

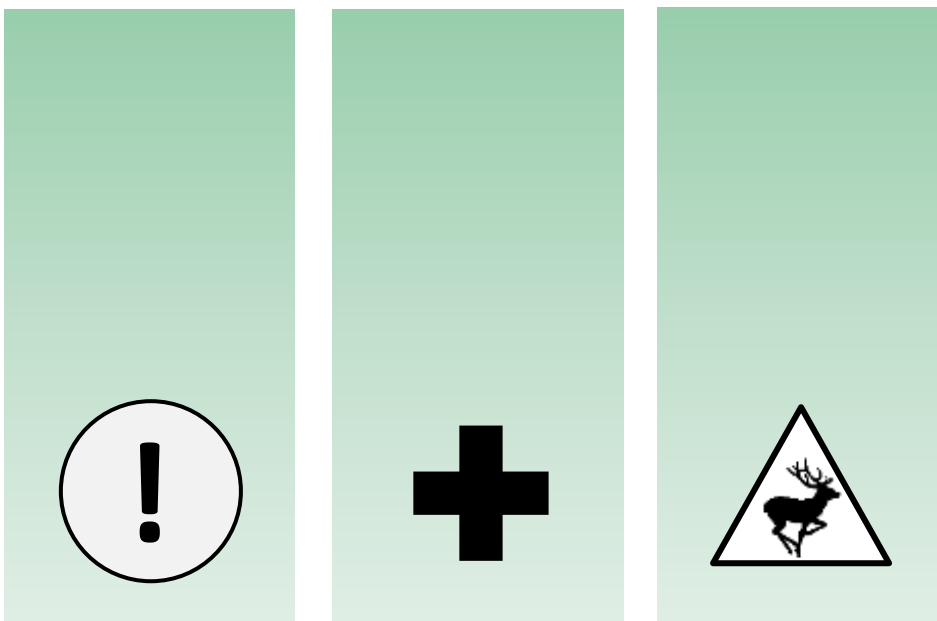


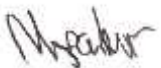
NOISE IMPACT ASSESSMENT BRIDGE ROAD WREXHAM

ENSAFE REFERENCE: AC109193-1R0

REPORT PREPARED FOR: ST LANDHOLDINGS

DATE: 22ND JUNE 2020



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Remarks				
Date	June 2020			
Prepared by	Michaela Moffatt			
Signature				
Position	Senior Acoustic Consultant			
Checked by	Martyn Parker			
Signature				
Position	Senior Acoustic Consultant			
Verified by	Conal Kearney			
Signature				
Position	Head of Acoustics and Air Quality			
Project number	AC109193-1r0			

EXECUTIVE SUMMARY

Ensafe Consultants has been commissioned by St Landholdings to undertake a Noise Impact Assessment for a proposed development of 6 no. of Gas Fired Engines at a Site off Bridge Road North, Wrexham.

Data Collection

Due to the COVID-19 outbreak at the time of this report, Ensafe had ceased site visits, in accordance with the current government guidelines. Upon review of existing site data, and following consultation with the Environmental Health department, a previously undertaken Background Sound Survey has been used to reasonably represent baseline noise levels at sensitive receptors within the vicinity of the site.

Additionally, Ensafe has been supplied with source noise measurements of the proposed engines at the Site.

Noise Impact Assessment

Engines may activate during any 07:00-23:00 daytime and 23:00-07:00 night-time period during both weekdays and weekends. As such, the lowest average measured background sound levels for daytime and night-time have been used to inform the assessment. The assessment allows for simultaneous activity of all six engines as a worst-case scenario.

The Noise Impact Assessment has indicated that rating levels fall below the background level during the daytime, achieving the most robust BS4142:2014 criterion at the receptor location.

During the Night-time the rating level would exceed the lowest median background by +1dB, however, considering that residents are likely to be inside the dwelling, specifically in bedrooms, during the night-time period and not in external areas to which BS4142:2014 relates, it is considered more prudent to assess internal noise levels. Accordingly, the assessment has shown that the calculated internal specific sound levels would achieve the criterion for bedrooms in BS8233:2014.

BS4142:2014 provides the following advice:

"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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact."

This assessment has shown that, in principle, there should be no adverse impact at the closest receptors as a result of the proposed noise sources.



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1. INTRODUCTION

Ensafe consultants have been commissioned by St Landholdings to undertake a Noise Impact Assessment for the proposed development at Bridge Road, Wrexham. Proposals account for 6 Generator units at a Site off Bridge Road in Wrexham, to be referred to hereafter as '*the Site*'.

