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Noise Assessment

Dig Gate Lane Gas-powered Standby Power Generation Facility

Land off Dig Gate Lane, Rochdale

For:

Sterling and Wilson Cogen Solutions Pvt Ltd

CRM.361.024.NO.R.001

'Experience and expertise working in union'

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Noise Assessment

Project:	Dig Gate Lane Gas-powered Standby Power Generation Facility
For:	Sterling and Wilson Cogen Solutions Pvt Ltd
Status:	Final
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Non-technical Summary

Enzygo Limited has been instructed by Sterling and Wilson Cogen Solutions Ltd to undertake an environmental noise impact assessment to support a variation to an existing planning permission for the proposed revised 7.5MW gas-powered standby power generation facility on land off Dig Gate Lane, Rochdale.

The variation is to replace the currently permitted generator building with containerised generators.

The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise sensitive receptors in line with the equipment's proposed operational hours, and to provide outline mitigation advice where considered necessary.

The BS4142 assessment has shown that the predicted sound rating levels are below the prevailing background noise levels which would indicate that the specific sound levels from the proposed facility would have a low impact.

As BS4142 is not intended to be applied to the derivation of indoor noise levels arising from outdoor sound, a further assessment has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS8233, specifically those relating to sleeping in bedrooms. The assessment has shown that, when considering a 15dB reduction for a partially open window, predicted internal noise levels would meet the 30dB $L_{Aeq,8hr}$ noise level recommended at all receptors assessed.

A comparison against the permitted noise levels, i.e. the predicted sound rating levels reported in the noise assessment prepared by WYG referenced A105041-13-5 to support the previous application, has also been made. The comparison shows that the predicted rating levels from the revised site layout are significantly lower than those that would be generated by the currently permitted layout.

Based on the findings of the assessment against the guidance contained in the relevant standards it is considered that the proposed facility, which would operate to support the National Grid during peak power demand periods predominantly between 07:30 and 20:30 hours, would be able to operate without adversely affecting the nearby sensitive receptors assessed in terms of acoustic impact.

During rare night-time emergency operations, the proposed facility would meet the internal guidance values for sleeping subject to the assumptions made.

1 Introduction

1.1 Project Introduction

1.1.1 Enzygo Limited (Enzygo) has been commissioned by Sterling and Wilson Cogen Solutions Pvt Ltd (SWC) to undertake an environmental noise impact assessment to support a variation of an existing planning permission for a the proposed revised 7.5MW gas-powered standby power generation facility on land off Dig Gate Lane, Rochdale.

1.1.2 The variation includes the replacement of the currently permitted generator building with containerised generators.

1.1.3 Planning permission was granted under application no. 17/01260/FUL in November 2017. The permission requires that the sound rating levels, specified within the noise assessment prepared by WYG referenced A105041-13-5 ("WYG Report") to support that application, must be achieved at all receptors assessed.

1.1.4 The assessment has been undertaken to assess compliance with the relevant standards at the nearest noise-sensitive receptors during the proposed operational hours of the equipment and to provide outline mitigation advice where considered necessary.

1.1.5 Details of the assessment methodology employed, the assessment and conclusions are presented within this report.

1.2 Site Description

1.2.1 The site lies adjacent to the M62 on a parcel of land between the M62 and Dig Gate Lane, Rochdale. The site is centred at grid reference SD 91846 11185, approximately.

1.2.2 To the north of the site there are warehouses and related buildings forming Kingsway Business Park, to the east of the site is the M62 beyond which is Dig Gate Barn and Farm with open farmland and other farm buildings as far as Newhey. To the south, beyond the M62 is open farmland as far as Broad Lane, Burnedge and to the west is retail buildings with the ASDA warehouses beyond and residential properties at Balderstone.

1.2.3 The nearest noise sensitive residential receptors, identified in the WYG Report, shown in Figure 1-1, are:

- No.3 White Horse Meadows, Balderstone;
- Chadwick Fold Farm, Burnedge;
- Dig Gate Barn, Milnrow; and
- Dig Gate Farm, Milnrow.

