REPORT

Sandsfield Gravel Company Ltd

Milegate Eastern Extension Quarry and Landfill

Noise Assessment

Submitted to:

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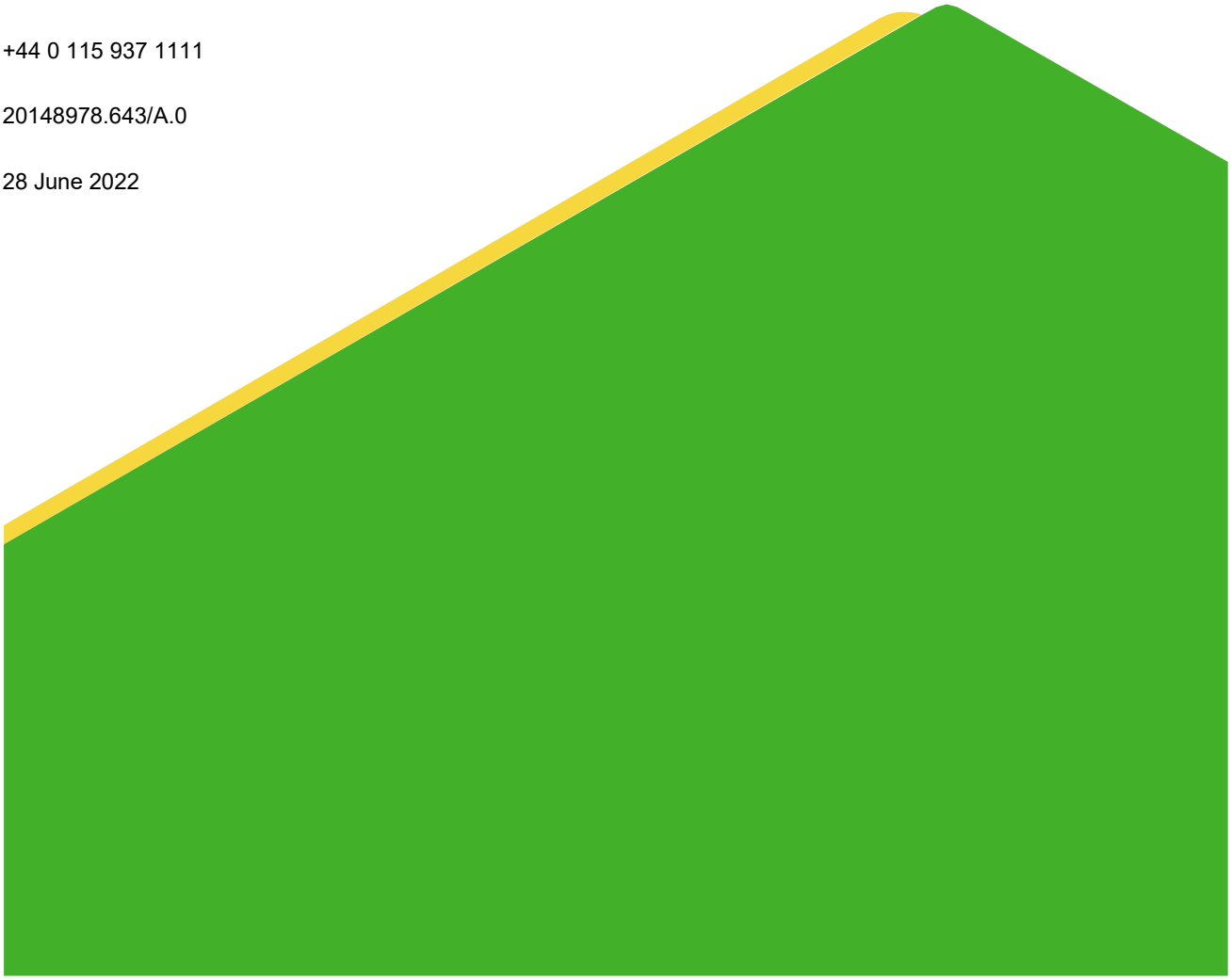
20148978.643/A.0

28 June 2022



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1.0 INTRODUCTION

Golder, member of WSP UK Ltd ('Golder') has been appointed by Sandsfield Gravel Company Ltd ('Sandsfield') to undertake an environmental noise assessment for its Milegate Extension landfill at Catwick Lane, Brandesburton, Driffield, East Yorkshire, YO25 8SA (the 'Site'). This noise assessment has been prepared for submission to The Environment Agency (EA) as part of Sandsfield's application to vary their existing Environmental Permit (EP) (reference EPR/BX1942IX). That permit was issued by the EA in 2006 and last varied and consolidated by the EA in February 2020 (Variation Notice V003).

The existing EP allows Sandsfield to dispose of non-hazardous waste under the listed activity of Section 5.2 Part A(1)(a) of the Environmental Permitting (England and Wales) Regulations and the Site can accept up to 75,000 tonnes of waste per year for landfilling. The EP also covers other associated activities including the 'flaring of landfill gas in an appliance', which is achieved through the use of an on-site landfill gas powered flare (with associate compressor and generator). The gas flare was originally installed towards the south-east corner of the site, but was later relocated towards the north-west corner of the site before being recently upgraded.

Sandsfield proposes to extend the existing Site into the neighbouring field to the east (the 'Eastern Extension') which is currently in agricultural use. A variation to the EP would allow continued and uninterrupted landfilling operations to extend into the Eastern Extension following mineral extraction.

The amount of gas produced by the landfill has risen over time, as the amount of the deposited waste has increased, so as part of the development the installation of a Landfill Gas Utilisation Plant Compound (LFGUP) is proposed towards the north-west corner of the site. The LFGUP would include two new landfill gas powered electricity generators (current generator to be de-commissioned) and incorporate the existing on-site flare and compressor which would be subject to small changes from their current locations.

In May 2022, Sandsfield submitted three planning applications (two S.73 applications and a full application for Planning Permission) to East Riding of Yorkshire Council (ERYC) in parallel (one Environmental Statement). Those planning submissions were made to:

- Allow continued and uninterrupted quarrying and landfilling operations to extend into the neighbouring field to the east (the 'Eastern Extension') which is currently in agricultural use. The Eastern Extension is proposed to be completed within the timeframe already permitted for the existing operations i.e. before February 2038.
- Gain planning approval for movement of the existing landfill flare from the southeast corner to the northwest corner of the existing site (January 2019) and upgrade of that flare (September 2021) (retrospective planning application).
- Install a new landfill gas utilisation plant compound at the northwest corner of the existing site, in which there will be the phased installation of two new landfill gas-to-energy engines ('micro-generators') and associated equipment. The landfill gas flare will be moved into this compound. A new cable connection will be installed from the compound, extending northwest to a new step-down transformer, enabling the gas engines to generate electricity and supply a neighbouring business by private wire and the National Grid.

A decision regarding the planning application submitted to ERYC is pending.

The scope of this noise assessment has been determined following review of Environmental Agency guidance *Risk assessments for your environmental permit: When you need to do an environmental risk assessment, when the Environment Agency will do it for you, and how to do a risk assessment* (last updated 1 April 2022). Given the significant distances to receptors, the landfilling activities already undertaken at the existing site (which will remain unchanged within the proposed Eastern Extension) and because proposed working hours would be daytime only (unchanged from existing), it is deemed that there will not be significant risk of noise

impact arising from proposed landfill operations, and specific quantitative assessment of noise from the landfill operations has therefore been scoped-out of this assessment. However, operation of the LFGUP would be 24hrs a day, so has been scoped-in and is the focus of the completed assessment. More details can be found in Section 2.5.

The noise assessment has been undertaken in accordance with the following EA online guidance documents which detail the arrangements for dealing with noise 'emissions' under the Environmental Permitting regime, including for proposed permit variations:

- *'Noise and vibration management: Environmental Permits. How UK environment agencies assess noise, legal requirements for managing noise, noise impact assessment and noise management plans*', the latest version of which is dated 31 January 2022 (this replaces H3 guidance); and
- '*Noise impact assessments involving calculations or modelling: Information you must submit to the Environment Agency in a noise impact assessment that uses computer modelling or spreadsheet calculation'*, the latest version of which is dated 06 November 2019.

In line with the requirements of the above EA guidance, a predictive noise assessment has been undertaken in accordance with BS4142: 2014+A1: 2019: *Method for rating and assessing industrial and commercial sound* (BS4142).

The completed assessment work has been undertaken drawing on the results of a site-specific background sound level survey, as well as source noise level measurements undertaken of the upgraded gas flare and ancillary equipment as installed.

The source noise measurement data, along with technical noise emission data for other equipment proposed for installation at the LFGUP, have been used to inform the prediction of operational noise levels for the proposed Permit Variation. Predictions have been undertaken by means of a detailed noise modelling exercise extending to cover the site and the closest identified noise-sensitive receptors. The assessment has considered both daytime and night-time operations.

The report also considers whether any of the assessed noise sources require mitigation in order to comply with the principles of Best Available Techniques (BAT).

This report details the findings of the completed assessment including the detail expressly stated as required within the Environment Agency online guidance documents referenced above.

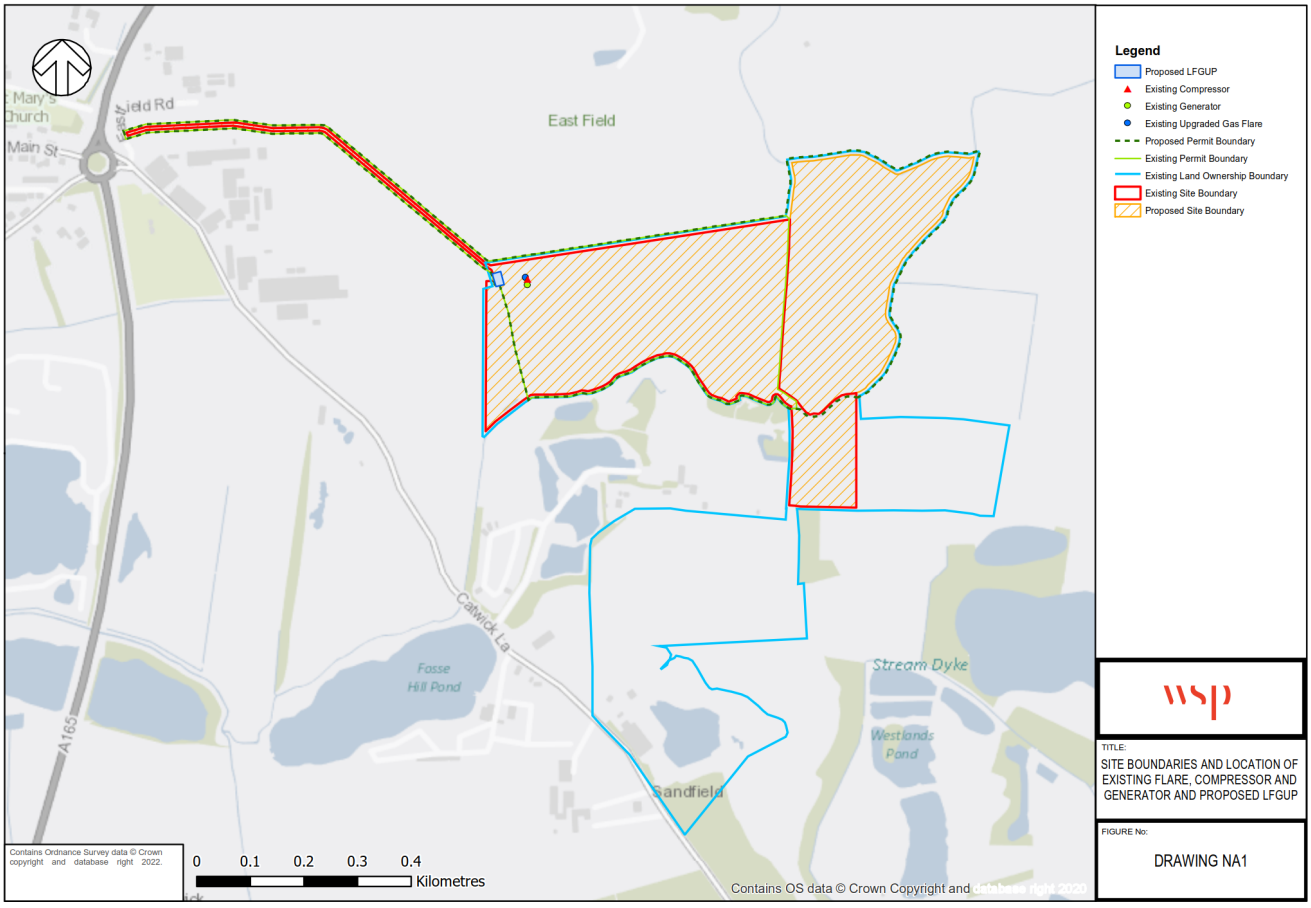
This report is necessarily technical in nature so a glossary of acoustic terminology can be found **in Appendix NA1**: **Glossary of Acoustic Terminology**.

2.0 SITE DESCRIPTION, PROJECT DETAILS AND ASSESSMENT SCOPE

2.1 Site Location

The Site is located approximately 1km south-east of the village of Brandesburton in East Yorkshire and is centred on National Grid Reference TA 131 472. The existing landfill operates as a combination of the original site (planning permission ref. DC/18/00628/CM/STRAT) and the Northern Extension (planning permission ref. DC/18/00581/ CM/STRAT PP-06758032). The current and extended site boundaries are presented as the red and orange (including hatch) lines respectively on **Drawing NA1: Site Boundaries and Location of Existing Flare, Compressor and Generator and Proposed LFGUP**. That drawing also presents the current and proposed permit boundaries in light and dashed dark green respectively, as well as the current land ownership boundary in blue.

