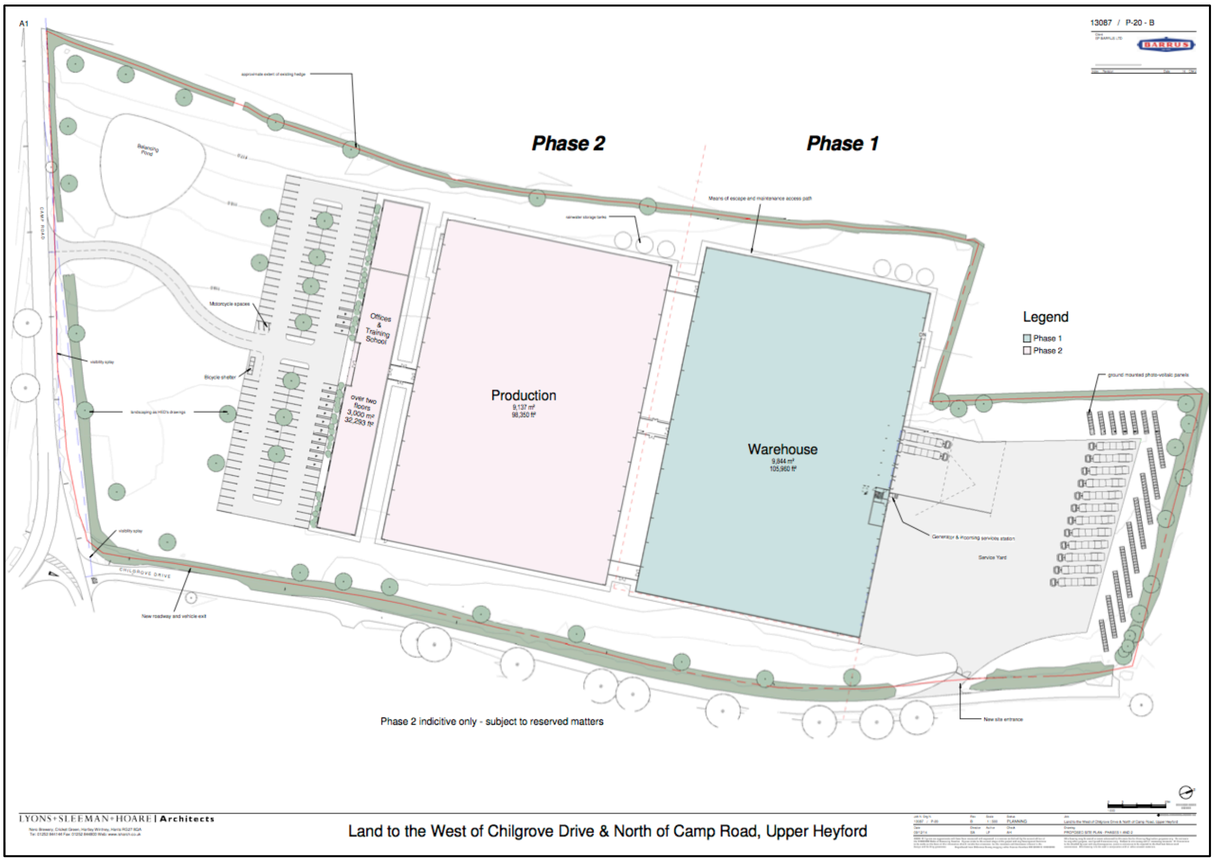


Figure B.2: Proposed site layout plan



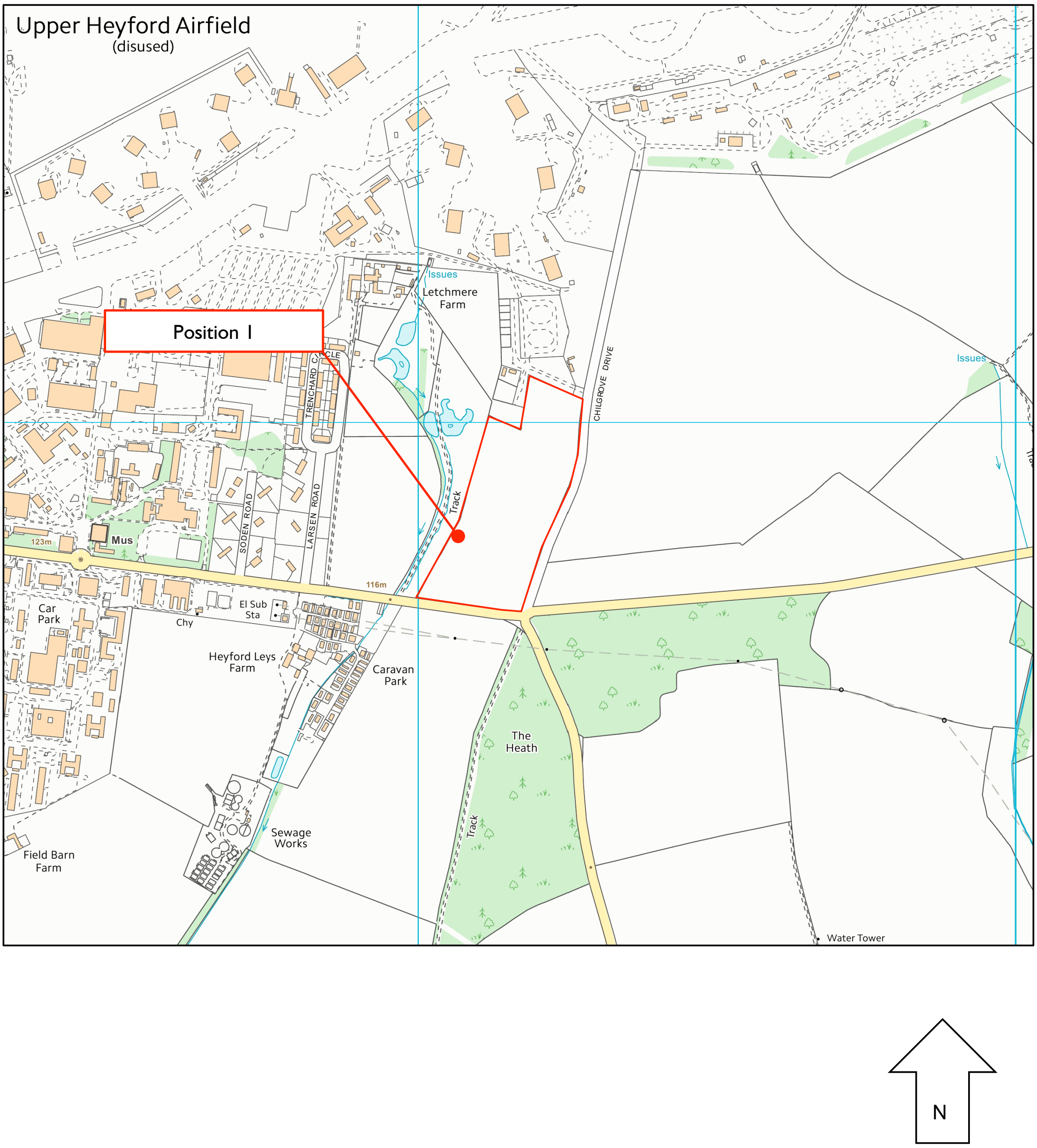
Appendix C – Noise Monitoring Equipment

Table C.1: Noise monitoring equipment

Position	Equipment	Serial Number
All measurements	01dB-Metravib Black Solo type 1 sound level meter	65682
	01dB-Metravib PRE21S pre-amplifier	16310
	01dB-Metravib MCE212 microphone	153491
	01dB-Metravib Cal21 acoustic calibrator	34134139