1.2.4 A fifth receptor, which was used as office accommodation, identified within the WYG Report as Broad Shaw Farm, has undergone a change of use to retail development since the WYG Report was submitted. As this is now retail development it is no longer considered to be noise-sensitive and is therefore not considered within this assessment.

1.3 Project Description

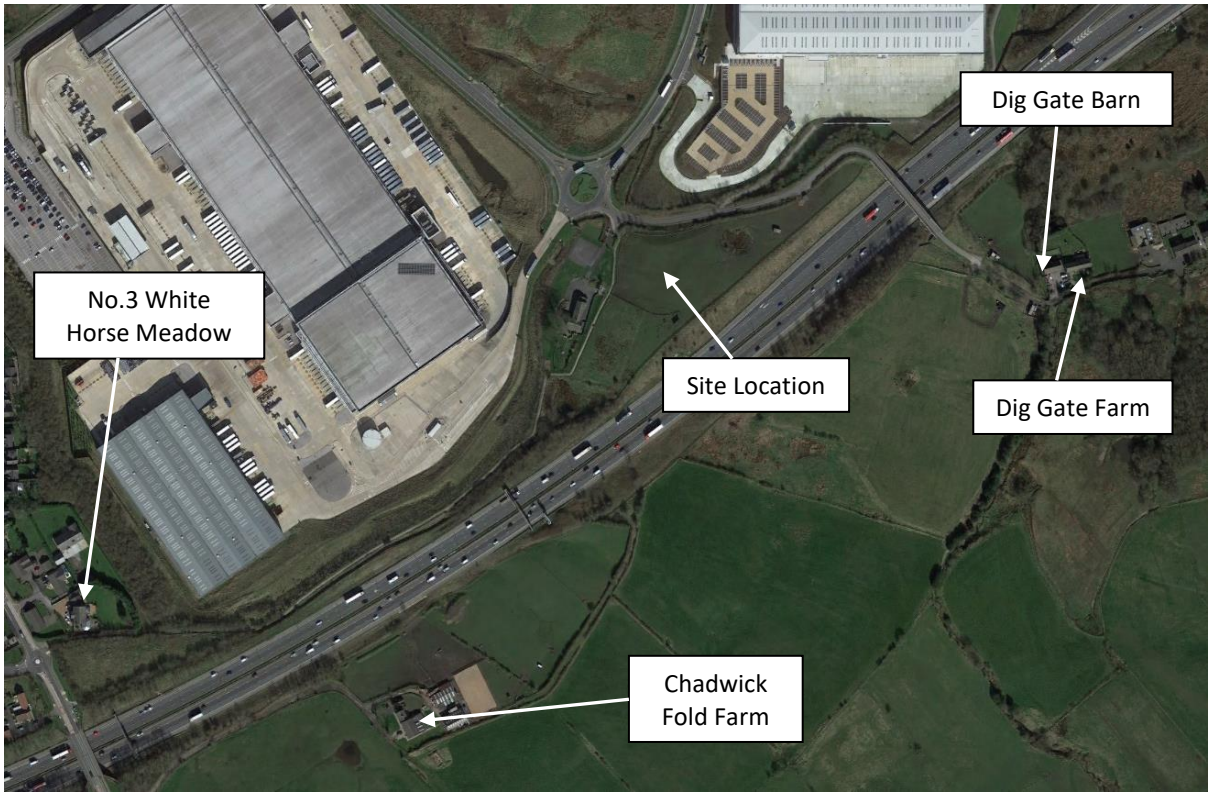
1.3.1 The gas-powered standby power generation facility would produce 7.5MW of electricity to support the National Grid when required to cope with short-term peak energy demand. This would predominantly occur during the daytime, predominantly between 07:30 and 20:30

hours, but may, under extremely rare emergency situations, such as a National Grid power outage, operate at night. In accordance with the planning permission, the facility, which will be enclosed within a 4m high paladin perimeter fence, will comprise the following equipment:

- 3no. 2.0MW and 1no. 1.5MW containerised gensets including roof mounted remote radiators and exhaust systems;
- A gas skid;
- A DNO room;
- An electrical switchgear room; and
- A welfare room.