This assessment has been undertaken to identify the noise impact due to associated engine upon existing noise-sensitive receptors in the vicinity of the Site.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.1 Site Location and Proposed Development

The Site is located immediately adjacent to existing Adargh group and is bound to the north west by Bridge Road. Commercial and industrial businesses surround the Site with the nearest residential area being Coed Aben Road.

A layout of the 6 gensets has been provided and used to inform the assessment.

The proposed engines have an envisaged use of c.3000 hours a year, with capacity to operate during any weekday or weekend time period.

1.2 Limitations

Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, Ensafe cannot be held responsible for any subsequent variations in the proposed mitigation performance.

Further limitations of this report are presented in Appendix I.

1.3 Confidentiality

Ensafe has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Ensafe; a charge may be levied against such approval.

2. ASSESSMENT METHODOLOGY

2.1 Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise

This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

Local authorities should adopt a corporate approach and ensure close co-operation between planning and environmental health departments when considering noise and noise generating developments.

Noise Exposure Categories (NECs) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.

Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities.

Local planning authorities should consider whether proposals for new noise-sensitive development would be incompatible with existing activities, taking into account the likely level of noise exposure at the time of the application and any increase that may reasonably be expected in the foreseeable future. Such development should not normally be permitted in areas which are, or are expected to become, subject to unacceptably high levels of noise and should not normally be permitted where high levels of noise will continue throughout the night.

Measures introduced to control the source of, or limit exposure to, noise should be proportionate and reasonable, and may include:

1. engineering: reduction of noise at point of generation (e.g. using quiet machines and/or quiet methods of working); containment of noise generated (e.g. insulating buildings which house machinery and/or providing purpose-built barriers around sites); protection of surrounding noise-sensitive buildings (e.g. improving sound insulation in these buildings and/or screening them by purpose-built barriers);
2. lay-out: adequate distance between noise source and noise-sensitive building or area; screening by natural barriers, other buildings, or non-critical rooms in a building;

3. administrative: limiting operating time of noise source; restricting activities allowed on the site; specifying an acceptable noise limit.

2.2 Local Planning Authority Guidance – Wrexham Council’s Environmental Health Department

Ensafe has contacted the Environmental Health Department at Wrexham Council during May 2020, via email, to discuss the assessment procedure following the Covid-19 outbreak. The following email was sent:

“Ensafe has been commissioned to undertake a Noise Impact Assessment for a proposed generator development at Bridge Road, Wrexham, LL13 9PS. We would like to agree upon a methodology prior to commencement of the assessment.

Due to the COVID-19 outbreak, Ensaf e had ceased site visits in accordance with previous government guidelines, and as such, we are unable to complete site survey works in Wales at this time. However, an alternate approach can be taken to establish existing noise conditions by the use of alternative baseline data such as existing baseline noise data and traffic flows, as supported by recent advice from the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA):

“Before the most recent restrictions, the COVID-19 outbreak presented new challenges in obtaining representative baseline sound levels because typical road, air and rail transport usage have been reduced by travel restrictions and social distancing measures. Other sound sources may also have been affected – for example, due to changes in operating patterns at industrial and commercial premises. However, now that site visits cannot routinely occur, other approaches may have to be taken to establish an appropriate robust estimate of baseline conditions, such as using existing data (for example, from previous local surveys and noise maps) or undertaking baseline sound predictions. These approaches can be supplemented by additional limited on-site sound level measurements, where permitted. The most appropriate option to use must be determined on a case-by-case basis, assessing the level of uncertainty and including this information in the reporting. Most importantly at this time, before progressing with any methodology, there should be discussion of the intended approach with the relevant regulating authority.”

Ensafe therefore propose to utilise existing background noise data that can be used as a baseline to reasonably represent the existing noise environment, which will inform the Noise Impact Assessment and any required mitigation measures. From reviewing the Sites location, it has been determined that the nearest residential dwellings is located on Coed Aben Road to the West.

This will be used to inform the following assessment:

- **Commercial Sound:** *An assessment of the potential impact of the proposed gas engines upon existing residential receptors will be undertaken based upon the guidance of BS4142:2014, BS8233:2014 and any requirements of the LPA.*

I trust the above is satisfactory and would be grateful if you could confirm acceptance to the above. Please do not hesitate to get in touch if you have any comments or would like to discuss further. Thank you, and I look forward to hearing from you.”

Ensafe received the following response in June 2020:

“What you are proposing sounds like a reasonable approach given the current circumstances, though I would make the following comments:

- 1) In Wales the assessment should be carried out with regards to Technical Advice Note (TAN) 11.*
- 2) Please include references in the report to where the baseline data has been sourced from and any degree of uncertainty with it.*
- 3) I know it is usual for a conservative approach to be taken when modelling the impact of a development and I think that this is particularly important due to historic background data being used.”*

Ensafe reviewed the data sources available, and subsequently located a previous background survey within the vicinity of the site that was undertaken in October 2018. Use of this dataset was supported by the Environmental Health Department at Wrexham Council.