Appendix D – Baseline Noise Survey Measurement Location

Figure D.1: Baseline noise survey measurement location



Appendix E – Full Baseline Noise Survey Results

Table E.1: Noise levels measured at Position 1, free-field dB

Date	Time	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{AFmax}
09/10/2014	14:00	54.1	48.8	57.1	67.4
09/10/2014	15:00	53.7	47.8	56.3	71.0
09/10/2014	16:00	53.5	45.9	56.8	67.6
09/10/2014	17:00	52.4	45.3	55.6	63.5
09/10/2014	18:00	50.4	40.9	54.0	64.5
09/10/2014	19:00	51.3	39.0	54.2	73.3
09/10/2014	20:00	50.5	35.2	53.8	69.8
09/10/2014	21:00	46.9	33.2	50.6	67.9
09/10/2014	22:00	44.1	30.5	48.2	64.0
09/10/2014	23:00	41.8	28.2	44.7	59.7
10/10/2014	00:00	44.2	28.6	48.2	62.3
10/10/2014	01:00	42.6	26.2	45.5	63.1
10/10/2014	02:00	39.4	24.4	39.0	64.0
10/10/2014	03:00	37.1	23.9	37.0	57.9
10/10/2014	04:00	42.0	26.8	44.8	62.2
10/10/2014	05:00	46.3	29.9	50.6	63.8
10/10/2014	06:00	50.2	40.7	53.9	64.5
10/10/2014	07:00	52.6	45.8	55.7	67.9
10/10/2014	08:00	51.0	45.9	53.5	63.9
10/10/2014	09:00	49.9	42.6	53.3	64.5
10/10/2014	10:00	49.5	40.3	52.7	67.0
10/10/2014	11:00	50.4	43.5	53.5	70.4
10/10/2014	12:00	50.4	42.9	53.8	66.7
10/10/2014	13:00	50.9	43.4	54.3	64.2
10/10/2014	14:00	52.2	44.8	55.2	68.2
10/10/2014	15:00	51.5	43.5	54.8	65.2
10/10/2014	16:00	50.1	41.3	53.5	63.7
10/10/2014	17:00	51.7	42.9	54.9	64.1
10/10/2014	18:00	49.4	40.0	53.1	62.5
10/10/2014	19:00	47.1	37.9	51.0	65.0
10/10/2014	20:00	45.7	32.4	49.9	61.1
10/10/2014	21:00	44.2	28.4	48.3	62.7
10/10/2014	22:00	42.0	27.8	46.2	59.3
10/10/2014	23:00	39.8	28.7	42.9	56.9
11/10/2014	00:00	40.2	24.4	41.9	59.4
11/10/2014	01:00	37.8	24.7	36.6	61.6
11/10/2014	02:00	39.6	23.8	40.7	59.7
11/10/2014	03:00	31.5	22.8	31.0	55.6
11/10/2014	04:00	35.8	25.0	32.6	58.7
11/10/2014	05:00	38.2	25.4	42.1	58.8
11/10/2014	06:00	41.1	29.0	45.5	54.7
11/10/2014	07:00	46.1	38.2	49.6	59.8