1.3.2 The manufacturers noise data for the gensets, radiators, etc., has been used to assess the potential noise effects of the facility at the nearest noise sensitive receptors.

Figure 1-1: Site Location Plan



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1.4 Consultation

1.4.1 Enzygo has consulted with Rochdale Borough Council regarding the proposed assessment methodology and the status of Broad Shaw Farm. It was agreed with Paul Fletcher that the assessment methodology was suitable and that, as Broad Shaw Farm was now retail development, it could be excluded from the assessment.

1.5 Noise Assessment Methodology

1.5.1 The noise assessment has been made in accordance with the guidance contained within British Standard 4142:2014 '*Method for rating and assessing industrial and commercial sound*' (BS4142), British Standard 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233) and the World Health Organisation guidance document '*Guidelines for Community Noise*' (WHO Guidelines) where appropriate. An assessment has also been made against the results of the noise predictions set out in the WYG Report.

1.5.2 Noise levels generated by the proposed development during operations to support the National Grid power supply during peak demands/power outages, have been predicted to the nearby sensitive receptors using the calculation methodology outlined in ISO 9613:1996 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*' (ISO 9613) using the proprietary noise modelling software CadnaA.

1.5.3 The assessment is based upon the results of the baseline noise survey, undertaken by WYG, at the nearby receptors over representative operational periods.

2 Standards and Guidance

2.1 Existing Planning Permission

2.1.1 The site has planning permission, granted under application no. 17/01260/FUL, which states in Condition 12:

"*The building envelope of the engine house hereby approved shall be constructed in accordance with the sound reduction mitigation measures set out at section 6.0 of the submitted Noise Assessment (ref. A105041-15-3 Issue 3). The rating sound levels specified within the Noise Assessment must be achieved at all times that the development is operational at all noise sensitive receptors.*

Reason: *In the interests of amenity and in compliance with Policies DM1 and G9 of the adopted Rochdale Core Strategy and the National Planning Policy Framework.*"

2.1.2 There are no other conditions relating to noise within the planning permission.

2.2 British Standard 4142:2014 *Methods for rating and assessing industrial and commercial sound*

2.2.1 BS4142 provides a methodology for rating and assessing sound associated with both industrial and commercial premises. The purpose of the Standard is clearly outlined in the opening section where it states that the method is appropriate for the consideration of:

- 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.

2.2.2 The Standard is based around the premise that the significance of the noise impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise level (not necessarily the lowest background level measured, but the typical background of the receptor) from the measured/calculated rating level of the specific sound under consideration. This comparison will enable the impact of the specific sound to be concluded based upon the premise that typically "*the greater this difference, the greater the magnitude of the impact*". This difference is then considered as follows:

- 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 upon 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 or a significant adverse impact.

2.2.3 BS4142 further states that "*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*" again depending upon the specific context of the site. The Standard further qualifies the assessment protocol by outlining conditions to the comparative assessment and stating that "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*", thus implying that all sites should be assessed on their own merits and specifics.

2.2.4 The Standard quantifies the typical reference periods to be used in the assessment of noise, namely:

Typical Daytime	07:00 – 23:00	1-hr assessment period
Typical Night-time	23:00 – 07:00	15-min assessment period

2.2.5 The Standard outlines methods for defining appropriate "*character corrections*" within the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Methods for tonality and c) the Reference Method. It is noted by the Standard that where multiple features are present the corrections should be added in a linear fashion to the specific level.