2.3 BS4142: 2014 ‘Methods for rating and assessing industrial and commercial sound’

This standard describes methods 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 processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure detailed in the standard compares the measured or predicted noise level ‘the specific noise level’ from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.’

The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00 – 23:00) 1 hour; and
- Night-time (23:00 – 07:00) 15 minutes.

There are a number of ‘penalties’ which can be attributed to the specific sound level depending upon the ‘acoustic features’ of the sound level under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

Tonality

- +2dB: where the tonality is just perceptible;
- +4dB: where the tonality is clearly perceptible; and

- +6dB: where the tonality is highly perceptible.

Impulsivity

- +3dB: where the impulsivity is just perceptible;
- +6dB: where the impulsivity is clearly perceptible; and
- +9dB: where the impulsivity is highly perceptible.

Intermittency

- +3dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background noise level can yield the following commentary:

- Typically the greater this difference (between the rating level and the background sound level), the greater the magnitude of impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

With the above in mind, it is common that a LPA will specify their own criteria for the rating level relative to the background sound level and, where this is the case, this criteria usually takes precedence over a simple comparison of the rating level against the background sound level.

2.4 British Standard BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings

Noise Criteria Limits

The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including dwellings, as shown in Table 1:

Table 1 BS8233 Recommended Internal Noise Levels

Criterion	Typical Situation	Design $L_{Aeq, T}$
		(dB)
Suitable resting/ sleeping conditions	Living Room	35
	Bedroom	30
For a Reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not exceed 45dB L_{max}		

BS8233 goes on to recommend noise levels for gardens. According to BS8233;

"It is desirable that the external noise level does not exceed 50dB $L_{Aeq, T}$, with an upper guideline value of 55dB $L_{Aeq, T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors might be warranted".

BS8233 goes on to say:

"In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited".

Ventilation Requirements

Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS8233 states:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

Section 7.7.2 states:

"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 façade insulation or the resulting noise level."

3. NOISE DATA

Due to the recent COVID-19 outbreak at the time of this report, Ensafe has ceased site visits, in accordance with the current government guidelines. However, an alternate approach can be taken to establish existing noise conditions by the use of alternative baselines data such as traffic flows and using analogous site data, as supported by recent advice from the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA).

3.1 Background Sound Data

Upon review of existing site data, and following consultation with the Environmental Health department, it was agreed that the use of historic data was reasonable given the restrictions and atypical noise-climate associated with COVID-19.

Ensafe (formerly REC) has previously conducted a full weekday and weekend background sound surveys at to support a similar development at Oak Road, Wrexham (Noise Impact Assessment Ref. AC106240-1r3 dated October 2018). This survey has been used to reasonably represent receptors on Coed Aben Road for the purposes of this assessment.

The survey was carried out during the following time period:

- 16:00 Friday 28th September to 15:00 Monday 1st October 2018.

The following location was chosen for the survey:

- Noise Measurement Position 1 (NMP1): Located within the redline boundary of the Site (Oak Road, Wrexham) in a location deemed representative of the existing receptors on Bryn Lane, equidistant from Oak Road as the receptors. The main sound source here is road traffic and industrial sound, to which the receptors are exposed. The Noise Measurement Position from this assessment is considered reasonably representative of receptors on Coed Aben Road.

A summary of the range of measured 1-hour daytime and 15 minute night-time background sound pressure levels for the proposed extended hours are presented in Table 2 below.

Table 2 Range of Measured Background Sound Pressure Levels

Date	Period	Range of Measured Ambient Sound Pressure Level (dB)	Range of Measured Background Sound Pressure Level (dB)
		L _{Aeq,T}	L _{A90,T}
Friday 28 th September 2018	Daytime (16:00 – 23:00)	48.9 – 58.4	44.3 – 48.0
	Night-time (23:00 – 07:00)	46.3 – 54.1	44.6 – 48.6
Saturday 29 th September 2018	Daytime (07:00 – 23:00)	45.9 – 52.8	40.8 – 46.9
	Night-time (23:00 – 07:00)	40.8 – 53.1	38.0 – 46.6

Date	Period	Range of Measured Ambient Sound Pressure Level (dB)	Range of Measured Background Sound Pressure Level (dB)
		$L_{Aeq,T}$	$L_{A90,T}$
Sunday 30 th September 2018	Daytime (07:00 – 23:00)	48.1 – 52.6	43.9 – 46.1
	Night-time (23:00 – 07:00)	42.4 – 57.4	40.6 – 52.1
Monday 1 st October 2018	Daytime (09:00 – 15:00)	52.5 – 62.3	47.4 – 52.0

Weather conditions were fine throughout the survey period with wind speeds below 12mph for the majority of the survey and no rain reported.