Date	Time	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{AFmax}
11/10/2014	08:00	45.2	36.6	48.9	63.1
11/10/2014	09:00	46.1	36.8	49.7	74.9
11/10/2014	10:00	46.8	36.5	50.6	63.9
11/10/2014	11:00	46.9	37.2	50.9	60.7
11/10/2014	12:00	46.3	35.9	50.3	61.5
11/10/2014	13:00	46.9	36.5	51.2	62.5
11/10/2014	14:00	47.4	37.2	51.3	62.8
11/10/2014	15:00	48.2	35.8	51.5	66.9
11/10/2014	16:00	48.4	38.4	52.2	69.0
11/10/2014	17:00	47.9	38.1	51.5	64.4
11/10/2014	18:00	47.0	35.2	51.1	62.6
11/10/2014	19:00	45.6	34.7	50.1	59.0
11/10/2014	20:00	44.7	32.2	48.9	60.4
11/10/2014	21:00	42.5	30.1	47.3	59.2
11/10/2014	22:00	42.0	31.0	46.5	57.9
11/10/2014	23:00	40.7	32.0	44.1	59.2
12/10/2014	00:00	39.6	30.3	42.2	57.3
12/10/2014	01:00	36.3	29.8	36.5	56.5
12/10/2014	02:00	37.2	30.1	37.2	59.5
12/10/2014	03:00	37.6	28.5	37.3	58.2
12/10/2014	04:00	38.9	32.1	39.3	56.8
12/10/2014	05:00	40.6	33.7	41.2	59.0
12/10/2014	06:00	43.8	32.4	46.5	65.8
12/10/2014	07:00	45.7	40.5	48.6	63.9
12/10/2014	08:00	47.0	43.1	49.8	65.0
12/10/2014	09:00	47.1	43.9	49.3	59.0
12/10/2014	10:00	48.3	45.9	49.8	59.0
12/10/2014	11:00	49.4	42.9	51.5	58.5
12/10/2014	12:00	44.9	38.7	47.6	60.8
12/10/2014	13:00	44.6	38.9	47.2	63.1
12/10/2014	14:00	45.3	39.8	47.9	61.8
12/10/2014	15:00	45.7	40.7	47.3	69.7
12/10/2014	16:00	45.0	41.6	47.2	60.5
12/10/2014	17:00	46.8	42.7	48.0	67.5
12/10/2014	18:00	47.2	43.9	49.3	69.6
12/10/2014	19:00	46.3	44.3	47.8	58.2
12/10/2014	20:00	45.7	43.5	47.4	60.1
12/10/2014	21:00	45.2	42.8	46.9	59.7
12/10/2014	22:00	44.2	41.7	45.9	56.2
12/10/2014	23:00	41.4	39.2	42.6	57.5
13/10/2014	00:00	42.5	39.5	44.3	58.1
13/10/2014	01:00	45.0	39.9	47.8	58.4
13/10/2014	02:00	48.0	41.8	50.9	64.5
13/10/2014	03:00	49.3	43.8	52.6	63.8
13/10/2014	04:00	48.1	44.0	50.6	63.8

Date	Time	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{AFmax}
13/10/2014	05:00	52.0	47.5	54.6	66.0
13/10/2014	06:00	53.9	49.6	56.5	68.7

Note: The measurements were all 1 hour in duration.

Table E.2: 15 minute background noise levels measured at Position 1, free-field dB

Date and Time	L_{A90}
09/10/2014 15:00	48
09/10/2014 15:15	48
09/10/2014 15:30	48
09/10/2014 15:45	48
09/10/2014 16:00	50
09/10/2014 16:15	47
09/10/2014 16:30	45
09/10/2014 16:45	45
09/10/2014 17:00	44
09/10/2014 17:15	46
09/10/2014 17:30	46
09/10/2014 17:45	45
09/10/2014 18:00	41
09/10/2014 18:15	43
09/10/2014 18:30	41
09/10/2014 18:45	39
09/10/2014 19:00	40
09/10/2014 19:15	38
09/10/2014 19:30	43
09/10/2014 19:45	37
09/10/2014 20:00	35
09/10/2014 20:15	38
09/10/2014 20:30	35
09/10/2014 20:45	35
09/10/2014 21:00	36
09/10/2014 21:15	33
09/10/2014 21:30	34
09/10/2014 21:45	32
09/10/2014 22:00	32
09/10/2014 22:15	33
09/10/2014 22:30	30
09/10/2014 22:45	30
09/10/2014 23:00	29
09/10/2014 23:15	30
09/10/2014 23:30	27
09/10/2014 23:45	28
10/10/2014 00:00	28
10/10/2014 00:15	29
10/10/2014 00:30	28
10/10/2014 00:45	30