Drawing NA1: Site Boundaries and Location of Existing Flare, Compressor and Generator and Proposed LFGUP



The Site lies in an area of relatively flat land, with ground elevations varying from 5 to 15m AOD. Ground levels across the Site typically fall gently to the south and east towards the Milldam Beck, which lies at an approximate elevation of 5m AOD. In general terms, much of the area surrounding the Site has been worked for the extraction of sand and gravel, and this has resulted in a number of pits that have been restored to ponds or restored by the disposal of waste as landfill.

To the immediate north of the Site lies open fields. The Moor Main Drain flows along the northern side of the proposed Eastern Extension and joins the Milldam Beck in the north-east corner. The drain then flows around the eastern and southern margins of the Site. Catfoss Airfield, a former RAF base, lies approximately 600 m north of the Site, and extends beyond 1km from the Site. The airfield is now used as an industrial estate. The settlement of Catfoss is located to the north-east of the site at a distance of just over 1km.

Beyond the Milldam Beck, to the east, are open fields beyond which is Catfoss Lane, a minor road passing north to south on which Manor Farm and Catfoss Cottages are located. Beyond this road and those residential properties are open fields.

The Site is bound on its southern edge by the Milldam Beck, which flows westwards. Beyond the Milldam Beck, there are number of surface water ponds (flooded remains of sand and gravel workings) which are used for coarse fishing, and also the Watersedge Caravan Park (249m from the site) and the Humberside Shooting Ground. The shooting ground includes a residential property (230m from the site).

Also, to the south / south-east of the site are Sandsfield's operations including active workings and Plant Pit 2 and Plant Pit 3 landfills.

Catwick Lane is to the south-west of the site, approximately 250m from the site at its closest point. It is a minor road orientated north-west to south-east and provides access to the site and current Sandsfield operations. Beyond Catwick Lane are a small number of dwellings and the Fosse Hill Jet-ski and Caravan Park.

A trading estate (off Catwick Lane) is located approximately 200m north-west of the Site and extends to approximately 800m north-west of the Site. The A165, a dual carriageway, passes north to south about 800m west of the Site, beyond which are further fields, the Dacre Lakeside Park and the village of Brandesburton.

2.2 Proposed Development

The EP variation application is proposed to:

- Allow landfilling operations to extend into the proposed Eastern Extension, in line with Sandfield's ownership boundary and thus increase the capacity of the landfill;
- Obtain retrospective permission for changing the location of the (recently upgraded) gas flare from the south-east corner to the north-west corner of the existing site; and
- Allow installation and operation of the proposed LFGUP, accommodating a further minor relocation of the existing upgraded landfill gas flare and ancillary equipment, and incorporate two new landfill gas powered electricity generators.

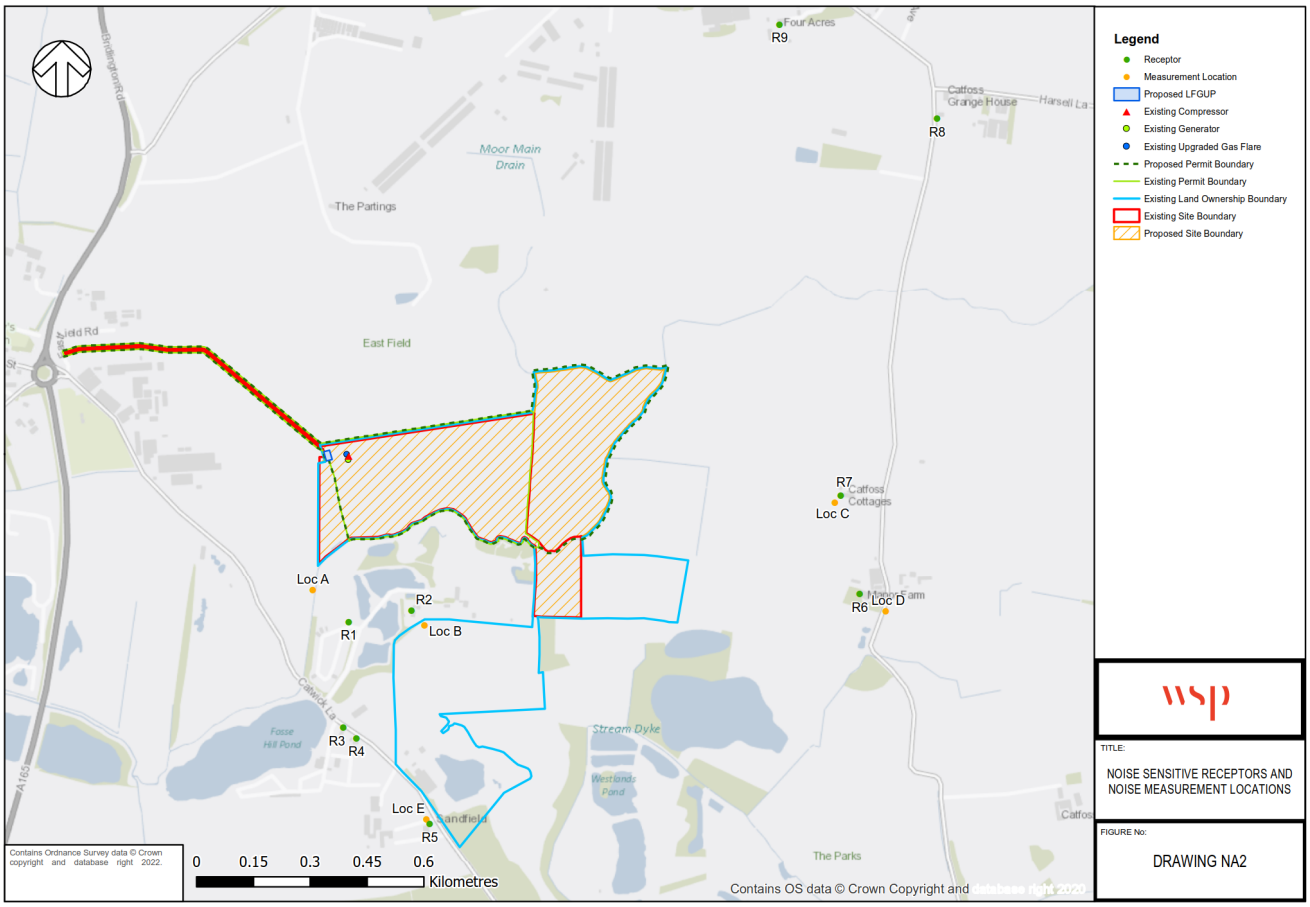
2.3 Study Area and Noise Sensitive Receptors

The study area includes the existing facility (encompassing the position of the existing upgraded gas flare and ancillary equipment, and the proposed LFGUP), the proposed Eastern Extension, and land extending to encompass the closest existing noise-sensitive receptors in all directions from the site. Those receptors are detailed in Table NA1 below and are also presented within **Drawing NA2: Noise Sensitive Receptors and Noise Measurement Locations**.

Table NA1: Noise Sensitive Receptors

Receptor Ref.	Description	Receptor Type	Distances to Closest Site Boundaries (m)		OS Grid Coordinates	
			Existing Facility	Eastern Extension	X	Y
R1	Waterside Edge Caravan Park, SW of the site. The closest caravan plot to the proposed eastern extension has been selected as the receptor location.	Leisure / Residential	249	530	512887	466898
R2	Dwelling at the Humberside Shooting Ground, south of the site	Residential	230	370	513052	446928
R3	Dwelling on south side of Catwick Lane, south of the site, adjacent to entrance to Fosse Hill Jet-ski and Caravan Park.	Residential	528	706	512873	446619
R4	Dwelling on south side of Catwick Lane, south of the site, south-east of receptor R3.	Residential	555	705	512907	446590
R5	Dwelling on south side of Catwick Lane, south of the site, east of access to Sandsfield Farm.	Residential	786	797	513101	446364
R6	Manor Farm, dwelling on Catfoss Lane, east of the site.	Residential	900	718	514235	446971
R7	Catfoss Cottages, dwellings on Catfoss Lane east of the site and north of receptor R6.	Residential	826	582	514185	447230
R8	Catfoss Grange House, a dwelling at Catfoss, north-east of the site.	Residential	1322	1040	514439	448224
R9	Four Acres (Catfoss), a dwelling at Catfoss, north-east of the site and north-west of Receptor R8.	Residential	1217	1000	514023	448472

Drawing NA2: Noise Sensitive Receptors and Noise Measurement Locations



2.4 Extant Noise Related Planning Conditions

The original site operates under planning consent ref. DC/18/00628/CM/STRAT. That consent includes the following condition which limits the allowable operational hours for landfilling operations:

> *"6. Except in emergencies to maintain safe quarry working (which shall be notified to the Planning Authority as soon as practicable) or unless the Planning Authority has agreed otherwise in writing:—*
>
> *(a) no operations other than water pumping servicing environmental monitoring and testing of plants shall be carried out at the site except between the times:-*
>
> *0700 hours and 1800 hours Monday to Friday, and*
>
> *0800 hours and 1300 hours Saturdays;*
>
> *(b) no servicing, maintenance and testing of plant shall be carried out at the site between 2000 hours and 0700 hours on any day and at no time on Sundays or public holidays;*
>
> *(c) periods of servicing and maintenance of plant outside the hours set out in (a) above shall be noted in the site log book."*

The consented northern extension to the existing facility operates under planning consent ref. DC/18/00581/CM/STRAT PP-06758032, which includes the same condition only numbered 8.

2.5 Assessment Scope

Landfilling operations at the Eastern Extension are proposed to be undertaken in compliance with the consented hours of operation as detailed above, and operations would remain unchanged from those currently undertaken at the existing Site. Operational hours would therefore remain unchanged, being limited to daytime hours only, with no operations during the later evening or night-time, no operations on Saturday afternoons (after 13:00) and no operations at any time on Sundays. In addition, the closest noise-sensitive receptors to the Site are at substantial distances from the proposed Eastern Extension. Table NA1 confirms that the closest receptors to the proposed Eastern Extension are R2 and R1. These receptors are at distances of greater than 350 and 500m respectively from the proposed Eastern Extension, and the proposed Eastern Extension is further from these receptors than the existing consent.

Taking these factors into account and in accordance with the criteria in EA guidance: *Risk assessments for your environmental permit: When you need to do an environmental risk assessment, when the Environment Agency will do it for you, and how to do a risk assessment* (last updated 1 April 2022), it is concluded that given the lack of significant risk of noise impact arising from proposed landfill operations, noise from landfilling operations can be scoped-out of this noise assessment.

However, operation of the existing gas flare and the proposed LFGUP are / will be 24hrs operation, so noise from those items has been scoped-in, and is the focus of this noise assessment.

2.6 Upgraded Gas Flare, Ancillary Equipment and LFGUP

2.6.1 Upgraded Gas Flare and Ancillary Equipment

The existing landfill gas flare was recently upgraded to accommodate an increase in minimum-maximum gas flow rate from 100-500 Nm^3/hr to 200-1000Nm^3/hr. The upgrade included changes in stack diameter and height from 1.12m to 1.37m (diameter) and 6.84m to 7.48m (height).

The ancillary equipment to the upgraded stack comprises an existing compressor and an existing generator.

The current locations of the upgraded gas flare and ancillary equipment are detailed below and shown in **Drawing NA3**: **Location of Existing Flare, Compressors and Generator, and Proposed**. The stated X-Y coordinates correspond to the approximate centre point of each plant item.

Existing Locations:

- Existing upgraded gas flare – X,Y: 512883,447337, top of stack above ground: 7.48m.
- Existing compressor – X,Y: 512887,447335, mid-unit height above ground: 1.25m.
- Existing generator – X,Y: 512887,447323, mid-unit height above ground: 1.25m.

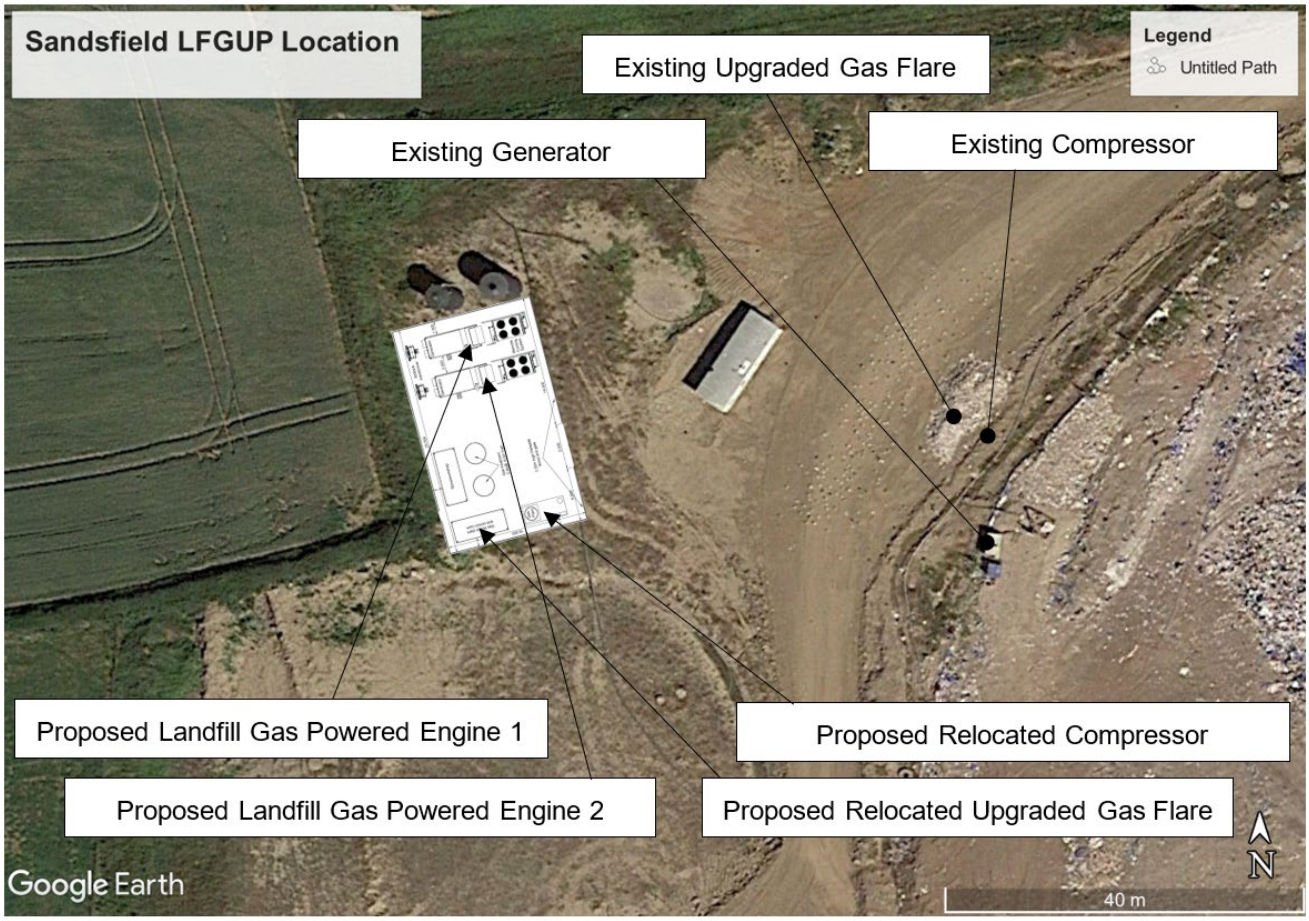
2.6.2 LFGUP

The LFGUP will include the existing upgraded gas flare and associated compressor (each item subject to a further minor relocation from existing positions), as well as two new landfill gas powered electricity generators (which would replace the existing generator (to be decommissioned)). There will also be two 300kVA transformers, but these would not be significant noise sources. The proposed plant locations are listed below, and the proposed layout of the LFGUP is presented in **Drawing NA3**: **Location of Existing Flare, Compressors and Generator, and Proposed LFGUP**. The stated X-Y coordinates correspond to the approximate centre point of each plant item.