Table 3 Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1	Sound Level Meter	Duo	10522	13 th March 2020
	Pre-amplifier	01dB PRE22	10329	
	Microphone	GRAS 40CD	154578	

The sound level meter was field-calibrated on Site prior to and after noise measurements were taken. No significant drift was witnessed. Calibration certificates are available upon request.

4. NOISE IMPACT ASSESSMENT

For the purposes of this assessment, Ensafe have used noise modelling software, CadnaA 2019 MR2, to determine the impact of noise from the proposed engines on the Site upon the nearest sensitive receptors. The resultant values were then assessed against the lowest median measured background sound levels over a reference period of 1 hour between 07:00 and 23:00 and 15-minute between 23:00 and 07:00 applicable to daytime and night-time respectively.

Ensafe has been supplied with the following information:

- Containerised Engine Noise Spec of 65dBA @ 10m; and
- Approximate Height of 5.8m.

The following inputs have been included in the model to generate the specific sound level at the receptor:

- Draft Site Layout Bridge Road dated 1st June 2020;
- Site elevations have been taken as existing;
- The engines emit a sound pressure of 65dBA @ 10m;
- Engine height at 5.8m;
- Engine noise input as a point source;
- Existing buildings that provide shielding from any of the noise sources have been included in the model;
- A reflection order of 2 has been used in all calculations; and
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors" as incorporated into CadnaA software.

4.1 BS4142 Assessment

For the BS4142: 2014 assessments, penalties are applied to the specific sound level in order to provide the rating level. These penalties relate to the acoustic features of the sound source. Accordingly, the following features have been accounted for in the assessment, in accordance with the subjective methods detailed in BS4142: 2014, for the units as a whole operation.

Table 4 Identification of Acoustic Penalties

Source	Penalty	Applicable?	Attributable Penalty	Comment
Genset	Tonality	Yes	2	Tones may be slightly perceptible at the receptors.
	Impulsivity	No	-	No impact noise associated with the engines running is anticipated.
	Intermittency	No	-	While the engines have the capability to switch on/off, it is expected that they will remain either active or dormant for prolonged periods of time. Therefore, a penalty for intermittency has not been applied.
	Other Sound Characteristics	No	-	Not applicable as other penalties have been assigned.

4.1.1 Daytime Assessment

The grid noise map determined that the highest predicted specific noise levels at the receptors Coed Aben Road is 36dB in gardens during the daytime assuming that all 6 engines are active simultaneously. Figures 2 of Appendix III illustrates the daytime grid noise map.

Table 5 calculates the Rating Level at the closest exposed garden area for Coed Aben Road. The lowest median background sound level has been used for the daytime period.

Table 5 Calculation of Rating Level and Comparison with Background Sound Level – Daytime

Receptors	Specific Sound Level, $L_{Aeq,1hr}$ (dB)	Total Penalty (dB)	Total Rating Level $L_{A,r}$ (dB)	Lowest Median Measured Background Sound Level $L_{A90,1hr}$ (dB)	Criteria, $L_{A,r} = L_{A90}$ (dB)	Difference +/- (dB)
Receptor on Coed Aben Road	36	+2	38	44	44	-4

Table 5 demonstrates that the rating level will fall below the existing measured background by approximately -4dB for receptors at Coed Aben Road.

BS4142:2014 provides the following advice:

“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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.”

4.1.2 Night-time Assessment

Table 6 calculates the Rating Level at the closest 1st floor façades for Coed Aben Road, as it is expected that inhabitants will be in bedrooms during the hours of 23:00 and 07:00. The lowest median background sound levels have been used.

Table 6 Calculation of Rating Level and Comparison with Background Sound Level – Night-time

Receptors	Specific Sound Level, $L_{Aeq,15mins}$ (dB)	Total Penalty (dB)	Total Rating Level $L_{A,r}$ (dB)	Typical Measured Background Sound Level $L_{A90,15mins}$ (dB)	Criteria, $L_{A,r} = L_{A90}$ (dB)	Difference +/- (dB)
Receptor on Coed Aben Road	41	+2	43	42	42	+1

Table 6 demonstrates that the rating level will exceed the existing measured background by approximately +1dB for receptors at Coed Aben Road.