Date and Time	L_{A90}
10/10/2014 01:00	29
10/10/2014 01:15	26
10/10/2014 01:30	26
10/10/2014 01:45	26
10/10/2014 02:00	26
10/10/2014 02:15	26
10/10/2014 02:30	24
10/10/2014 02:45	24
10/10/2014 03:00	23
10/10/2014 03:15	24
10/10/2014 03:30	24
10/10/2014 03:45	25
10/10/2014 04:00	26
10/10/2014 04:15	30
10/10/2014 04:30	27
10/10/2014 04:45	28
10/10/2014 05:00	28
10/10/2014 05:15	33
10/10/2014 05:30	38
10/10/2014 05:45	38
10/10/2014 06:00	38
10/10/2014 06:15	41
10/10/2014 06:30	42
10/10/2014 06:45	44
10/10/2014 07:00	43
10/10/2014 07:15	45
10/10/2014 07:30	47
10/10/2014 07:45	48
10/10/2014 08:00	47
10/10/2014 08:15	46
10/10/2014 08:30	45
10/10/2014 08:45	46
10/10/2014 09:00	44
10/10/2014 09:15	44
10/10/2014 09:30	42
10/10/2014 09:45	42
10/10/2014 10:00	40
10/10/2014 10:15	39
10/10/2014 10:30	44
10/10/2014 10:45	42
10/10/2014 11:00	43
10/10/2014 11:15	43
10/10/2014 11:30	44
10/10/2014 11:45	44
10/10/2014 12:00	44
10/10/2014 12:15	42

Date and Time	L_{A90}
10/10/2014 12:30	43
10/10/2014 12:45	44
10/10/2014 13:00	44
10/10/2014 13:15	43
10/10/2014 13:30	43
10/10/2014 13:45	45
10/10/2014 14:00	50
10/10/2014 14:15	48
10/10/2014 14:30	44
10/10/2014 14:45	43
10/10/2014 15:00	44
10/10/2014 15:15	45
10/10/2014 15:30	44
10/10/2014 15:45	43
10/10/2014 16:00	42
10/10/2014 16:15	41
10/10/2014 16:30	41
10/10/2014 16:45	41
10/10/2014 17:00	45
10/10/2014 17:15	41
10/10/2014 17:30	44
10/10/2014 17:45	43
10/10/2014 18:00	40
10/10/2014 18:15	40
10/10/2014 18:30	40
10/10/2014 18:45	40
10/10/2014 19:00	40
10/10/2014 19:15	39
10/10/2014 19:30	37
10/10/2014 19:45	37
10/10/2014 20:00	39
10/10/2014 20:15	36
10/10/2014 20:30	31
10/10/2014 20:45	31
10/10/2014 21:00	30
10/10/2014 21:15	29
10/10/2014 21:30	28
10/10/2014 21:45	28
10/10/2014 22:00	29
10/10/2014 22:15	29
10/10/2014 22:30	27
10/10/2014 22:45	28
10/10/2014 23:00	30
10/10/2014 23:15	28
10/10/2014 23:30	28
10/10/2014 23:45	29

Date and Time	L_{A90}
11/10/2014 00:00	25
11/10/2014 00:15	26
11/10/2014 00:30	24
11/10/2014 00:45	25
11/10/2014 01:00	25
11/10/2014 01:15	25
11/10/2014 01:30	24
11/10/2014 01:45	25
11/10/2014 02:00	24
11/10/2014 02:15	24
11/10/2014 02:30	23
11/10/2014 02:45	24
11/10/2014 03:00	23
11/10/2014 03:15	22
11/10/2014 03:30	24
11/10/2014 03:45	23
11/10/2014 04:00	26
11/10/2014 04:15	26
11/10/2014 04:30	24
11/10/2014 04:45	26
11/10/2014 05:00	25
11/10/2014 05:15	25
11/10/2014 05:30	27
11/10/2014 05:45	29
11/10/2014 06:00	28
11/10/2014 06:15	28
11/10/2014 06:30	32
11/10/2014 06:45	34
11/10/2014 07:00	39
11/10/2014 07:15	39
11/10/2014 07:30	37
11/10/2014 07:45	37
11/10/2014 08:00	37
11/10/2014 08:15	37
11/10/2014 08:30	36
11/10/2014 08:45	38
11/10/2014 09:00	37
11/10/2014 09:15	38
11/10/2014 09:30	37
11/10/2014 09:45	36
11/10/2014 10:00	36
11/10/2014 10:15	35
11/10/2014 10:30	36
11/10/2014 10:45	38
11/10/2014 11:00	38
11/10/2014 11:15	37