Proposed Locations

- Relocated upgraded gas flare – X,Y: 512838,447326, top of stack above ground: 7.48m.
- Relocated compressor – X,Y: 512831,477324, mid-unit height above ground: 1.25m.
- Proposed landfill gas powered electricity generator 1 – X,Y: 512830,447344, mid-unit height above ground: 0.75m.
- Proposed landfill gas powered electricity generator 2 – X,Y: 512831,447340, mid-unit height above ground: 0.75m.

Drawing NA3: Location of Existing Flare, Compressors and Generator, and Proposed LFGUP



3.0 ASSESSMENT GUIDANCE

3.1 BS4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound (BS 4142)

BS 4142 describes methods for assessing sound of an industrial and/or commercial nature, including sound from fixed installations (such as mechanical and electrical plant).

It provides a method of determining the 'rating level' for sources of industrial or commercial sound for the purposes of investigating noise impact, assessing sound from new, modified, or additional sources of sound, and assessing sound affecting new residential premises.

BS 4142 uses several specific terms to define the various levels used in assessments, including:

- Specific sound – the commercial / industrial noise source under consideration;
- Residual sound – the sound level at the noise-sensitive receivers in the absence of the specific sound;
- Ambient sound – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e. ambient = residual + specific);
- Background level - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period; and
- Rating level – the specific sound, corrected for acoustically distinguishing characteristics.

The basis of the assessment approach is to determine the Specific sound level of the source under assessment, as arising at the receptor/s being considered. Where the source contains acoustic characters, e.g. tonality, impulsivity or intermittency, corrections are added to the specific sound level in determination of the 'Rating level'. The Rating level is then compared against the Background sound level that is present in absence of the source under investigation. The difference between the two levels is an indication of the degree of impact associated with the source, although this is also context specific.

The Background sound level is determined by measurement for both the daytime and night-time periods, and detailed advice is provided on how to analyse the measurement data to identify representative values. Separate assessments are undertaken for both daytime and night-time periods.

With regards to acoustic character corrections, BS 4142 states that it is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:

- Tonality: +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', and rising to +6 dB for 'highly perceptible' tones;
- Impulsivity (rapidity of change and overall chance in level): +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity; and
- Intermittency: if the on/off-time of the specific sound is readily distinctive at the noise-sensitive receivers, +3 dB.

Typically, the greater the difference between the background sound level and the rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context specific.

As a guideline, BS 4142 states that:

- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context.
- A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context.
- The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact, depending on context.
- Where the rating level does not exceed the background level, this in an indication that the specific sound will have a low impact, depending on context.

However, BS4142 also requires careful consideration to context and states that the above scale is only an indication of likely impact and that the initial estimate may need to be modified to account for context, including reference to factors such as:

- The absolute level of the sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether dwellings or other premises used for residuals purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
  - Façade insulation on treatment;
  - Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
  - Acoustic screening.

The advice where there are low background sound levels / rating levels is as follows:

> *"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."*

To provide numeric context to the above statement, the previous (1997) version of BS4142 described background noise levels of 30 dB $L_{A90,T}$ and rating levels of 35dB $L_{Ar,Tr}$ as being '*very low*'.

This description is reasonable in the context that BS8233: 2014: *Guidance on sound insulation and noise reduction for buildings* and the World Health Organisation: *Guidelines for community noise* document noise criteria of 50 and 55dB(A) $L_{Aeq,T}$ for external living areas such as residential gardens. Similarly, these documents detail criteria of 30 and 35 dB $L_{Aeq,T}$ internally for sleeping / resting respectively, which are equivalent to 40 and 45dB(A) externally assuming a 10dB reduction through a partially open window to the inside.

Therefore, when rating levels are 35dB $L_{Ar,Tr}$ or lower, this is a strong indication of there not being a significant impact regardless of relationship to the background sound level.

3.2 Noise and Vibration Management: Environmental Permits (23 July 2021)

This guidance was produced by the Environment Agency, the Scottish Environment Protection Agency (SEPA), Natural Resources Wales and the Northern Ireland Environment Agency in order to help those seeking Environmental Permits, a variation to their Permit or to comply with their existing Permits.

The document was produced on 23 July 2021 and supersedes the Environment Agency *Horizontal Guidance for Noise (H3) Parts 1* and *Part 2* and SEPA's *Guidance on the control of noise at PPC installations*.

The guidance covers:

- How the environment agencies will assess noise from certain industrial processes;
- What the law says you must do to manage noise and vibration; and
- Advice on how to manage noise – in particular, how to carry out a noise impact assessment and what operators should include in a Noise Management Plan (NMP).

The objective of the document is to assist in the regulation of noise from certain industrial processes and to protect and improve the environment, public health, and wellbeing.

It is advised that if noise is audible at noise sensitive receptors it could be 'possibly causing an impact' and the operator must prevent significant pollution and comply with the requirement to use 'appropriate measures' (Waste Framework Directive 2018/851), or 'best available techniques' (BAT) to prevent or minimise noise pollution.

Advice is given on when noise assessment is needed, the standards to be used, and the required competencies of the assessor. It is advised that noise assessments may be required by operators (or Permit applicants) at the application stage or when applying to vary a Permit, or to comply with specific Permit conditions.

Potential Noise Sensitive Receptors (NSRs) are to include residential properties, schools, hospitals, offices, public recreation areas, 'other NSRs' and noise sensitive habitats. Where noise may cause an impact at such receptors, the operator is required to carry out an assessment to determine the level of impact and how much work needs to be done to prevent or minimise the noise pollution. In respect of noise mitigation, the principle of BAT is referenced, employment of which is a legal defence against alleged noise nuisance.

To quantify the level of environmental noise impact from industrial sources (either existing or proposed) the guidance refers to the use of the assessment method detailed in BS 4142 (as summarised above), but goes on to state that in rare circumstances other methods may also be appropriate. The adoption of alternative assessment methods should be discussed and agreed with the regulator prior to commencement of the assessment work.

The guidance gives 4 steps to follow when undertaking a noise impact assessment. These are summarised as follows:

<u>Step 1: Desktop Risk Assessment</u>

This involves identifying and ranking in order of their off-site impact, any plant or operations that could be audible at any known (or proposed) NSRs. If noise emissions could cause pollution at an NSR, a noise impact assessment will be needed.

Step 2: Off-Site Monitoring Survey

Conducting a survey in line with BS4142 by a qualified acoustician, and using appropriate measurement equipment. The survey can be used to establish both prevailing industrial noise levels as well as the underlying background sound levels, and facilitate assessment in accordance with BS4142. It is stated that application of a minimum +3dB character correction is expected in the determination of industrial noise (rating) levels where a source is not tonal or impulsive but is readily distinguishable (unless no requirement for that correction can be robustly justified).

It is stated that in the determination of background sound levels it should be ensured that there is not influence from site noise, and that the adopted background sound levels should be those that 'typically' prevail, i.e. not the lowest recorded values.

Where the application is for a Permit variation, the assessment should consider all the noise resulting from the proposed variation, i.e. the existing site and the variation together. The assessment should show both components clearly and then add them together to give a new total for site noise at the receptors.

Step 3: Source Assessment

This step is to quantify the emissions from the noisiest items of plant or operations identified in Step 1, and then use that data to estimate the impact of these noise sources using BS4142 and/or modelling software. It should be recognised that there can be uncertainty associated with source sound level data and predictions. The level of noise impact as described by the Environmental Permits guidance can be described as follows, and is related to the closest BS 4142 descriptors:

- *Unacceptable level of audible or detectable noise* – This level of noise means that significant pollution is being, or is likely to be, caused at a receptor (regardless of whether the operator is taking appropriate measures). Further action must be taken, or operations may have to reduce or stop. The Environment Agency will not issue a Permit for operations likely to be at this level. The closest corresponding BS 4142 descriptor is 'significant adverse impact' (following consideration of the context).
- *Audible or detectible noise* – This level of noise means that noise pollution is being (or is likely to be) caused at a receptor. There is a duty to use appropriate measures to prevent, or where that is not practicable, minimise noise. There is not a breach of requirements if appropriate measures are employed, but it will be necessary to rigorously demonstrate that the measures are appropriate. The closest corresponding BS4142 descriptor is 'adverse impact' (following consideration of the context).
- *No noise, or barely audible or detectable noise* – This level of noise means that no action is needed beyond basic appropriate measures or BAT. The closest corresponding BS 4142 descriptor is 'low impact or no impact' (following consideration of context). Low impact does not mean there is no pollution. However, if the impact is correctly assessed as low impact under BS4142, the Environment Agency may decide that taking action to minimise noise is a low priority.

Step 4: BAT or Appropriate Measures Justification.

Present a justification that the operator is (or will be) using BAT to prevent or minimise polluting noise emissions.

With respect to noise modelling, reference is made in the Environment Agencies online guidance noted entitled: *Noise impact assessment involving calculators or modelling: Information you must submit to the Environment Agency in a Noise Impact Assessment that uses computer modelling or Spreadsheet calculation*. This online guidance note is summarised in Section 3.3 below.

It is stated that noise modelling should apply the calculation method detailed in ISO 9613: *Acoustics – attenuation of sound during propagation outdoors*.

The guidance goes on to provide additional guidance and good practice for areas including: 'Vibration Impact Assessment', 'How context affects an assessment', 'Dealing with uncertainty', 'Weather conditions', 'Source directivity', 'Measurement', 'Monitoring locations', Monitoring durations', Manufacturers' sound power levels data', 'Attenuation predictions', 'Operator error', 'Equipment' and 'Soundscape assessments'.

The section entitled 'Appropriate measures to meet permit conditions' confirms that when considering mitigation, the hierarchy of noise control should be as follows:

- Prevent the generation of noise at source by good design, site layout and maintenance;
- Minimise or contain noise at source by following good operational techniques and management practice;
- Use effective silencers, physical barriers, or enclosures;
- Use sympathetic timing to control unavoidably noisy operations; and
- Where possible, increase the distance between the source and receptors.

Guidance is then also presented on control measures that should be considered to prevent or reduce noise pollution, which should include, but are not limited to:

- Assessing noise at different places and times to find where the problem is coming from;
- Maintaining equipment so noise levels are reduced (for example, balancing fans and fixing loose covers);
- Using enclosure or abatement (for example, acoustic enclosures, silencers, keeping doors and other openings in buildings closed);
- Timing operations sympathetically (for example, do not plan any noisy maintenance work during evenings and weekends);
- Siting activities away from sensitive receptors (for example, locating vehicle routes or noisy plant as far away as possible from NSRs);
- Switching off plant, vehicles and ventilation units when not in use; and
- Reducing, altering or stopping noisy activities until circumstances have changed, or other appropriate measures are in place, so operations can re-start without preventable, or significant adverse, noise impact.

The guidance goes on to include advice on engagement with neighbours and noise monitoring, and presents a suggested noise impact assessment report structure.

3.3 Noise Impact Assessments Involving Calculations or Modelling: Information You Must Submit to the Environment Agency in a Noise Impact Assessment That Uses Computer Modelling or Spreadsheet Calculation

This document is the Environment Agency's online guidance for noise assessment. The content of this document is as follows:

> *"If you need to give the Environment Agency a noise impact assessment that uses computer modelling or spreadsheet calculations you must include the information listed in this guidance. This includes general information such as descriptions of your site and detailed noise data, usually displayed in tables.*

You must also:

• clearly state any assumptions used in the computer model or spreadsheet

• submit all noise modelling files or spreadsheet calculations

• submit noise model input data in QSI data exchange format files where you have used noise modelling

If you do not provide all the information required, we may take longer to process your application.

We do not require assessments of off-site traffic or construction noise.

General information you must provide

You must provide a description of:

• the site location and layout

• your proposed activities and sources of any noise

• local receptors and reasons for selection

• your noise remediation approach

You must also provide a:

• map showing the site and surrounding area including receptors

• Site plan including the site boundary

You must also provide a:

• full noise survey report if you have carried out a BS4142 assessment

• description of the noise mitigation measures you propose using and supporting evidence, such as the manufacturer's engineering specification for items that mitigate noise emissions, or calculations of the screening effect of barriers

Noise data you must provide

You must provide the following information. You must use 1 metre resolution National Grid references for all location data.