2.2.6 The Subjective Method is based on the following corrections:

Table 2-2: BS4142 Subjective Method Rating Corrections

Level of Perceptibility	Tonal Correction	Impulsivity Correction	Correction for "Other sound characteristics"	Intermittency Correction
No Perceptibility	+0 dB	+0 dB	Where neither tonal nor Impulsive but clearly identifiable +3 dB	If intermittency is readily identifiable +3 dB
Just Perceptible	+2 dB	+3 dB		
Clearly Perceptible	+4 dB	+6 dB		
Highly Perceptible	+6 dB	+9 dB		

2.3 British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*

2.3.1 BS8233 provides guidance and recommendations for the control of noise from outside sources to maintain an internal acoustic environment appropriate for the intended use. The Standard suggests appropriate criteria and limits for differing 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 to the external noise climate. However, it is considered that the guidance provides suitable criteria for the assessment of internal noise levels in this instance.

2.3.2 The Standard suggests suitable guidance values for residential dwellings shown in Table 2-3.

Table 2-3: BS8233 Indoor Ambient Noise Levels for Dwellings

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

2.3.3 Whilst it is considered desirable to achieve these internal noise levels with the windows open, it is not stipulated with the Standard which states:

"*If relying on closes windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.*"

2.3.4 The Standard suggests that the level of noise reduction provided by a partially open window would be approximately 15dB.

2.4 World Health Organisation – *Guidelines for Community Noise*

2.4.1 The World Health Organisation's (WHO) *Guidelines for Community Noise* document, with respect to external noise, states:

"*4.2.7 Annoyance responses*

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day…"

2.4.2 For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00 hours) 8-hour noise level of 30dB L_{Aeq} inside bedrooms (for reasonably steady noise sources) to avoid sleep disturbance.

2.4.3 The WHO guidelines also recommend a night-time (23:00 - 07:00 hours) maximum noise level of 45dB $L_{Aeq,8hr}$ or 60dB L_{AFmax} outside bedrooms to avoid sleep disturbance.

2.5 ISO9613 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

2.5.1 The noise levels generated by the operation of the proposed development have been predicted using the calculation methodology set out in ISO9613-2. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

2.5.2 The methodology assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3 Baseline Noise Monitoring Survey

3.1 Baseline Noise Survey

3.1.1 Details of the prevailing background noise levels measured by WYG in October 2017 and reported in the WYG Report are detailed in Table 3-1 below.

Table 3-1: Baseline Survey Results, dB

	Period	No.3 White Horse Meadows	Chadwick Fold Farm	Dig Gate Barn	Dig Gate Farm
Background Noise Level, L_{A90}	Day	64	64	75	65
	Night	56	56	56	54

3.1.2 The noise climate around the site and nearby receptors was noted as being dominated by road traffic noise from the M62. Other noise sources were noted as road traffic from the B6194 and HGVs entering and leaving the ASDA distribution centre.

4 Noise Assessment

4.1 Noise Emissions

4.1.1 As described in Section 1, the proposed facility will consist of 3no. 2.0MW and 1no. 1.5MW generators in individual containerised units. Each containerised package has been designed to achieve a noise specification of 65dB(A) measured at 10m from the side of the container.

4.1.2 The proposed facility would also include ancillary items such as a switchgear room, welfare room, DNO room and gas skid. No significant noise emissions are expected from these plant items and therefore are not included within the following assessment.

4.2 Noise Modelling Protocols

4.2.1 The noise model was constructed using the proprietary noise modelling software package CadnaA. The potential noise impacts at the nearby residential properties have been predicted using the calculation methodology outlined in ISO9613.

4.2.1 The noise model was constructed utilising Google Earth geo-referenced 1:1 scaled aerial photography and noise source data supplied by the client. Table 4-1 shows the adopted sound power levels used within the noise model and the heights used for the sources.

Table 4-1: Modelled Source Emission Heights

Plant Noise Source	Sound Pressure Level, L_P dB	Source Height
Containerised Generator	65dB(A) @ 10m	3.0m max
Exhaust Outlet	65dB(A) @ 10m	10m
Remote Radiator	62dB(A) @ 10m	4.4m max

4.3 Noise Modelling Assumptions

4.3.1 Modelled noise levels form the basis of the calculated specific sound level. Noise emissions from the site have also been plotted graphically and are shown in Appendix A. The following assumptions have been made during the modelling process:

- All sources have a 100% on-time throughout the 1-hour daytime and 15-minute night-time assessment periods;
- Wind and temperature gradient assisted sound propagation at all receptors; and
- 90% soft ground between the sources and receptors.