Considering that residents are likely to be inside the dwelling, specifically in bedrooms, during the night-time period and not in external areas to which BS4142:2014 relates, it is considered prudent to assess internal noise levels. Accordingly, Table 7 considers the internal specific sound level in bedrooms assuming a sound reduction of 33dB with windows closed and 15dB with a partially open window, as per BS8233:2014.

Table 7 Internal Noise Impact Assessment - Bedrooms

Receptor	Calculated Specific Sound Level, $L_{Aeq,1hr}$ (dB)	Internal Specific Sound Level – Windows Closed (dB)	BS8233:2014 30dB Bedroom Criteria Achieved?	Internal Rating Level – Windows Partially Open (dB)	BS8233:2014 30dB Bedroom Criteria Achieved?
Receptor on Coed Aben Road	41	11	Yes	26	Yes

Table 7 determines that the internal criterion for bedrooms in BS8233:2014 would be achieved with both a closed and partially opened window in addition to the BS4142:2014 criterion externally.

5. CONCLUSION

Ensafe has been commissioned by St Landholdings to undertake a Noise Impact Assessment for a proposed development of 6 no. Gas Fired Power Station on land off Bridge Road North, Wrexham.

This assessment has been undertaken to identify the noise impact of the associated engines upon existing noise-sensitive receptors in the vicinity of the Site. The assessment has been undertaken with due regard to the most robust BS4142:2014 criterion.

A previously undertaken weekday and weekend Background Sound Survey has been used to reasonably represent the existing receptors in the vicinity of the Site. Additionally, Ensaf e has been supplied with noise specification data for the proposed engines.

The Noise Impact Assessment has indicated that rating levels at the closest existing noise sensitive receptors achieve the most robust BS4142:2014 criteria for the daytime period.

Regarding the night-time Assessment, the specific sound level would be +1dB above the existing background during the night-time period. However, the specific sound level has also been calculated internally as residents are most likely to be inside, specifically in bedrooms during the night-time period. The assessment demonstrated that the specific sound level would achieve the BS8233:2014 night-time criterion for bedrooms with both a closed and partially opened window.

This assessment has shown that, in principle, there should be no adverse impact at the closest receptors as a result of the proposed noise sources.

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between Ensaf e and the Client as indicated in Section 1.2.
2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
3. Ensaf e cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Ensaf e is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Ensaf e in this connection without their explicit written agreement there to by Ensaf e.
4. Where a noise survey is required to inform the assessment, Ensaf e will endeavour to ensure that all noise measurements taken are robust, representative and reliable in order to inform an accurate noise impact assessment.
5. Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, Ensaf e cannot be held responsible for any subsequent variations in the proposed mitigation performance.

APPENDIX II GLOSSARY OF ACOUSTIC TERMINOLOGY

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold 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 mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. 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 or impulsiveness 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.

The most widely used 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_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1 Typical Sound Pressure Levels

Sound Pressure Level	Location/Example
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain

Acoustic Terminology

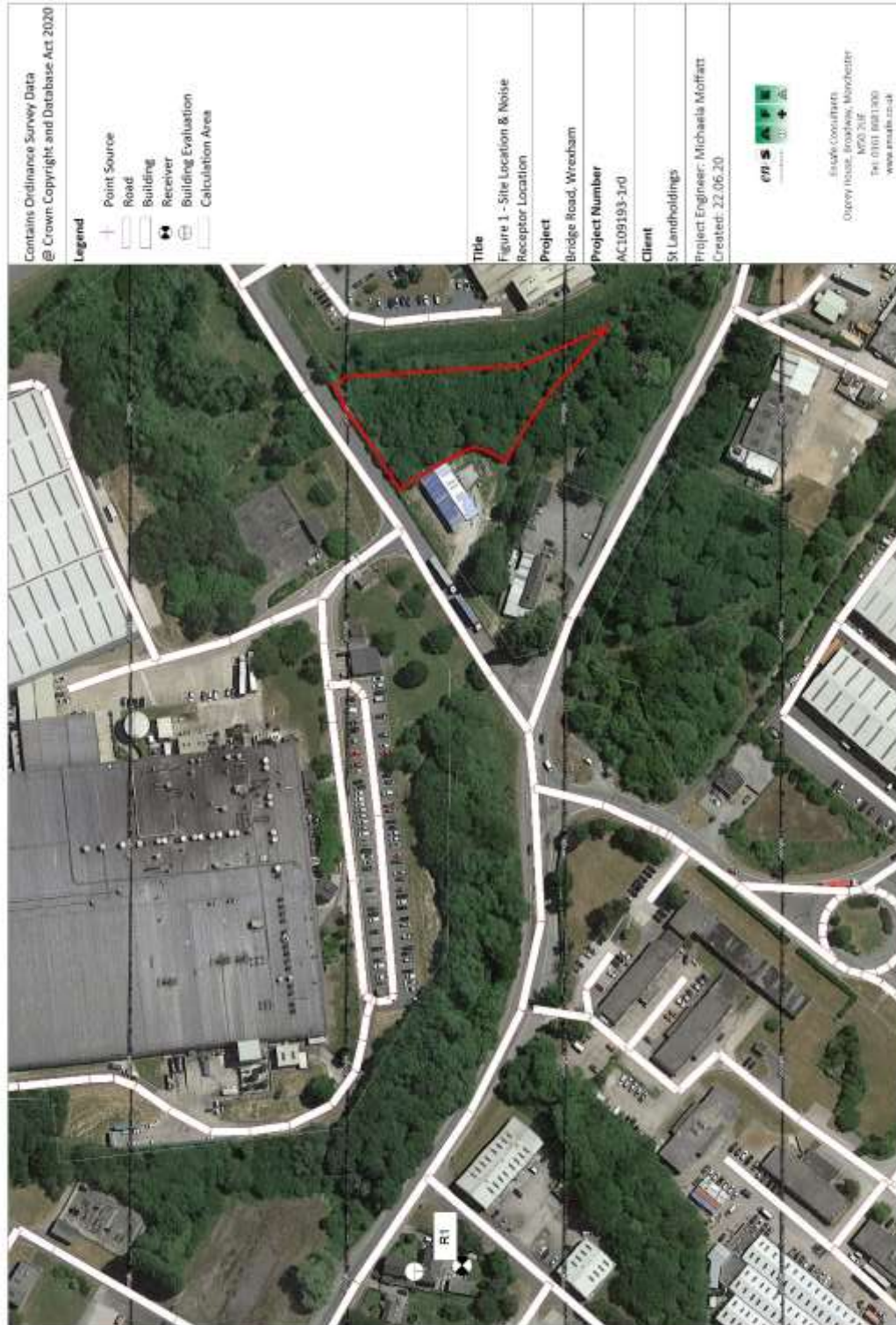
Table A2 Terminology

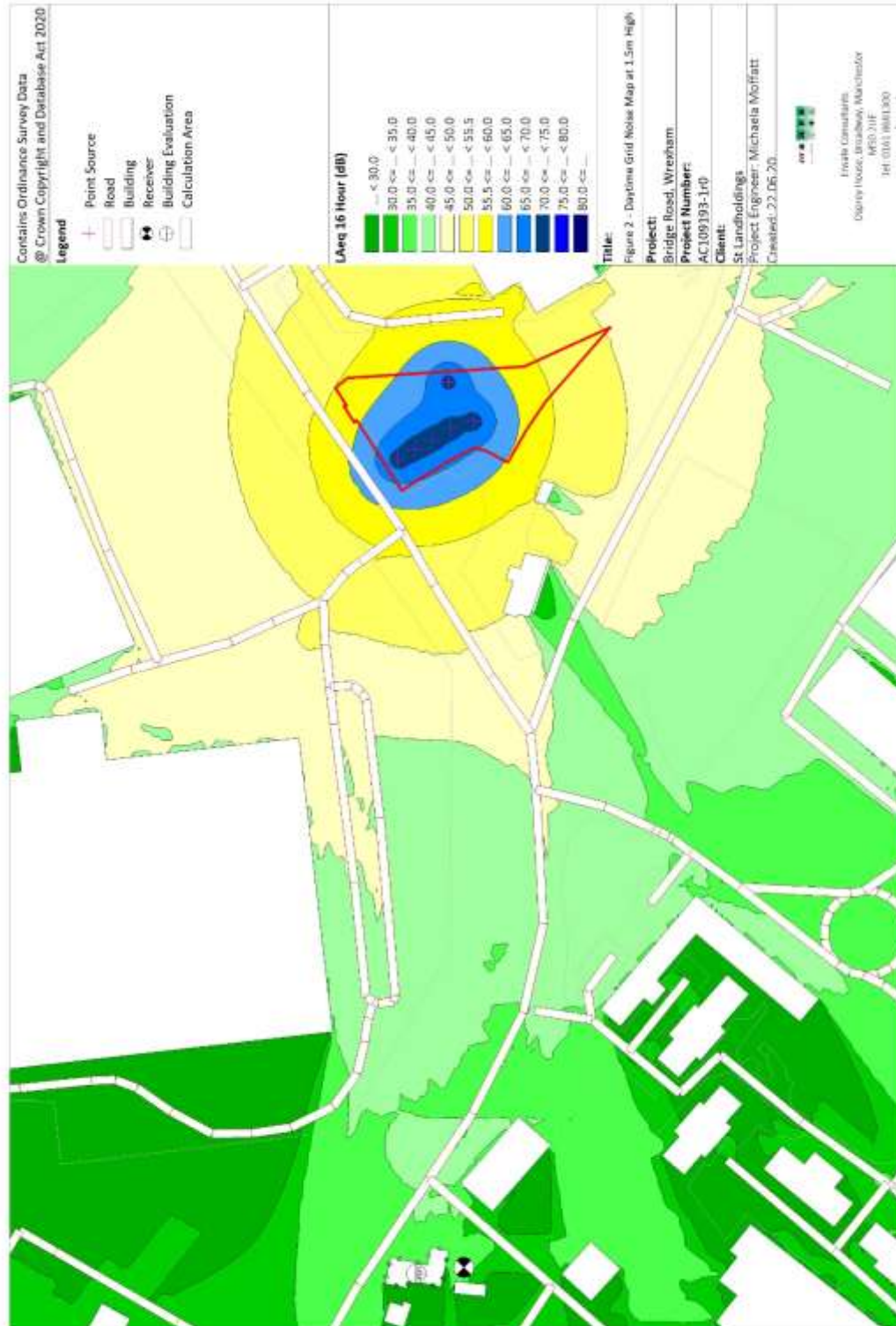
Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10 ⁻⁵ Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L _{Aeq, T}	L _{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L _{Amax}	L _{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L _{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L ₁₀ & L ₉₀	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L ₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L ₉₀ is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L ₁₀ index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