Fixed and mobile plant

You must provide the following information for fixed and mobile plant:

• grid references

• referenced or derived sound power levels (preferably octave band, for derived provide the measurements and calculations)

• heights

• directivities

• operating times

Noise emitting buildings

You must provide the following information for noise emitting buildings:

- *corner grid references*
- *heights*
- *octave band reverberant sound pressure calculations or measurements*
- *referenced octave band transmission coefficients*
- *façade and roof emissions*

You must also account for aperture emissions, providing:

- *grid references*
- *dimensions*
- *sound power levels*
- *opening times*

Site traffic

You must provide the following information about site traffic:

- *grid references for site roads*
- *vehicle sound power levels*
- *traffic numbers*
- *traffic speed*

Site buildings

For site buildings, whether acoustically emitting or not, provide:

- *corner grid references*
- *heights*

Off-site buildings

For any off-site buildings that may affect sound levels at receptors (through screening, reflection or diffraction), provide:

- *corner grid references*
- *heights*

Site acoustic barriers

You must provide the following information about site acoustic barriers:

- *grid references at ends*
- *construction details*
- *thicknesses*
- *heights*

Terrain data

Where you are relying on screening by buildings or barriers for noise attenuation you must provide accurate elevations (height above sea level) and heights (above ground) for:

- *sources*
- *barriers or buildings*
- *receptors*

Use high resolution spot heights or contours.

You should incorporate the terrain data into the model. Do not submit separate copyrighted terrain files.

Receptors

You must provide the following information about any receptors:

- *grid references*
- *addresses or other identification*
- *number of storeys (estimate sound pressure levels for each storey)*
- *sensitivity*
- *BS4142 background LA90*
- *specific and rating levels for site activities*
- *rationale for applying or not applying acoustic penalties*
- *numerical impacts”*

4.0 BASELINE DATA COLLECITON

4.1 Desk Study

At the outset of the assessment, and prior to undertaking the baseline sound survey, a desk-based study was undertaken. This included a review of Ordnance Survey (OS) mapping, Google online mapping, aerial photography and Street View photography for the site and surrounding area.

The desk review also included a review of project information including the technical specification of the upgraded gas flare and ancillary equipment and noise emission data for the two proposed landfill gas powered electricity generators. The desk study also included discussions with the Waste Manager of the existing facility.

The desk study was undertaken to:

- Determine potential local noise sources, including both off-site environmental noise sources (road traffic routes, industrial facilities etc.) and specific on-site sources that would be operated under the EP variation;
- Determine local noise-sensitive receptors in the vicinity of the Site; and
- Appropriately target baseline and source noise measurement locations.

4.2 Site Visit and Baseline/Source Sound Survey

A detailed baseline and source sound survey has been undertaken on, and in the vicinity of, the Site. The purpose of the survey was:

- To determine the prevailing ambient and background sound environment at sample locations selected as representative of the closest noise-sensitive receptors to the Proposed Development; and
- To determine the noise levels generated by key fixed plant sources that would be operated under the EP variation i.e. the upgraded gas flare and ancillary equipment.

Prior to the survey, discussions were held with the site Waste Manager to confirm the findings of the desk study and refine the proposed baseline sound measurement locations.

4.2.1 Survey Timing

The survey commenced at 10:30 on 18 November 2021, concluding the following day at 12:00, so extended over a full weekday including continuous daytime and night-time measurements.

The survey included the following:

- Continuous 24-hour weekday noise measurements at three different locations (A. B and C), selected as representative of the closest noise-sensitive receptors to the site.
- A series of 20-minute daytime and evening spot measurements at two locations (D and E), selected as representative of other receptors more distant from the site.
- A series of source noise measurements of the existing upgraded gas flare and associated compressor and generator.

4.2.2 Equipment and Calibration

The baseline noise survey was undertaken utilising the Type 1 specification noise measurement equipment presented in Table NA2 below.

Table NA2: Noise Measurement Equipment

WSP Equipment Reference	Equipment	Make/model	Serial Number
Fusion 1	Sound Level Meter	01dB-Metravib Fusion	10797
	Pre-amplifier	01dB PRE22	10870
	Microphone	GRAS Type 40CD	207593
Cube 1	Sound Level Meter	01 dB CUBE	10621
	Pre-amplifier	Acoem PRE 22	10635
	Microphone	GRAS 40CD	207269
Cube 4	Sound Level Meter	01 dB CUBE	10748
	Pre-amplifier	Acoem PRE 22	11102
	Microphone	GRAS 40CD	224197
Solo 22	Sound Level Meter	01dB- Metravib Blue Solo	61331
	Pre-amplifier	01dB- Metravib PRE 21 S	14575
	Microphone	01dB Metravib MCE 212	92344
Calibrators	Cal – F1	01dB-Stell Cal 21	34254631
	Cal – C4	01dB-Stell Cal 21	35054825
	Cal – 22	Norsonic type 1251 Sound Calibrator	31460

Each of the measurement systems had been calibrated to traceable standards within the previous 24 months, and the calibrators within the previous 12 months. Each measurement chain was subject to field calibration at the beginning and end of each measurement using one of the calibrators. No significant calibration drifts arose.

At each measurement location, the microphone of the installed measurement system was fitted with a windshield.

4.2.3 Purpose and Measurement Locations

The adopted measurement locations are described in Table NA3 with Locations A to E depicted in **Drawing NA2**: **Noise Sensitive Receptors and Noise Measurement Locations**.

Table NA3: Noise Measurement Locations

Measurement Location	Grid Co-ordinates	Company Equipment Reference	Description	Purpose
Long-term Unattended Monitoring				
A	512793 446981	CUBE 1	Continuous measurement starting at 11:15 on 18 November 2021 and ending 11:45 on 19 November 2021. The microphone was mounted 1.5m above ground in free-field conditions in a field south-west of the current site and south-west of the proposed extension. The noise environment was dominated by road traffic noise from Catwick Lane and the A165 with further contribution from the industrial estate during associated daytime working hours, including from a steel cutting business.	To benchmark the prevailing daytime ambient and background sound levels at a location representative of the Watergate Caravan Park (Receptor R1)
B	513087 446888	Fusion 1	Continuous measurement starting at 11:30 on 18 November 2021 and ending 11:30 on 19 November 2021. The microphone was mounted 1.5m above ground in free-field conditions south of the existing site. The noise environment on-site was generally quiet, with low level contribution from current site activities (excavators, bulldozers) during daytime working hours. Impulsive noise was noted from operations at the adjacent Humberside Shooting Ground (clay pigeon shooting etc.)	To establish the current ambient and background noise levels at a location representative of the dwelling at the Humberside Shooting Ground (Receptor R2)
C	514169 447212	CUBE 4	Continuous measurement starting at 10:30 on 18 November 2021 and ending 12:00 on 19 November 2021. The microphone was mounted 1.5m above ground in free-field conditions in a field east of the current site and proposed eastern extension. The noise environment was generally quiet, with low very level contributions from current Sandsfield activities (excavators, bulldozers) during daytime working hours, as well as noise from the Humberside Shooting Ground. Other sources included distant road traffic and occasional pass-bys on Catfoss Lane to the east.	To benchmark the prevailing daytime ambient and background sound levels at a location selected as representative of the closest properties on Catfoss Lane (Receptors R6 and R7)

Measurement Location	Grid Co-ordinates	Company Equipment Reference	Description	Purpose
Short Term Attended Measurements				
D	514303 446925	Solo 22	Four short-term 20-minute periods, two in the afternoon of 18 November 2021 and two the following morning. The microphone was mounted 1.5m above ground in free-field conditions 4m from the nearest carriageway on Catfoss Lane, close to Manor Farm. The noise environment consisted of distant road traffic noise and occasional pass-bys on Catfoss Lane.	To support the long-term measurements in establishing the prevailing daytime ambient and background sound levels at the closest properties on Catfoss Lane (Receptors R6 and R7)
E	513092 446377	Solo 22	Four short-term 20-minute periods, two in the afternoon of 18 November 2021 and two the following morning. The microphone was mounted 1.5m above ground in free-field conditions south-west of Catwick Lane, approximately 12m from the nearest carriageway on Catwick Lane and close to Receptor R5, and also representative of Receptors R3 and R4. The noise climate was dominated by road traffic noise from Catwick lane with occasional contribution from nearby industrial operations.	To allow comparison of the noise environments at Receptor R3 to R5 (closest receptors South-west of Catwick Lane) with that determined for Receptor R1 (which benefitted from longer term continuous monitoring).
Source Specific Spot Check Measurements				
Various	Various	Solo 22	Spot measurements were undertaken at various locations around the existing upgraded gas flare and associated ancillary equipment whilst operating. The microphone was used in a handheld capacity, with all measurements subject to free-field conditions.	To establish the noise levels and spectral content of the current flare stack and ancillary equipment.

4.2.4 Meteorological Conditions

Meteorological measurement data for the survey period was obtained using a Davis Vantage Vue weather station which was installed at Location C.

The obtained measured data has been analysed and the temperature, precipitation, wind speed and wind direction data are presented in graphical from in **Appendix NA2: Baseline Sound Survey Data.**

It can be seen from **Appendix NA2: Baseline Sound Survey Data** that wind speeds remained below 5ms^{-1} for the vast majority of the survey, with short periods up to no greater than 6ms^{-1} between survey commencement and 17:00 on the first day. There was no precipitation and temperatures remained above freezing for the full duration of the survey.

Whilst there were short periods when wind speeds were just above 5ms^{-1}, the meteorological conditions remained generally conducive to accurate environmental noise measurement over the course of the survey.

4.2.5 Measurement Results

A full breakdown of the measured noise levels for this survey can be seen in **Appendix A2: Baseline Sound Data**. Table NA4 to Table NA7 below present the key measured noise level data that have been adopted in the assessment work.

Table NA4 presents a summary of the background sound levels measured at Locations A, B & C.

Table NA5 and Table NA6 present comparisons of the measured background sound levels obtained at Locations D and E with those obtained from Locations C and A respectively. The comparison in Table NA5 confirms that the noise environment at Location D is very similar to that at Location C (as expected). The comparison in Table NA6 confirms that the noise environment at Location E is higher than that at Location A (also as expected), and therefore that using background data from Location A represents a robust case.

Table NA7 presents the measured octave band spectral data that has been used to assess noise from the gas flare and ancillary equipment.

Table NA4: Summary of Representative Background Sound Levels at Locations A, B and C, Free-field, dB

Measurement Location	Background Sound Levels, $L_{A90,T}$	
	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
A	37	27
B	35	25
C	39	30

Table NA5: Location D Measurement Data, and Comparison with Location C, Free-field, dB

Measurement Start	Duration	Location D		Location C		Difference [D-C]	
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$
18/11/2021 15:00:03	00:20:00	50.5	42.7	50.1	43.4	0.4	-0.7
18/11/2021 15:57:32	00:20:00	51.8	45.2	51.6	45.3	0.2	-0.1
19/11/2021 09:25:16	00:20:00	48.6	43.8	47.9	42.8	0.7	1.0
19/11/2021 10:21:00	00:20:00	51.8	42.5	51.1	41.4	0.7	1.1

Table NA6: Location E Measurement Data, and Comparison with Location A, Free-field, dB

Measurement Start	Duration	Location E		Location A		Difference [E – A]	
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$
18/11/2021 14:30:48	00:20:00	58.1	48.7	50.0	46.6	8.1	2.1
18/11/2021 15:30:00	00:20:00	56.8	48.2	50.5	47.2	6.3	1.0
19/11/2021 09:53:23	00:20:00	59.4	51.5	50.7	47.1	8.7	4.4
19/11/2021 10:50:10	00:20:00	58.7	51.2	50.8	47.3	7.9	3.9

Table NA7: Adopted Flare Stack Noise Emission Data, Free-field, dB(A)

Ref.	Plant	Dir.	Distance (m)	Octave Band Centre Frequency (Hz)										$L_{Aeq,T}$
				31.5	63	125	250	500	1k	2k	4k	8k	16k	
1	Existing gas flare compressor	Right	2	67.7	71.0	68.2	67.5	64.0	64.9	60.8	61.5	56.7	50.2	**69.6**
2	Existing gas flare generator	-	5	77.5	71.8	78.6	72.0	68.0	59.7	56.5	51.6	43.9	41.5	**68.9**
8	Existing upgraded gas flare	Left	5	83.4	73.8	69.3	64.7	60.2	54.9	50.4	46.6	39.4	40.4	**62.0**

5.0 ADOPTED PLANT SOURCE DATA

Table NA7 above presents the measured source noise data that has been adopted for the gas flare, compressor and generator as operational. In addition, manufacturers noise emission data has also been referenced, as detailed below, and found in **Appendix NA3: Plant Specifications and Noise Emission Data**.

5.1 Existing Upgraded Gas Flare

Prior to upgrading the gas flare, the manufacturer advised that once upgraded, the full system would have a noise level of not greater than 70dB(A) @ 10m (see **Appendix NA3: Plant Specifications and Noise Emission Data**), which corresponds to a sound power level of not greater than 98dB(A) L_{WA}. However, because the upgraded flare is currently operational, it has been possible to determine the actual operational noise levels for each element of the installed system. Table NA8 below presents the octave band sound power level data that has been applied to each element. The data has been determined from the measured source levels detailed in Table NA7. The combined sound power level of all three items operating simultaneously is 92.3dB(A) L_{WA}, i.e. consistent with the 'not greater than 98dB(A)' as advised by the manufacturer.