4.4 Predicted Sound Levels/Sound Rating Levels

4.4.1 Noise levels generated by the proposed development have been predicted to the site facing façade of the nearest receptors. Predictions have been made to heights of 1.5m for ground floor and 4.0m for first floor windows.

4.4.1 In accordance with the guidance contained in BS4142 the specific sound level has been corrected for tonal, impulsive, intermittent or other acoustic characteristics which may be

present at the receptors to determine the sound rating level. To maintain consistency across the assessments, a correction of +3dB has been applied.

4.4.2 It is noted that BS4142 assessments are undertaken using whole dB values with 0.5dB being rounded up. Table 4-2 details the predicted specific sound levels and derived sound rating levels.

Table 4-2: Predicted Specific Sound Levels at the Assessment Locations

Location	Assessment Location	Assessment Height, m	Specific Sound Level dB $L_{Aeq,1hr}$	Sound Rating Level, dB $L_{Ar,T}$
No.3 White Horse Meadows	Ground Floor – day	1.5	37.3	40
	1st Floor - night	4.0	38.7	42
Chadwick Fold Farm	Ground Floor – day	1.5	40.3	43
	1st Floor - night	4.0	41.8	45
Dig Gate Barn	Ground Floor – day	1.5	40.4	43
	1st Floor - night	4.0	43.9	47
Dig Gate Farm	Ground Floor – day	1.5	30.3	33
	1st Floor - night	4.0	38.4	41

4.5 BS4142 Assessment

4.5.1 A comparative assessment has been undertaken to determine the potential impact of the predicted sound rating levels at the nearest residential receptors upon the prevailing background noise levels. Table 4-3 details the results of the assessment.

Table 4-3: BS 4142 Assessment

Location	Period	Background Noise Level dB L_{A90}	Sound Rating Level dB $L_{Ar,T}$	Level Exceeding Background dB
No.3 White Horse Meadows	Day	64	40	-24
	Night	56	42	-14
Chadwick Fold Farm	Day	64	43	-21
	Night	56	45	-11
Dig Gate Barn	Day	75	43	-32
	Night	56	47	-9
Dig Gate Farm	Day	65	33	-32
	Night	54	41	-13

4.5.2 Table 4-3 shows that the predicted sound rating levels are below the prevailing background noise levels indicating that the specific sound would have a **low impact**.

4.5.3 It is considered unlikely that residents nearby would be using external amenity space at night, the predicted noise levels inside properties has been assessed in accordance with the guidance contained in BS8233, specifically those relating to sleeping in bedrooms.

4.6 BS8233 Indoor Noise Level Assessment, Emergency Night-time Operations

4.6.1 An assessment of the predicted internal noise levels, generated during rare emergency night-time operations at the proposed facility, has been made against the guideline values for internal ambient noise levels for sleeping in bedrooms outlined in BS8233.

4.6.2 Table 4-4 details the results of the assessment when considering a 15dB reduction for a partially open window.

Table 4-4: BS8233 Assessment

Location	Floor	Predicted Internal Noise Level dB L_{Aeq}	Guideline Value for Night-time Sleeping dB $L_{Aeq,8hr}$	Difference
No.3 White Horse Meadows	1st	24	30	-6
Chadwick Fold Farm	1st	27		-3
Dig Gate Barn	1st	29		-1
Dig Gate Farm	1st	23		-7

4.6.3 Table 4-4 shows that the predicted internal noise levels generated by the proposed facility during rare night-time operations would meet the guideline values for sleeping conditions in bedrooms at all locations assessed.

4.7 Assessment against Permitted Development Noise Levels

4.7.1 An assessment against the permitted noise levels, i.e. the predicted sound rating levels contained within the WYG Report, has been made. Table 4-5 details the results of the assessment.