Date and Time	L_{A90}
11/10/2014 11:30	37
11/10/2014 11:45	37
11/10/2014 12:00	38
11/10/2014 12:15	35
11/10/2014 12:30	37
11/10/2014 12:45	36
11/10/2014 13:00	35
11/10/2014 13:15	36
11/10/2014 13:30	37
11/10/2014 13:45	37
11/10/2014 14:00	37
11/10/2014 14:15	39
11/10/2014 14:30	38
11/10/2014 14:45	35
11/10/2014 15:00	34
11/10/2014 15:15	37
11/10/2014 15:30	37
11/10/2014 15:45	36
11/10/2014 16:00	40
11/10/2014 16:15	38
11/10/2014 16:30	39
11/10/2014 16:45	37
11/10/2014 17:00	39
11/10/2014 17:15	39
11/10/2014 17:30	38
11/10/2014 17:45	37
11/10/2014 18:00	36
11/10/2014 18:15	34
11/10/2014 18:30	35
11/10/2014 18:45	38
11/10/2014 19:00	37
11/10/2014 19:15	33
11/10/2014 19:30	35
11/10/2014 19:45	35
11/10/2014 20:00	32
11/10/2014 20:15	32
11/10/2014 20:30	32
11/10/2014 20:45	34
11/10/2014 21:00	30
11/10/2014 21:15	30
11/10/2014 21:30	29
11/10/2014 21:45	32
11/10/2014 22:00	32
11/10/2014 22:15	32
11/10/2014 22:30	30
11/10/2014 22:45	32

Date and Time	L_{A90}
11/10/2014 23:00	32
11/10/2014 23:15	33
11/10/2014 23:30	32
11/10/2014 23:45	31
12/10/2014 00:00	30
12/10/2014 00:15	33
12/10/2014 00:30	31
12/10/2014 00:45	29
12/10/2014 01:00	29
12/10/2014 01:15	30
12/10/2014 01:30	30
12/10/2014 01:45	31
12/10/2014 02:00	31
12/10/2014 02:15	29
12/10/2014 02:30	30
12/10/2014 02:45	31
12/10/2014 03:00	29
12/10/2014 03:15	28
12/10/2014 03:30	29
12/10/2014 03:45	28
12/10/2014 04:00	33
12/10/2014 04:15	30
12/10/2014 04:30	32
12/10/2014 04:45	34
12/10/2014 05:00	34
12/10/2014 05:15	33
12/10/2014 05:30	34
12/10/2014 05:45	35
12/10/2014 06:00	32
12/10/2014 06:15	32
12/10/2014 06:30	38
12/10/2014 06:45	40
12/10/2014 07:00	41
12/10/2014 07:15	43
12/10/2014 07:30	40
12/10/2014 07:45	40
12/10/2014 08:00	42
12/10/2014 08:15	43
12/10/2014 08:30	44
12/10/2014 08:45	44
12/10/2014 09:00	43
12/10/2014 09:15	44
12/10/2014 09:30	44
12/10/2014 09:45	46
12/10/2014 10:00	46
12/10/2014 10:15	45

Date and Time	L_{A90}
12/10/2014 10:30	47
12/10/2014 10:45	47
12/10/2014 11:00	48
12/10/2014 11:15	50
12/10/2014 11:30	46
12/10/2014 11:45	41
12/10/2014 12:00	40
12/10/2014 12:15	39
12/10/2014 12:30	39
12/10/2014 12:45	38
12/10/2014 13:00	38
12/10/2014 13:15	39
12/10/2014 13:30	39
12/10/2014 13:45	39
12/10/2014 14:00	39
12/10/2014 14:15	40
12/10/2014 14:30	41
12/10/2014 14:45	40
12/10/2014 15:00	41
12/10/2014 15:15	41
12/10/2014 15:30	41
12/10/2014 15:45	41
12/10/2014 16:00	42
12/10/2014 16:15	42
12/10/2014 16:30	42
12/10/2014 16:45	42
12/10/2014 17:00	43
12/10/2014 17:15	43
12/10/2014 17:30	42
12/10/2014 17:45	43
12/10/2014 18:00	43
12/10/2014 18:15	44
12/10/2014 18:30	45
12/10/2014 18:45	45
12/10/2014 19:00	44
12/10/2014 19:15	44
12/10/2014 19:30	44
12/10/2014 19:45	44
12/10/2014 20:00	44
12/10/2014 20:15	44
12/10/2014 20:30	43
12/10/2014 20:45	43
12/10/2014 21:00	43
12/10/2014 21:15	43
12/10/2014 21:30	43
12/10/2014 21:45	43