Table NA8: Applied Sound Power Level Data – Existing Gas Flare and Ancillary Equipment – dB, L_W

Noise Model Data Ref	Meas. Ref.	Source	Octave Band Centre Frequency (Hz)										L_{WA} A-weighted (dB(A))
			Linear (dB)										
			32	63	125	250	500	1k	2k	4k	8k	16k	
C1	1	Existing gas flare compressor	81.7	85.0	82.2	81.5	78.0	78.9	74.8	75.5	70.7	64.2	**83.6**
G1	2	Existing gas flare generator	99.5	93.8	100.6	94.0	90.0	81.7	78.5	73.6	65.9	63.5	**90.9**
F1	8	Existing upgraded gas flare	105.4	95.8	91.3	86.7	82.2	76.9	72.4	68.6	61.4	62.4	**84.0**

5.1.1 Proposed LFGUP

For the upgraded gas flare and compressor, which would be relocated to the LFGUP, the sound power level data detailed in Table NA8 have been applied. In addition, the LFGUP would include two proposed landfill gas powered electricity generators replacing the current generator which would be decommissioned. The model proposed for installation is as follows:

- Scania 190kW rated SGI-13, installed in acoustic enclosure.

Appendix NA3: Plant Specifications and Noise Emission Data contains the manufacturers source noise emission data for the candidate landfill gas powered electricity generators as currently proposed for installation. Manufacturers data for the engines confirms a sound pressure level of 65dB(A) at 10m (per unit) when installed within the acoustic enclosure as proposed. This corresponds to a sound power level of 93dB(A) L_{WA}.

The plant manufacturer was unable to provide octave band data for either the containerised unit, or for the generator or engine that it contains. However, octave band data has been obtained for a Cummins diesel powered 250kW generator set (model ref. 250DQDDA) operating both unhoused and in a range of different enclosures. That data is also presented in **Appendix NA3: Plant Specifications and Noise Emission Data**, and its application in this case is considered worst case because a landfill gas power generator is expected to contain less low frequency noise than a diesel-powered generator.

Table NA9 presents the octave band data for the Cummins 250DQDDA with F202 enclosure (an enclosure similar to that proposed), level adjusted to the Scania SGI-13 sound power level of 93.0dB(A). This data has been applied to each of the two landfill gas powered electricity generators.

Table NA9: Applied Landfill Gas Powered Generator Sound Power Level Data – dB, L_{WA}

Source Data Ref.	Source	Octave Band Centre Frequency (Hz)								L_{WA} A-weighted (dB(A))
		Linear (dB)								
		63	125	250	500	1k	2k	4k	8k	
Ref.4	Scania 190kW rated SGI-13, with diesel generator set spectrum applied (worst case)	99.7	99.6	91.1	88.7	87.5	85.3	81.5	77.6	**93.0**

6.0 NOISE MODEL AND PREDICITON RESULTS

6.1 Noise Model

A detailed noise model has been prepared within the CadnaA® PC-based proprietary noise modelling suite, including each of the noise sources that have been scoped-in to this assessment, as detailed in **Section 2.5** and **Section 2.6**.

The model has been used to facilitate noise level predictions for two operational scenarios as follows:

Scenario 1 (Existing): the existing upgraded gas flare and ancillary compressor and generator at current locations

Scenario 2 (Proposed): the proposed LFGUP incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and ancillary compressor.

6.1.1 Modelled Approach and Settings

The following approach was adopted in the production of the noise model:

6.1.1.1 Topography, Buildings Plans, Receptors

- The results of an OS referenced manual site-specific topographic survey and site-specific topographic drone survey were incorporated into the model. The land areas covered included the existing Site and immediately surrounding area encompassing the proposed Eastern Extension.
- Open Source LiDAR 1m posting digital terrain model (DTM) topographic data was then incorporated into the noise model extending across the wider area up to and beyond the closest noise sensitive receptors to the site.
- The combined topographic data (survey + LiDAR data) was converted into 0.5m ground contours.
- OS Open Source mapping information was incorporated into the model based on OS six figure grid references, as well as freely available aerial photography showing the locations of the existing upgraded flare stack, and associated compressor and generator.
- A scaled schematic drawing (Drawing NA3 above) for the proposed LFGUP was calibrated into the noise model based on OS six figure grid references.
- Noise level prediction points (receivers) were incorporated at each of the closest dwellings to the site (R1 to R9 as detailed in Table NA1), at free-field locations and with heights of 1.5m (ground floor) and 4m (first floor) above local ground.

6.1.1.2 Model Settings

- The model was set to apply the prediction methodology set out in the ISO 9613-2: *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation noise level prediction method for* plant noise sources.
- OS Open Source buildings information was incorporated into the model based on OS six figure grid references.
- All buildings were set to have a nominal height of 8m.
- All building façades were set to have absorption coefficients of no greater than 0.1.
- 3rd order reflections were set to be included within the completed noise level calculations.

- Globally, ground absorption was set to G = 1 (100% acoustically absorbent ground), representative of the local area.
- Temperature was set to 10ºC and humidity to 70% so that atmospheric absorption was accounted for.

6.1.1.3 Modelled Sources

- Each of the plant noise sources associated with Scenarios 1 and 2 were incorporated into the noise model as acoustic point sources, as per Table NA10 below.

Table NA10: Modelled Noise Sources and Applied Source Data

Plant	Applied Source Data Ref.	Source Type	Location			Assumed % on-time
			X	Y	Z	
Scenario 1 (Existing)						
Existing upgraded gas flare	Ref.3	Point source	512883	447337	7.48	100%
Existing gas flare compressor	Ref.1	Point source	512887	447335	1.25	100%
Existing gas flare generator	Ref.2	Point source	512887	447323	1.25	100%
Scenario 2 (Proposed)						
Existing upgraded gas flare (relocated to LFGUP)	Ref.3	Point source	512838	447326	7.48	100%
Existing gas flare compressor (relocated to LFGUP)	Ref.1	Point source	512831	477324	1.25	100%
Proposed landfill gas powered engine 1 (within LFGUP)	Ref.4	Point source	512830	447344	0.75	100%
Proposed landfill gas powered engine 2 (within LFGUP)	Ref.4	Point source	512831	447340	0.75	100%

6.2 Predicted Receptor Noise Levels

The noise model has been used to determine the operational noise levels for Scenarios 1 and 2 at each of the receptors R1 to R9. Noise levels have been calculated at heights of 1.5m (ground floor) and 4m (first floor), with the results presented in Table NA11 below.

The noise model has also been used to determine noise contours across the site and surrounding area. The noise contours for Scenario 2 (worst case) can be seen in **Drawing NA4: Proposed LFGUP (incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and compressor) – DAYTIME – 1.5m above ground Free-field dB** and **Drawing NA5: Proposed LFGUP (incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and compressor). – NIGHT-TIME– 4.0m above ground Free-field dB**. The daytime contour has been determined at 1.5m above ground (ground floor living space height), whilst the night-time contour has been determined at 4m above ground (first floor bedroom height).

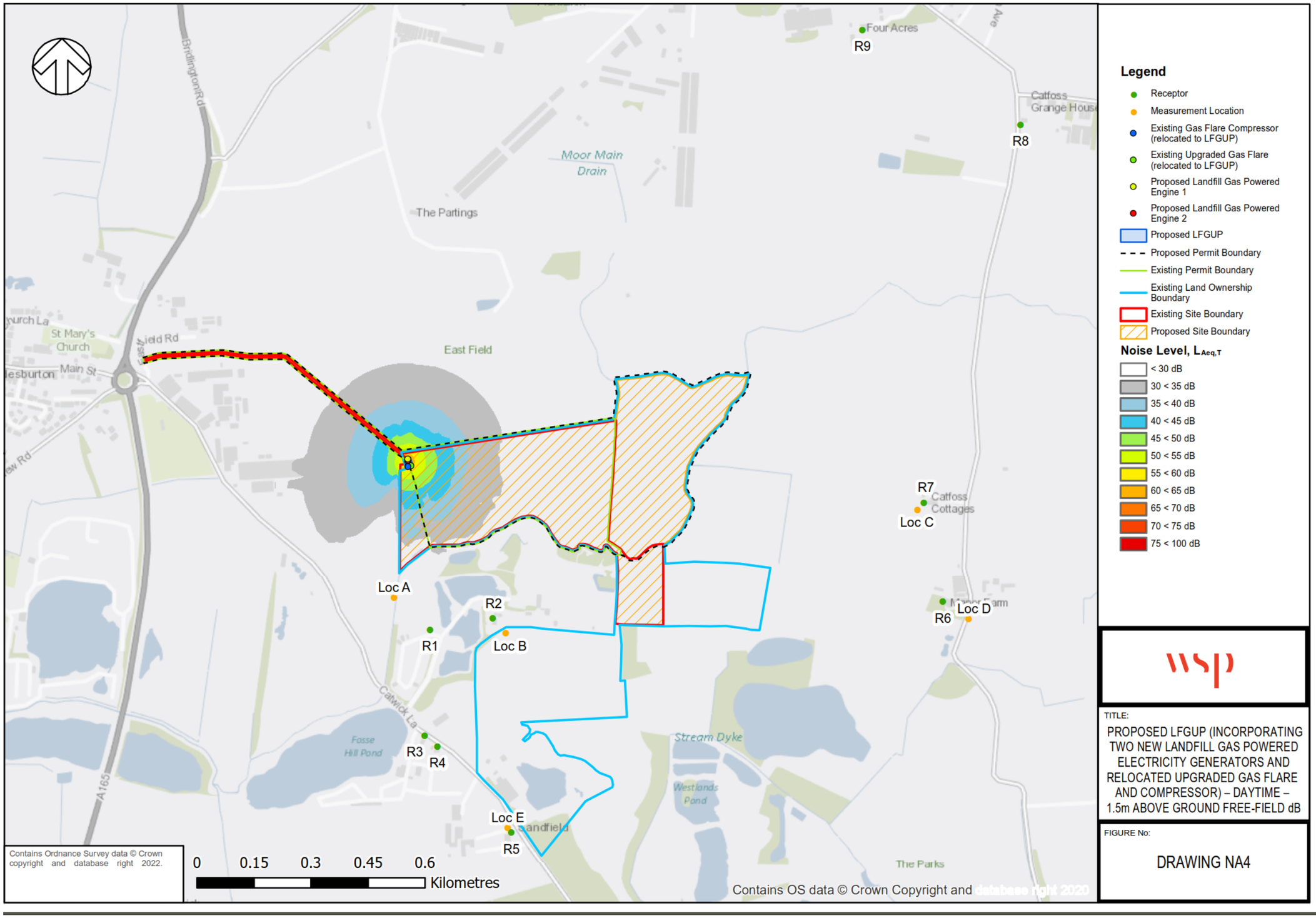
Table NA11: Predicted Receptor Specific Sound Levels ($L_{Aeq,T}$), dB(A)

Receptor Reference	Specific Sound level ($L_{Aeq,T}$, dB(A))	
	Daytime (1.5m above ground)	Night-time (4.0m above ground)
Scenario 1 (Existing) – Upgraded flare stack with ancillary compressor and generator		
R1	21	23
R2	24	25
R3	17	19
R4	14	17
R5	11	13
R6	7	10
R7	9	11
R8	4	7
R9	3	6
Scenario 2 (Proposed) - LFGUP (incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and compressor)		
R1	**23**	**24**
R2	**27**	**27**
R3	**19**	**21**
R4	15	17
R5	15	16
R6	10	11
R7	**11**	**12**
R8	**7**	**8**
R9	4	7
Bold text denotes the receptors and associated levels used in the subsequent assessment (highest noise levels covering a range of different directions from the proposed plant).		

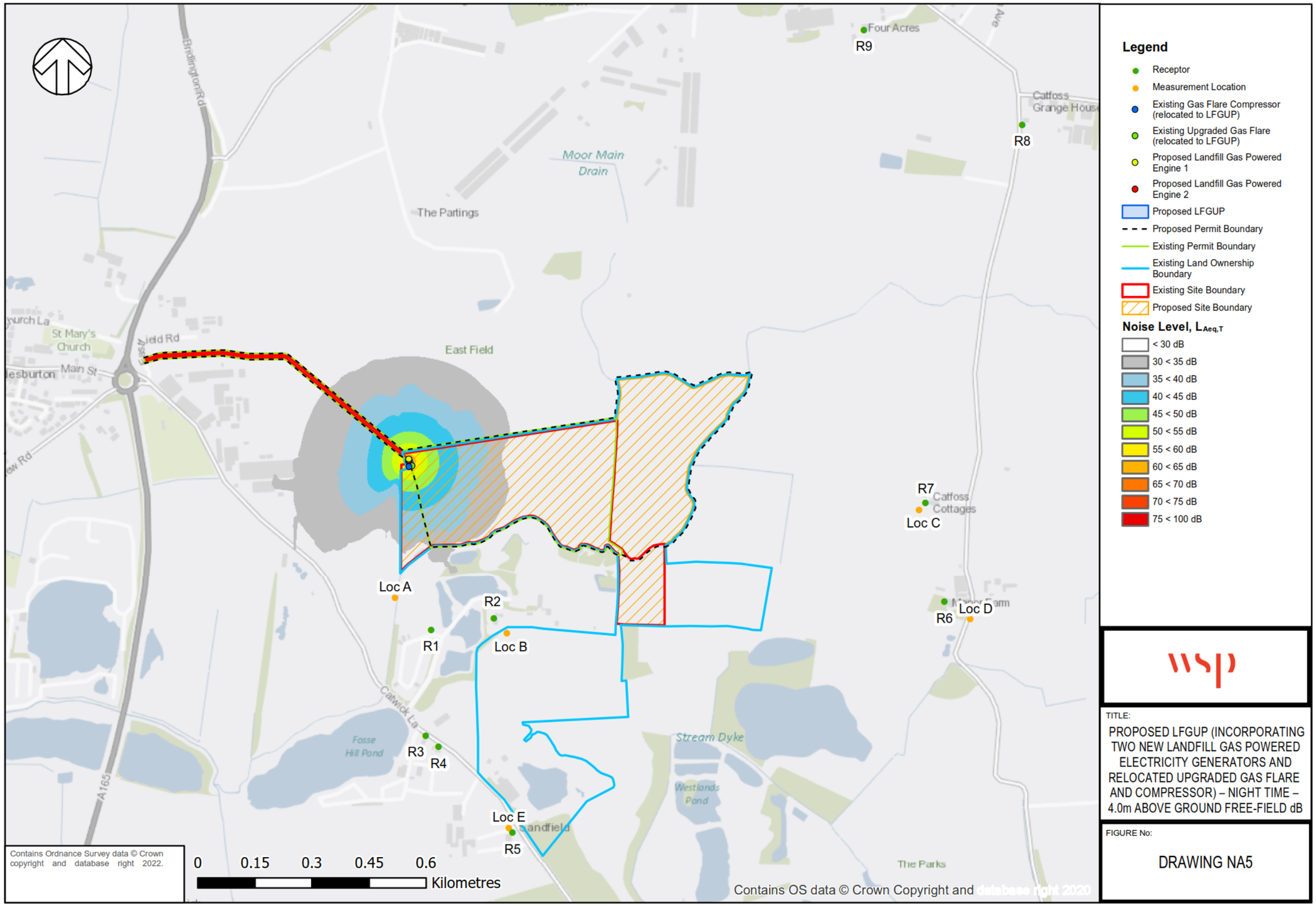
The receptor specific noise levels presented in Table NA11 are all low (defined as less than 30 dB as discussed in section 3.1X), but are highest for Scenario 2 (Proposed LFGUP). Scenario 2 therefore represents a worst case.