Table 4-5: Comparison against Permitted Development Noise Levels

Location	Period	Permitted (WYG Predicted) Sound Rating Level dB $L_{Ar,15min}$	Enzygo Predicted Sound Rating Level dB LAr,T	Difference
No.3 White Horse Meadows	Day	43	40	-3
	Night	46	42	-4
Chadwick Fold Farm	Day	47	43	-4
	Night	49	45	-4
Dig Gate Barn	Day	48	43	-5
	Night	50	47	-3
Dig Gate Farm	Day	42	33	-9
	Night	44	41	-3

4.7.2 Table 4-5 shows that the predicted sound rating levels from the operation of the revised site design would be significantly lower than those that would be generated by the currently permitted layout.

4.8 WHO Guidance Assessment

4.8.1 The guidance contained in the WHO document *Guidelines for Community Noise* reflects the guidance outlined in BS8233, or vice versa, with respect to internal noise levels at night. It has already been shown that the predicted internal noise levels from the proposed facility would meet the BS8233 guideline values during any emergency night-time operation of the generator plant.

4.8.2 The predicted maximum noise levels outside bedroom windows are well below the 60dB L_{AFmax} guideline level suggested by the WHO.

5 Conclusion

5.1 Background

5.1.1 Enzygo Limited (Enzygo) has been commissioned by Sterling and Wilson Cogen Solutions Pvt Ltd (SWC) to undertake an environmental noise impact assessment to support a variation of an existing planning permission for a the proposed revised 7.5MW gas-powered standby power generation facility on land off Dig Gate Lane, Rochdale.

5.1.2 The variation includes the replacement of the currently permitted generator building with containerised generators.

5.1.3 Planning permission was granted under application no. 17/01260/FUL in November 2017. The permission requires that the sound rating levels, specified within the noise assessment prepared by WYG referenced A105041-13-5 (WYG Report), must be achieved at all receptors assessed.

5.1.4 The assessment is based on the results of a series of noise predictions undertaken in accordance with the calculation methodology contained in ISO9613 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*'.

5.2 Noise Assessment

5.2.1 Sound levels generated by the proposed development have been predicted using CadnaA and an assessment has been made in accordance with the guidance contained in BS4142, BS8233 and WHO Guidelines for Community Noise. Reference has also been made to the noise exposure hierarchy described in the planning practice guidance.

5.2.2 The BS4142 assessment has shown that the predicted sound rating levels are below the prevailing background noise levels which would indicate that the specific sound levels from the proposed facility would have a **low impact**.

5.2.3 As BS4142 is not intended to be applied to the derivation of indoor noise levels arising from outdoor sound, a further assessment has been made against the guideline values for internal ambient noise levels in dwellings outlined in BS8233, specifically those relating to sleeping in bedrooms. The assessment has shown that, when considering a 15dB reduction for a partially open window, predicted internal noise levels would meet the 30dB $L_{Aeq,8hr}$ noise level recommended at all receptors assessed.

5.2.4 A comparison against the permitted noise levels, i.e. the predicted sound rating levels reported in the WYG Report, has also been made. The comparison shows that the predicted rating levels from the revised site layout are significantly lower than those that would be generated by the currently permitted layout.

5.3 General Conclusion

5.3.1 Based on the findings of the assessment against the guidance contained in the relevant standards it is considered that the proposed facility, which would operate to support the National Grid during peak power demand periods predominantly between 07:30 and 20:30 hours, would be able to operate without adversely affecting the nearby sensitive receptors assessed in terms of acoustic impact.

5.3.2 During rare night-time emergency operations, the proposed facility would also meet the internal guidance values for sleeping subject to the assumptions made.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
$L_{A10,T}$	The 10th statistical percentile of a measurement period, i.e. the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
$L_{A90,T}$	The 90th statistical percentile of a measurement period, i.e. the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all sources incident at one location, both in the near- and far-field (*The ambient sound comprises the residual sound and the specific sound when present)*.
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

Term	Definition
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = $t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20µPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t.
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over a period of time, T.
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of ±1dB;
- Type 1 sound level meter – operational tolerance of ±1.1dB;
- Meteorology – allowance of ±1.9dB; and
- CadnaA noise propagation modelling software – operational accuracy of ±2.1dB

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of ±3dB.