Date and Time	L_{A90}
12/10/2014 22:00	42
12/10/2014 22:15	42
12/10/2014 22:30	43
12/10/2014 22:45	41
12/10/2014 23:00	41
12/10/2014 23:15	39
12/10/2014 23:30	39
12/10/2014 23:45	39
13/10/2014 00:00	40
13/10/2014 00:15	39
13/10/2014 00:30	39
13/10/2014 00:45	41
13/10/2014 01:00	40
13/10/2014 01:15	39
13/10/2014 01:30	42
13/10/2014 01:45	43
13/10/2014 02:00	43
13/10/2014 02:15	41
13/10/2014 02:30	43
13/10/2014 02:45	45
13/10/2014 03:00	44
13/10/2014 03:15	43
13/10/2014 03:30	45
13/10/2014 03:45	45
13/10/2014 04:00	44
13/10/2014 04:15	44
13/10/2014 04:30	44
13/10/2014 04:45	44
13/10/2014 05:00	47
13/10/2014 05:15	48
13/10/2014 05:30	48
13/10/2014 05:45	49
13/10/2014 06:00	50
13/10/2014 06:15	50
13/10/2014 06:30	49
13/10/2014 06:45	49

Note: The measurements were all 15 minutes in duration.

Appendix F – Noise Assessment Information

Table F.1: Plant assumed for construction works - site preparation works

Item	BS5228 Ref	Sound Power Level, dB	% On-time	Number
Tracked Excavator	Table C2, Ref 19	105	50	1
Lorry	Table C2, Ref 34	108	50	1
Wheeled Loader	Table C2, Ref 28	104	50	1
Dump Truck	Table C2, Ref 30	107	50	1

Table F.2: Plant assumed for construction works - foundation works

Item	BS5228 Ref	Sound Power Level, dB	% On-time	Number
Poker vibrator	Table C4, Ref 33	106	75	1
Concrete pump and a cement mixer truck	Table C4, Ref 24	95	50	1
Concrete truck	Table C4, Ref 18	103	75	1
Lorry	Table D7, Ref 121	98	25	1

Table F.3: Plant assumed for construction works - building erection works

Item	BS5228 Ref	Sound Power Level, dB	% On-time	Number
Hammering	Table D2, Ref 15	112	25	1
Lorry - pull up	Table D7, Ref 121	98	25	2
Diesel Generator	Table C4, Ref 76	89	90	2
Poker vibrator	Table C4, Ref 33	106	50	1
Compressor	Table D7, Ref 8	98	80	1
Tracked crane	Table D7, Ref 107	114	50	1
Scaffolding	Table D7, Ref 1	108	25	1
Hand-held nail gun	Table C4, Ref 95	101	10	1