Receptors R1, R2, R3, R7 and R8 are used in the assessment in Section 7.0 because they have the highest specific noise levels whilst covering a range of different directions from the Proposed Development. Those results are presented in bold type in Table NA11.

Drawing NA4: Proposed LFGUP (incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and compressor) – DAYTIME – 1.5m above ground Free-field dB $L_{Aeq,T}$



Drawing NA5: Proposed LFGUP (incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and compressor). – NIGHT-TIME– 4.0m above ground Free-field dB $L_{Aeq,T}$



7.0 ASSESSMENT

7.1 Application of Baseline Data

Appendix A2: Baseline Sound Survey Data contains an analysis of the background sound levels measured in accordance with BS4142. The adopted representative daytime and night-time background sound levels for Measurement Locations A, B and C are presented in Table NA4 above.

Table NA5 compares the ambient and background sound levels measured during short-term spot measurements at Location D, with those measured at Location C, over the same measurement time periods. It can be seen that the two data sets are very similar, with differences between locations D and C being within 1dB of each other. The measurement data for Location C, which benefited from a longer continuous measurement, has therefore been adopted for receptors to the north-east and east of the Proposed Development.

Table NA6 compares the ambient and background sound levels measured during short term spot measurements at Location E, with those measured at Location A over the same measurement time periods. It can be seen that Location E has a higher baseline noise environment than Location A, as expected due to proximity to Catwick Lane. Applying the background measurement data obtained at Location A (which benefited from a longer continuous measurement) to receptors on the south side of Catwick Lane therefore represents a worst case.

Table NA12 below details how the measured background noise level data has been applied to the receptors brought forward for assessment.

Table NA12: Applied Background Noise Level Data

Assessed Receptor Reference	Adopted Baseline Measurement Data
R1	Location A
R2	Location B
R3	Location A
R7	Location C
R8	Location C

7.2 BS4142 Assessment

Table NA13 (daytime) and Table NA14 (night-time) below present assessments of the noise levels predicted to arise for Scenario 2, in accordance with BS4142.

EA Guidance states that "*a minimum +3dB character correction is expected in the determination of industrial noise (rating) levels where a source is not tonal or impulsive but is readily distinguishable (unless no requirement for that correction can be robustly justified)".* In this case, the source would operate continuously and would not be impulsive in nature, in addition, the closest receptor is over 425m away so the specific sound sources are not expected to be readily distinguishable or subjectively tonal. As such it is readily justifiable that no character corrections should be applied under Assessment Steps B, C and D (see Table NA13 and NA14 below).

Table NA13: BS4142 Assessment – Daytime

Assessment Step	Receptor				
	R1	R2	R3	R7	R8
Modelled Specific sound level ($L_{Aeq,T}$) [A]	23	27	19	11	7
Tonality [B]	0	0	0	0	0
Impulsivity [C]	0	0	0	0	0
Intermittency [D]	0	0	0	0	0
Rating level ($L_{Ar,Tr}$) [E] = [A + B + C + D]	23	27	19	11	7
Background sound level ($L_{A90,T}$)	37	35	37	39	39
Rating level versus background sound level [E – F]	-14	-8	-18	-28	-32
Initial Assessment of Impact					
BS4142 Assessment	Indication of a low impact	Indication of a low impact	Indication of a low impact	Indication of a low impact	Indication of a low impact
Contextual factors					
For all receptors, the resulting rating levels are all below 35dB $L_{Ar,Tr}$, which BS4142:1997 describes as being "*very low*". BS4142: 2014 states: "*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.*" BS8233: 2014 provides additional guidance in respect of absolute noise levels appropriate for residential occupation. Daytime criteria of 35dB $L_{Aeq,16hr}$ in bedrooms and living rooms and 40dB(A) $L_{Aeq,16hr}$ in living rooms are stated, equivalent to external criteria of 45dB(A) $L_{Aeq,16hr}$ and 50dB(A) $L_{Aeq,16hr}$ assuming a 10dB attenuation through a façade with a partially open window. Criteria of 50 and 55dB(A) $L_{Aeq,16hr}$ are also stated for external living spaces. The predicted rating levels are all substantially below these criteria.					
Modified / Final Assessment of Impact					
BS4142 Assessment	No Significant Impact	No Significant Impact	No Significant Impact	No Significant Impact	No Significant Impact

Table NA14: BS4142 Assessment – Night-time

Assessment Step	Receptor				
	R1	R2	R3	R7	R8
Modelled Specific sound level ($L_{Aeq,T}$) [A]	24	27	21	12	8
Tonality [B]	0	0	0	0	0
Impulsivity [C]	0	0	0	0	0
Intermittency [D]	0	0	0	0	0
Rating level ($L_{Ar,Tr}$) [E] = [A + B + C + D]	24	27	21	12	8
Background sound level ($L_{A90,T}$)	27	25	27	30	30
Rating level versus background sound level [E – F]	-3	+2	-6	-18	-22
Initial Assessment of Impact					
BS4142 Assessment	Indication of a low impact	Indication of a low impact	Indication of a low impact	Indication of a low impact	Indication of a low impact
Contextual factors					
For all receptors, the resulting rating noise levels are below 35dB $L_{Ar,Tr}$, which BS4142:1997 [Ref. 11.20] described as being "*very low*". The initial BS4142 assessment above is based on an appraisal of external noise levels. However, during the night-time people can reasonably be expected to be residing indoors (not outdoors), and therefore benefit from the noise reduction associated with the building fabric. BS4142: 2014 states "*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.*" BS8233: 2014 provides additional guidance in respect of the absolute noise levels appropriate for residential occupation. A night-time criterion of 30dB(A) $L_{Aeq,8hr}$ in bedrooms is stated, equivalent to external criteria of 40dB(A) $L_{Aeq,8hr}$ assuming a 10dB attenuation through a façade with a partially open window. The predicted rating levels are all substantially below that criterion.					
Modified / Final Assessment of Impact					
BS4142 Assessment	No Significant Impact	No Significant Impact	No Significant Impact	No Significant Impact	No Significant Impact

From Table NA13 and Table NA14 above, it can be seen that for all receptors, noise from Scenario 2 (proposed) would give rise to No Significant Impact during both daytime and night-time periods.

Table NA12 confirms that lower noise levels are generated under Scenario 1 (existing) compared to Scenario 2 (proposed), so the same conclusion of No Significant Impact therefore also applies to current operations.

8.0 MITIGATION

The completed assessment has identified that receptor noise levels generated under both Scenario 1 (Existing) and Scenario 2 (Proposed) are very low. Assessment in accordance with BS4142 confirms that No Significant Impact arises due to noise.

This positive conclusion is in part because the scheme has been designed with the principles of Best Available Measures (BAT) for noise mitigation as follows:

- Generation of noise at source has been minimised through the selection of appropriate plant.
- The scheme incorporates the use of dedicated acoustic enclosures for the proposed landfill gas powered energy generators.
- The plant items have been located at significant distances from local receptors, maximising the benefit of attenuation due to distance.

In addition, the operator would operate a management and maintenance scheme to ensure that the plant is operated appropriately including being retained in good order with well fitted parts, and with doors and side panels etc remaining closed when in use etc.

9.0 CONCLUSION

This report has presented the results of a detailed noise assessment undertaken by Golder Associates (UK), following appointment by Sandsfield Gravel Company Ltd ('Sandsfield'), to support an application to vary existing Environmental Permit (EP) reference EPR/BX1942IX. That EP was issued in 2006 and last varied and consolidated by the Environment Agency (EA) in February 2020 (variation notice V003).

The existing EP allows Sandsfield to dispose of non-hazardous waste under the listed activity of Section 5.2 Part A(1)(a) of the Environmental Permitting (England and Wales) Regulations. The EP also covers other associated activities including the 'flaring of landfill gas in an appliance', which is achieved through the use of an on-site landfill gas powered flare (with associated compressor and generator). The gas flare was originally installed towards the south-east corner of the site, but was then relocated towards the north-west corner of the site before being recently upgraded.

The permit variation is sought to allow an extension of landfilling operations into the neighbouring field to the east (the 'Eastern Extension') once current mineral extraction activities in that area are complete.

The EP variation application also covers the operation of the upgraded gas flare (and ancillary generator and compressor) at its current location (north-west corner of site) and the proposed installation and use of a Landfill Gas Utilisation Plant Compound (LFGUP), also towards the north-west corner of the site. The LFGUP would include two new landfill gas powered electricity generators (replacing the current generator), and would incorporate the existing on-site flare and compressor (which would be subject to small changes from their current locations).

Sandsfield has submitted two planning applications (a S.73 application and a full application for Planning Permission) to East Riding of Yorkshire Council (ERYC) in parallel (one Environmental Statement) to cover the proposed operations. At the time of writing a decision on those applications was pending.

The scope of this noise assessment has been determined following review of Environmental Agency guidance *Risk assessments for your environmental permit: When you need to do an environmental risk assessment, when the Environment Agency will do it for you, and how to do a risk assessment* (latest updated 01 April 2022). Due to the significant distances to receptors, the landfilling activities already undertaken at the existing site (which will remain unchanged within the proposed Eastern Extension) and because proposed working hours would be daytime only (unchanged from existing), it is deemed that there is not significant risk of noise impact arising from proposed landfill operations, and specific quantitative assessment of noise from the landfill operations was therefore scoped-out of this assessment. However, operation of the current upgraded gas flare and the LFGUP is / would be 24hrs a day, so have been scoped-in and have been the focus of the completed noise assessment.

The completed assessment has been undertaken in accordance with Environment Agency guidance for dealing with noise emissions under the Environmental Permitting regime, namely the following:

- '*Noise and vibration management: Environmental Permits. How UK environment agencies assess noise, legal requirements for managing noise, noise impact assessment and noise management plans'.* This replaces H3 guidance, the latest version of which is dated 31 January 2022; and
- '*Noise impact assessments involving calculations or modelling: Information you must submit to the Environment Agency in a noise impact assessment that uses computer modelling or spreadsheet calculation*', the latest version of which is dated 06 November 2019.

In line with the requirements of the above guidance, the noise assessment has been undertaken in accordance with BS4142: 2014+A1: 2019: *Method for rating and assessing industrial and commercial sound* (BS4142).

The completed assessment work has been undertaken drawing on the results of a site-specific background sound level survey, as well as source noise measurements undertaken of the upgraded gas flare and ancillary equipment as installed, and manufacturers noise emission data for the proposed landfill gas powered electricity generators.

A detailed noise model for the site and surrounding area has been prepared to facilitate noise level predictions for the proposed Permit Variation, in the CadnaA® PC-based noise modelling suite. This report provides details of the adopted approach, including how each source has been modelled and the source noise emission data applied.

The noise model has been used to calculate the resulting operational noise levels for two operational scenarios:

- Scenario 1 (Existing): the existing upgraded gas flare and ancillary compressor and generator at current locations
- Scenario 2 (Proposed): the proposed LFGUP incorporating two new landfill gas powered electricity generators and relocated upgraded gas flare and ancillary compressor.

It has been identified that receptor noise levels arising from the two scenarios are similar, but with Scenario 2 slightly higher than Scenario 1. The Scenario 2 noise levels were therefore brought froward for assessment.

Appraisal of the Scenario 2 noise levels in accordance with BS4142 has found that during both daytime and night-time periods there would be no significant impact due to noise. This is in part because the operational noise levels are generally below the prevailing background sound levels at receptors (substantially so in the most part), but also because the resulting receptor noise levels are generally very low in absolute terms. The same conclusions can also be drawn for Scenario 1 which has lower associated operational noise levels.

Notwithstanding the finding of no significant impact, the report has considered mitigation with respect to the principle of Best Available Techniques (BAT). It has been identified that the principles of BAT are being complied with, having been an integral consideration in the scheme design process, through the selection of appropriate plant, the use of acoustic enclosures and the appropriate siting of plant etc.

In summary, this report has identified that noise is not a factor that requires further consideration in the determination of the proposed Permit Variation.

Signature Page

Golder WSP UK Ltd

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Date: 28 June 2022

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Appendix NA1 – Glossary of Acoustic Terminology

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 NA15: Range of Sound Levels Commonly Found in the Environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 4 0dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of pain

Acoustic Terminology

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.

$L_{Aeq,T}$: 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}: The maximum A-weighted sound pressure level recorded over a particular period. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall $L_{Aeq,T}$ noise level, but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response, denoted L_{AFmax} or $L_{Amax,F}$.

L_{10} and 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 the L_{90} is the level exceeded for 90% of the time. Unless described otherwise, they are measured using the 'fast' sound level meter response, denoted L_{AF10} and L_{AF90}.