Appendix A – Noise Contour Plots

Figure B-1 – Noise Contour Plot - Daytime

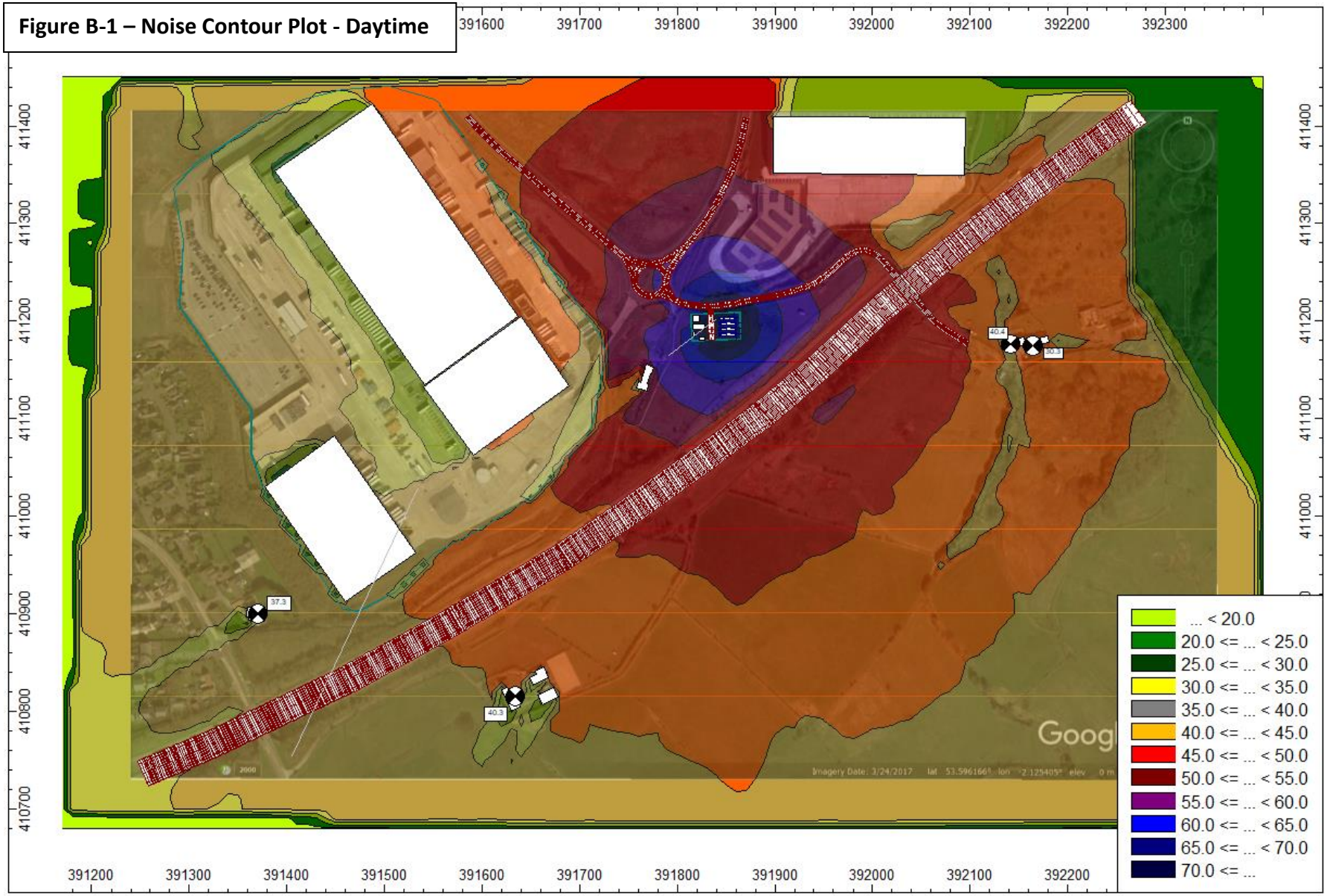