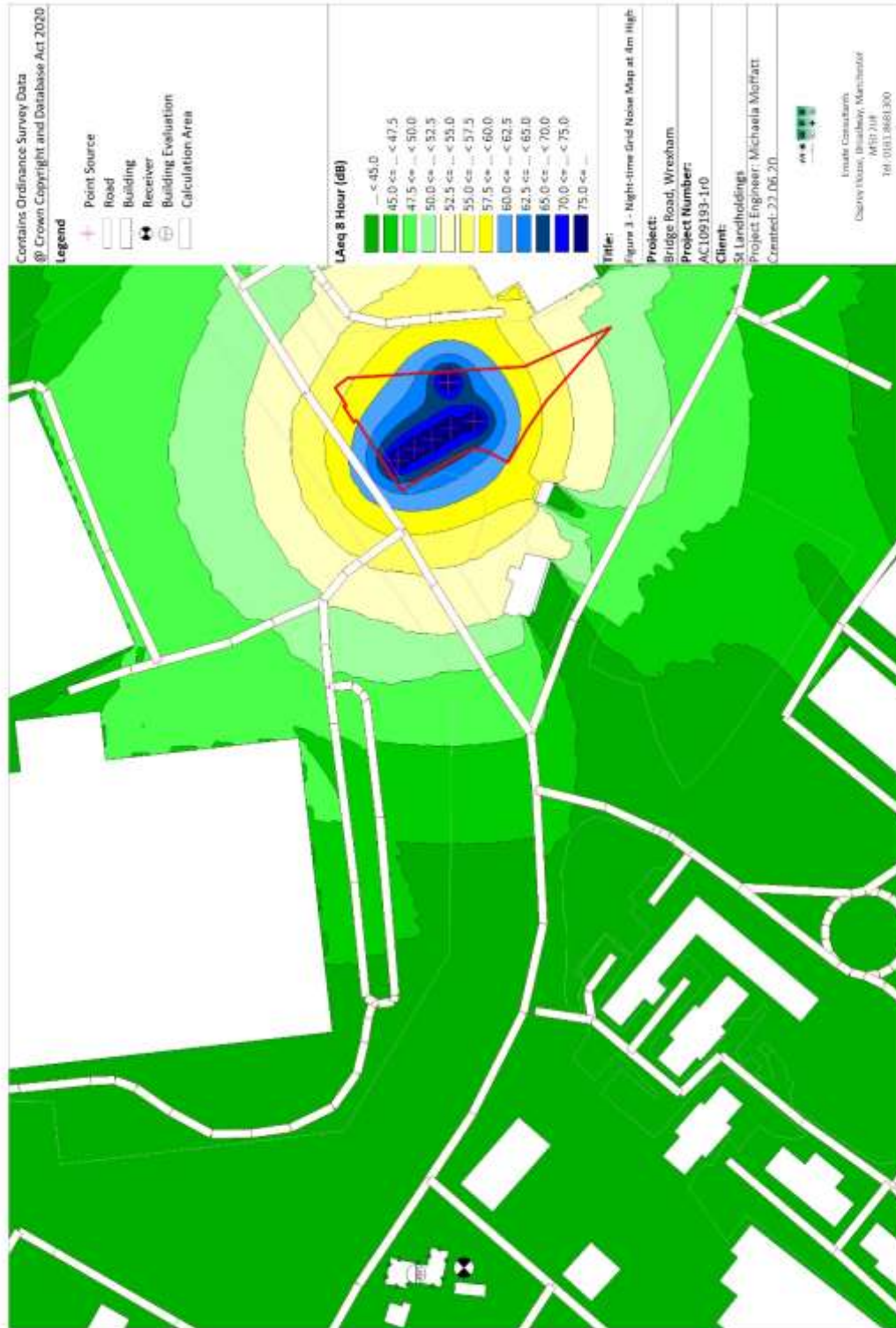


Noise Impact Assessment
Bridge Road, Wrexham
June 2020
AC109193-1r0

APPENDIX III FIGURES







APPENDIX IV MEASURED BACKGROUND SOUND LEVELS

Table A3 Measured Background Sound Levels - Oak Road, Wrexham 2018

Period Start	Measured Sound Pressure Level, $L_{Aeq,1hr}$ (dB)	Measured Background Sound Level, $L_{A90,1hr}$ (dB)
28/09/2018 16:00	58.4	45.5
28/09/2018 17:00	53.1	46.1
28/09/2018 18:00	53.1	45.8
28/09/2018 19:00	50.4	44.3
28/09/2018 20:00	48.9	44.5
28/09/2018 21:00	51.1	45.8
28/09/2018 22:00	52	48
28/09/2018 23:00	50.1	48
29/09/2018 00:00	50.8	47.8
29/09/2018 01:00	50.4	46.9
29/09/2018 02:00	49.8	46.8
29/09/2018 03:00	49.5	47.4
29/09/2018 04:00	50.2	45
29/09/2018 05:00	52	45.4
29/09/2018 06:00	52.7	47.1
29/09/2018 07:00	52	46.9
29/09/2018 08:00	52.8	45
29/09/2018 09:00	52.1	44
29/09/2018 10:00	51.8	42.9
29/09/2018 11:00	52	41.6
29/09/2018 12:00	52.6	45.2
29/09/2018 13:00	51.3	45.2
29/09/2018 14:00	51.7	44.4
29/09/2018 15:00	50.9	44.4
29/09/2018 16:00	50.9	44.6

Period Start	Measured Sound Pressure Level, L _{Aeq,1hr} (dB)	Measured Background Sound Level, L _{A90,1hr} (dB)
29/09/2018 17:00	52.7	45.4
29/09/2018 18:00	51.4	44.5
29/09/2018 19:00	48.3	43.2
29/09/2018 20:00	47.3	40.8
29/09/2018 21:00	45.9	41.3
29/09/2018 22:00	47.8	44.3
29/09/2018 23:00	46.7	41.9
30/09/2018 00:00	43.6	39.9
30/09/2018 01:00	46.7	41.7
30/09/2018 02:00	45.7	41.4
30/09/2018 03:00	45.5	39.9
30/09/2018 04:00	42.7	39.1
30/09/2018 05:00	48.8	43.1
30/09/2018 06:00	51.1	45
30/09/2018 07:00	48.1	43.9
30/09/2018 08:00	50.1	45.2
30/09/2018 09:00	50.6	45
30/09/2018 10:00	50.5	45
30/09/2018 11:00	52.6	45.1
30/09/2018 12:00	52.2	45.6
30/09/2018 13:00	51.7	45.1
30/09/2018 14:00	51.8	45.3
30/09/2018 15:00	51.7	46.1
30/09/2018 16:00	52	46
30/09/2018 17:00	51.4	45
30/09/2018 18:00	51.4	45.7

Period Start	Measured Sound Pressure Level, L _{Aeq,1hr} (dB)	Measured Background Sound Level, L _{A90,1hr} (dB)
30/09/2018 19:00	50.8	44.9
30/09/2018 20:00	49.1	44.1
30/09/2018 21:00	48.2	44.1
30/09/2018 22:00	48.3	45
30/09/2018 23:00	48.8	44.3
01/10/2018 00:00	46.7	44
01/10/2018 01:00	47.3	43.2
01/10/2018 02:00	45.3	41.6
01/10/2018 03:00	46.6	42.1
01/10/2018 04:00	48.5	42
01/10/2018 05:00	53.4	45.5
01/10/2018 06:00	56.2	47.3
01/10/2018 07:00	57.6	52
01/10/2018 08:00	56.9	50.9
01/10/2018 09:00	52.5	47.6
01/10/2018 10:00	52.7	47.4
01/10/2018 11:00	53.9	48.1
01/10/2018 12:00	54.1	49.2
01/10/2018 13:00	55.8	50.6
01/10/2018 14:00	62.3	52