Sound Power Level, L_W / L_{WA}: The sound power level is the acoustic energy emitted by a source (e.g. item of machinery or equipment), which produces a sound pressure level at some distance. While the sound power level of a source is fixed, the sound pressure level depends upon the distance from the source and the acoustic characteristics of the area in which it is located. Sound power level is commonly expressed in terms of decibels (dB, or dB(A))

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 at least 3.5 m away from buildings.

Façade Level: A sound field determined at a distance of 1 m in front of a large sound reflecting object such as a building façade.

Ambient Noise Level: The all-encompassing noise level measured in $L_{Aeq,T}$. The Ambient Noise Level incorporates background sounds as well as the industrial source noise under consideration.

Background Noise Level: The noise level exceeded for 90% of the time, the L_{A90} noise index, in the absence of sound of an industrial and/or commercial nature (BS4142).

Specific Sound Level, $L_s = L_{Aeq,T}$: The term used in BS4142 to describe the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time period.

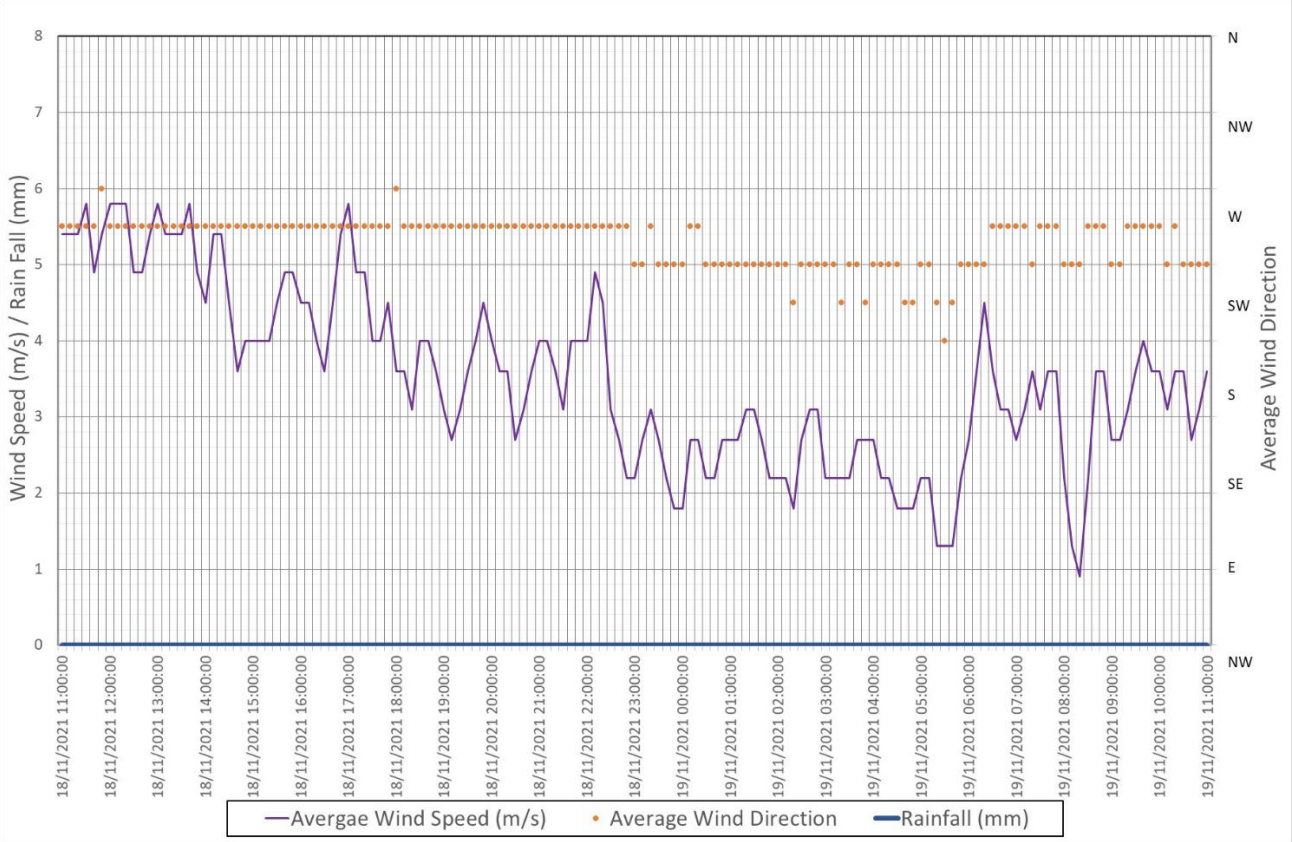
Rating Level, $L_{Ar,Tr}$: The term used in BS4142 to describe the specific sound level plus any adjustment for the characteristic features of the sound.

Appendix NA2 – Baseline Sound Survey Data

SURVEY DATA

Meteorological Data

Figure NA1: Site Specific Meteorological Data during the Baseline Noise Survey



Noise Measurement Data

Measurement Location A

Table NA16: Location A – Tabulated 15 Minute Measurement Data

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 11:15:00	00:15:00	52.6	47.9	54.9	75.7
18/11/2021 11:30:00	00:15:00	50.4	46.8	52.7	59.4
18/11/2021 11:45:00	00:15:00	50.0	46.8	51.9	66.1
18/11/2021 12:00:00	00:15:00	50.6	47.6	52.5	60.5
18/11/2021 12:15:00	00:15:00	49.4	45.5	51.7	59.1
18/11/2021 12:30:00	00:15:00	49.9	46.4	52.0	60.4
18/11/2021 12:45:00	00:15:00	50.4	47.0	52.7	60.0
18/11/2021 13:00:00	00:15:00	50.3	46.4	52.9	61.0
18/11/2021 13:15:00	00:15:00	50.9	46.9	53.1	63.6
18/11/2021 13:30:00	00:15:00	50.2	46.6	52.4	58.8
18/11/2021 13:45:00	00:15:00	49.1	46.0	51.4	60.7
18/11/2021 14:00:00	00:15:00	50.5	46.7	52.6	62.3
18/11/2021 14:15:00	00:15:00	51.4	47.8	53.0	66.4
18/11/2021 14:30:00	00:15:00	50.0	46.5	52.2	63.5
18/11/2021 14:45:00	00:15:00	49.6	46.3	51.8	59.5
18/11/2021 15:00:00	00:15:00	49.8	46.9	51.4	66.3
18/11/2021 15:15:00	00:15:00	50.1	46.6	52.3	63.7
18/11/2021 15:30:00	00:15:00	50.3	47.0	52.4	60.3
18/11/2021 15:45:00	00:15:00	50.7	47.0	52.8	61.4
18/11/2021 16:00:00	00:15:00	52.1	48.0	53.7	67.8
18/11/2021 16:15:00	00:15:00	50.5	47.4	52.3	66.7
18/11/2021 16:30:00	00:15:00	51.7	47.8	54.0	62.5
18/11/2021 16:45:00	00:15:00	51.1	48.3	53.3	60.5
18/11/2021 17:00:00	00:15:00	51.9	48.1	54.0	63.9
18/11/2021 17:15:00	00:15:00	50.8	47.5	53.0	60.6
18/11/2021 17:30:00	00:15:00	49.2	45.2	51.6	57.4
18/11/2021 17:45:00	00:15:00	48.5	43.7	51.0	59.3
18/11/2021 18:00:00	00:15:00	47.1	42.1	49.1	63.8
18/11/2021 18:15:00	00:15:00	46.2	41.2	48.9	57.6
18/11/2021 18:30:00	00:15:00	46.9	41.7	49.8	59.5
18/11/2021 18:45:00	00:15:00	46.5	41.6	48.8	63.2
18/11/2021 19:00:00	00:15:00	46.5	38.1	46.8	66.3

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 19:15:00	00:15:00	44.8	37.2	48.1	57.1
18/11/2021 19:30:00	00:15:00	44.4	38.1	47.5	57.3
18/11/2021 19:45:00	00:15:00	45.4	40.3	48.0	60.1
18/11/2021 20:00:00	00:15:00	45.6	40.0	48.3	62.0
18/11/2021 20:15:00	00:15:00	44.3	38.7	46.9	57.9
18/11/2021 20:30:00	00:15:00	45.0	39.2	48.4	57.4
18/11/2021 20:45:00	00:15:00	43.6	35.9	47.0	56.2
18/11/2021 21:00:00	00:15:00	44.6	38.6	47.5	58.6
18/11/2021 21:15:00	00:15:00	43.5	36.5	46.3	55.7
18/11/2021 21:30:00	00:15:00	41.1	33.2	44.5	52.4
18/11/2021 21:45:00	00:15:00	40.6	31.7	43.9	59.2
18/11/2021 22:00:00	00:15:00	44.1	37.0	45.7	62.5
18/11/2021 22:15:00	00:15:00	42.4	36.2	44.7	60.1
18/11/2021 22:30:00	00:15:00	39.0	31.3	42.4	52.9
18/11/2021 22:45:00	00:15:00	39.7	32.5	42.9	53.8
18/11/2021 23:00:00	00:15:00	39.9	32.8	43.3	53.4
18/11/2021 23:15:00	00:15:00	38.9	31.8	42.2	54.7
18/11/2021 23:30:00	00:15:00	35.3	28.8	38.7	50.0
18/11/2021 23:45:00	00:15:00	35.1	27.2	37.2	53.8
19/11/2021 00:00:00	00:15:00	36.6	29.7	40.0	52.5
19/11/2021 00:15:00	00:15:00	37.9	29.2	39.7	54.8
19/11/2021 00:30:00	00:15:00	34.2	28.2	37.5	46.9
19/11/2021 00:45:00	00:15:00	34.4	29.7	37.3	48.2
19/11/2021 01:00:00	00:15:00	33.3	28.5	35.7	51.2
19/11/2021 01:15:00	00:15:00	33.2	28.3	35.9	47.8
19/11/2021 01:30:00	00:15:00	34.7	26.8	38.2	49.1
19/11/2021 01:45:00	00:15:00	35.5	26.1	38.2	52.5
19/11/2021 02:00:00	00:15:00	30.8	24.8	34.4	47.1
19/11/2021 02:15:00	00:15:00	32.5	28.1	35.2	48.8
19/11/2021 02:30:00	00:15:00	32.8	28.4	35.5	44.3
19/11/2021 02:45:00	00:15:00	32.0	26.9	34.5	49.5
19/11/2021 03:00:00	00:15:00	30.2	24.7	33.3	47.3
19/11/2021 03:15:00	00:15:00	28.2	24.2	31.2	39.0
19/11/2021 03:30:00	00:15:00	34.3	28.5	37.5	48.7
19/11/2021 03:45:00	00:15:00	35.1	24.3	37.7	55.2

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
19/11/2021 04:00:00	00:15:00	32.5	24.5	36.2	47.2
19/11/2021 04:15:00	00:15:00	36.1	26.5	38.0	56.1
19/11/2021 04:30:00	00:15:00	38.2	26.7	41.1	54.1
19/11/2021 04:45:00	00:15:00	38.0	30.0	41.4	50.7
19/11/2021 05:00:00	00:15:00	42.8	34.6	45.2	55.5
19/11/2021 05:15:00	00:15:00	42.2	35.9	45.0	53.7
19/11/2021 05:30:00	00:15:00	45.7	37.8	48.7	61.5
19/11/2021 05:45:00	00:15:00	44.9	39.6	47.8	56.9
19/11/2021 06:00:00	00:15:00	46.5	41.1	49.2	58.2
19/11/2021 06:15:00	00:15:00	47.6	43.3	49.9	60.2
19/11/2021 06:30:00	00:15:00	47.9	43.7	50.4	58.3
19/11/2021 06:45:00	00:15:00	49.1	45.1	51.2	61.6
19/11/2021 07:00:00	00:15:00	48.1	44.9	50.2	60.0
19/11/2021 07:15:00	00:15:00	50.7	46.3	53.4	65.5
19/11/2021 07:30:00	00:15:00	50.4	47.3	52.2	59.2
19/11/2021 07:45:00	00:15:00	50.5	46.5	52.8	66.7
19/11/2021 08:00:00	00:15:00	48.8	45.1	50.8	58.8
19/11/2021 08:15:00	00:15:00	50.7	48.1	52.5	58.2
19/11/2021 08:30:00	00:15:00	50.7	47.4	52.6	63.4
19/11/2021 08:45:00	00:15:00	49.6	45.0	52.0	60.0
19/11/2021 09:00:00	00:15:00	48.5	44.0	51.3	60.2
19/11/2021 09:15:00	00:15:00	48.4	44.4	50.8	63.1
19/11/2021 09:30:00	00:15:00	49.5	45.2	51.9	61.8
19/11/2021 09:45:00	00:15:00	49.2	45.8	50.9	58.8
19/11/2021 10:00:00	00:15:00	51.1	47.4	53.2	63.0
19/11/2021 10:15:00	00:15:00	51.0	46.6	53.5	65.6
19/11/2021 10:30:00	00:15:00	49.1	45.8	51.1	58.2
19/11/2021 10:45:00	00:15:00	50.8	46.5	52.8	65.6
19/11/2021 11:00:00	00:15:00	50.2	46.6	52.3	59.4
19/11/2021 11:15:00	00:15:00	49.4	46.1	51.4	61.9
19/11/2021 11:30:00	00:15:00	50.6	45.6	53.3	63.4

Figure NA2: Location A, Histogram of Measured Daytime $L_{A90,15min}$ Background Sound Levels