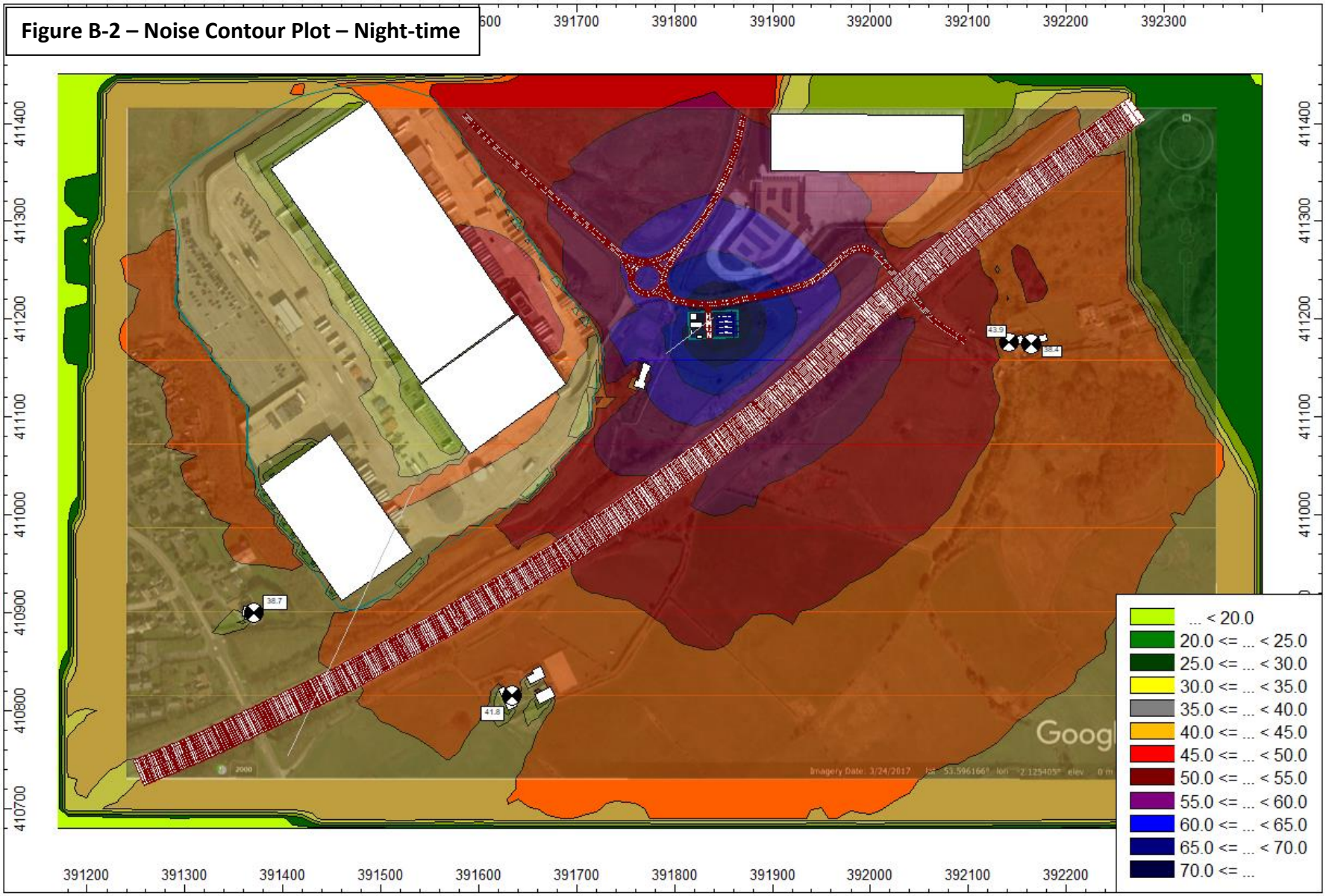


Figure B-2 – Noise Contour Plot – Night-time





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