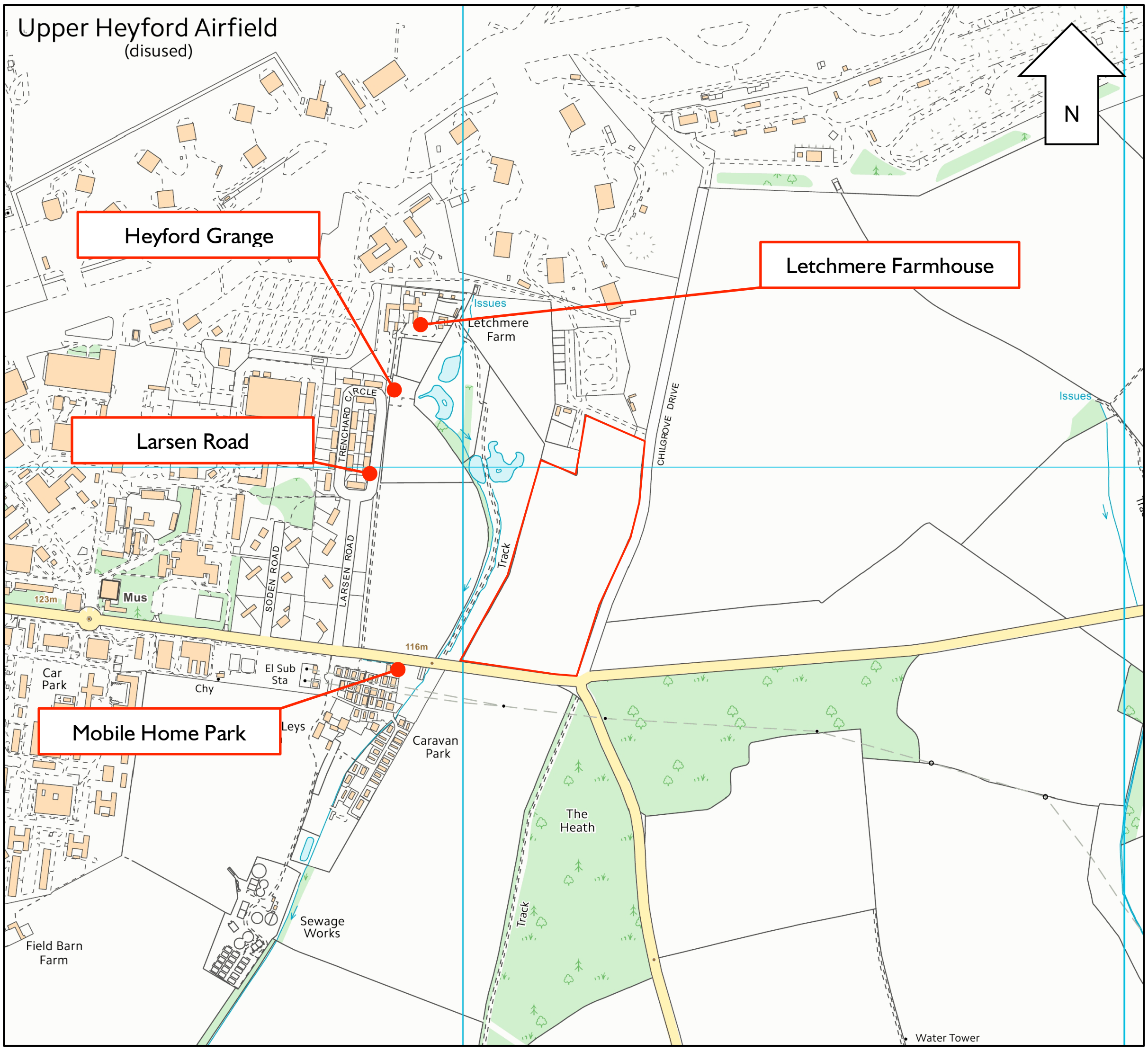
Table F.4: Plant assumed for construction works - road works

Item	BS5228 Ref	Sound Power Level, dB	% On-time	Number
Asphalt paver (+ tipping lorry)	Table C5, Ref 30	103	50	1
Road Lorry (Full)	Table C6, Ref 21	108	50	1

Table F.5: Plant assumed for construction works - landscaping works

Item	BS5228 Ref	Sound Power Level, dB	% On-time	Number
Tracked Excavator	Table C5, Ref 18	108	50	2
Dozer	Table C2, Ref 10	108	50	2

Figure F.1: Noise assessment locations



Resound Acoustics Limited, 13 Rother Street, Stratford-upon-Avon, Warwickshire CV37 6LU
Telephone: (01789) 387979 Fax: (01789) 415997
www.resoundacoustics.co.uk