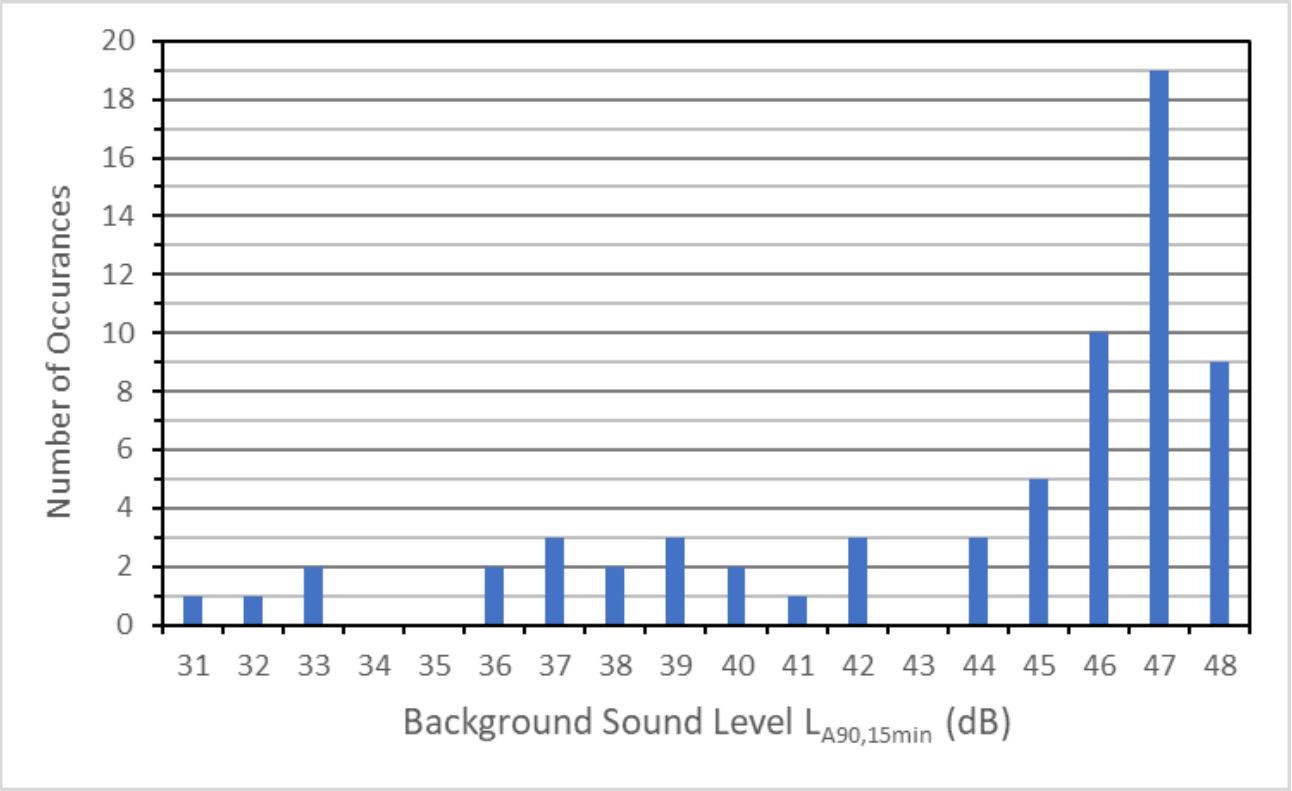


Figure NA3: Location A, Histogram of Measured Night-time $L_{A90,15min}$ Background Sound Levels

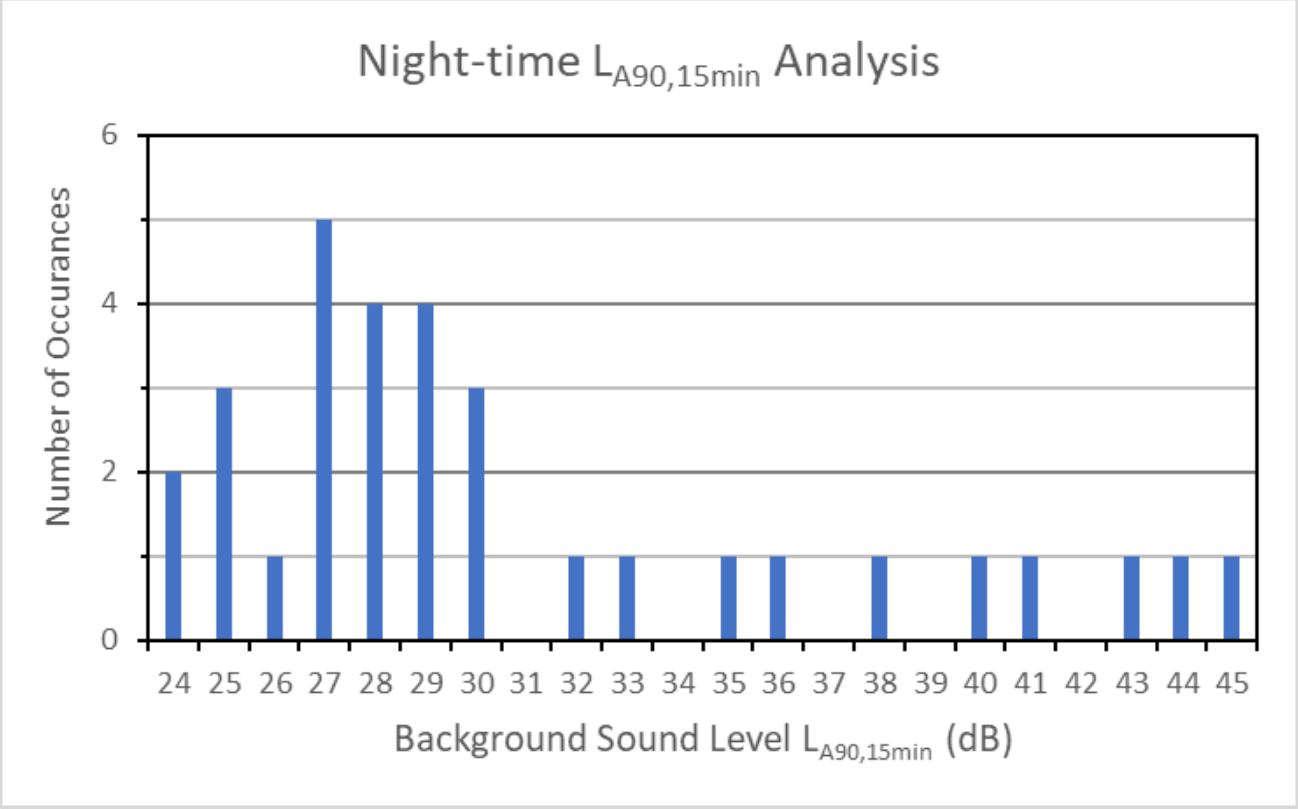


Table NA17: Location A Background Noise Levels - Statistical Analysis, dB

Parameter	Daytime $L_{A90,15\ mins}$	Night-Time $L_{A90,15\ mins}$
Max	48	45
Min	31	24
Linear Average	44	31
Log Average	45	36
Most Commonly Occurring	47	27
Period $L_{A90,T}$	40	27
Selected Value Representative Background Value	**37**	**27**

Table NA18: Location A Period Values, dB

Period	$L_{Aeq,T}$	$L_{A90,T}$
16 hour daytime (07:00 to 23:00)	49.1	40.4
8 hour night-time (23:00 to 07:00)	41.3	26.9
Proposed weekday operational working hours (07:00 to 18:00)	50.2	46.3
Proposed Saturday operational working hours (8:00 to 13:00)*	50.0	46.0
* Level data determined from weekday survey period		

Measurement Location B

Table NA19: Location B – Tabulated 15 Minute Measurement Data

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 11:30:00	00:15:00	55.8	44.3	55.5	76.8
18/11/2021 11:45:00	00:15:00	49.3	44.7	51.7	67.0
18/11/2021 12:00:00	00:15:00	46.9	43.8	48.5	59.7
18/11/2021 12:15:00	00:15:00	46.3	43.1	47.9	65.2
18/11/2021 12:30:00	00:15:00	46.6	43.3	48.4	58.3
18/11/2021 12:45:00	00:15:00	49.0	45.8	50.4	67.0
18/11/2021 13:00:00	00:15:00	48.4	45.2	49.8	69.1
18/11/2021 13:15:00	00:15:00	47.9	44.3	49.9	63.6
18/11/2021 13:30:00	00:15:00	48.9	45.4	50.6	63.5
18/11/2021 13:45:00	00:15:00	47.9	44.6	48.9	68.2
18/11/2021 14:00:00	00:15:00	48.8	46.3	50.1	65.6
18/11/2021 14:15:00	00:15:00	48.8	46.1	50.5	62.0
18/11/2021 14:30:00	00:15:00	48.0	45.2	49.7	64.0
18/11/2021 14:45:00	00:15:00	46.8	43.6	48.3	68.3
18/11/2021 15:00:00	00:15:00	46.5	43.9	48.1	59.3
18/11/2021 15:15:00	00:15:00	47.2	44.5	48.4	66.8
18/11/2021 15:30:00	00:15:00	47.2	44.2	49.0	62.9
18/11/2021 15:45:00	00:15:00	47.0	42.8	49.1	63.3
18/11/2021 16:00:00	00:15:00	48.0	45.2	48.8	70.8
18/11/2021 16:15:00	00:15:00	46.7	44.2	48.5	56.2
18/11/2021 16:30:00	00:15:00	48.0	45.0	49.8	60.0
18/11/2021 16:45:00	00:15:00	47.8	45.5	49.4	61.5
18/11/2021 17:00:00	00:15:00	48.3	45.7	49.9	54.4
18/11/2021 17:15:00	00:15:00	46.6	44.0	48.3	56.2
18/11/2021 17:30:00	00:15:00	45.7	42.6	47.8	53.1
18/11/2021 17:45:00	00:15:00	44.4	41.1	46.1	54.4
18/11/2021 18:00:00	00:15:00	43.0	39.6	45.1	52.7
18/11/2021 18:15:00	00:15:00	42.1	38.6	44.3	55.8
18/11/2021 18:30:00	00:15:00	42.6	38.5	45.0	55.2
18/11/2021 18:45:00	00:15:00	42.3	38.3	44.5	56.0
18/11/2021 19:00:00	00:15:00	40.7	34.5	42.8	60.4
18/11/2021 19:15:00	00:15:00	40.4	34.9	42.9	51.6
18/11/2021 19:30:00	00:15:00	40.6	35.7	43.5	54.7

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 19:45:00	00:15:00	41.1	36.9	43.0	54.1
18/11/2021 20:00:00	00:15:00	40.8	36.8	42.9	54.1
18/11/2021 20:15:00	00:15:00	40.6	36.1	43.1	52.4
18/11/2021 20:30:00	00:15:00	40.3	35.8	42.8	54.0
18/11/2021 20:45:00	00:15:00	39.2	32.8	42.2	51.6
18/11/2021 21:00:00	00:15:00	40.2	35.2	42.7	53.8
18/11/2021 21:15:00	00:15:00	40.6	35.3	43.1	55.8
18/11/2021 21:30:00	00:15:00	38.0	31.4	41.2	49.6
18/11/2021 21:45:00	00:15:00	36.7	28.9	39.7	54.5
18/11/2021 22:00:00	00:15:00	40.1	34.1	42.4	54.6
18/11/2021 22:15:00	00:15:00	39.4	34.7	41.9	55.8
18/11/2021 22:30:00	00:15:00	35.7	30.0	38.5	50.1
18/11/2021 22:45:00	00:15:00	35.6	30.0	38.4	49.0
18/11/2021 23:00:00	00:15:00	35.3	30.0	38.1	48.0
18/11/2021 23:15:00	00:15:00	34.5	29.0	37.1	49.2
18/11/2021 23:30:00	00:15:00	32.6	27.2	35.6	49.3
18/11/2021 23:45:00	00:15:00	30.6	23.8	33.0	49.5
19/11/2021 00:00:00	00:15:00	34.0	26.3	36.3	55.3
19/11/2021 00:15:00	00:15:00	32.5	26.6	33.9	54.2
19/11/2021 00:30:00	00:15:00	31.0	25.8	33.9	44.6
19/11/2021 00:45:00	00:15:00	29.9	27.1	32.0	41.2
19/11/2021 01:00:00	00:15:00	29.4	25.5	31.9	43.1
19/11/2021 01:15:00	00:15:00	30.3	25.9	32.7	46.0
19/11/2021 01:30:00	00:15:00	31.7	24.6	35.0	46.7
19/11/2021 01:45:00	00:15:00	30.9	23.2	34.0	49.9
19/11/2021 02:00:00	00:15:00	31.5	22.9	35.3	47.2
19/11/2021 02:15:00	00:15:00	38.1	27.6	41.2	49.2
19/11/2021 02:30:00	00:15:00	28.7	26.4	30.3	41.0
19/11/2021 02:45:00	00:15:00	29.0	23.3	30.5	45.1
19/11/2021 03:00:00	00:15:00	27.3	22.8	29.9	42.2
19/11/2021 03:15:00	00:15:00	34.9	23.3	40.6	49.2
19/11/2021 03:30:00	00:15:00	38.2	25.5	41.8	51.5
19/11/2021 03:45:00	00:15:00	30.1	23.4	33.9	45.8
19/11/2021 04:00:00	00:15:00	30.3	22.3	34.1	46.6
19/11/2021 04:15:00	00:15:00	32.4	24.3	35.4	51.1

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
19/11/2021 04:30:00	00:15:00	33.5	24.5	37.5	47.2
19/11/2021 04:45:00	00:15:00	35.4	28.3	38.6	51.6
19/11/2021 05:00:00	00:15:00	37.4	30.4	40.3	49.5
19/11/2021 05:15:00	00:15:00	39.6	33.3	42.4	52.6
19/11/2021 05:30:00	00:15:00	43.8	35.2	46.3	61.9
19/11/2021 05:45:00	00:15:00	43.1	37.3	46.3	54.9
19/11/2021 06:00:00	00:15:00	43.8	39.5	46.4	53.1
19/11/2021 06:15:00	00:15:00	44.5	40.9	46.8	53.7
19/11/2021 06:30:00	00:15:00	45.2	41.9	47.3	52.7
19/11/2021 06:45:00	00:15:00	45.8	42.1	47.9	55.3
19/11/2021 07:00:00	00:15:00	46.3	42.7	48.1	64.7
19/11/2021 07:15:00	00:15:00	48.4	44.4	50.6	62.2
19/11/2021 07:30:00	00:15:00	51.8	46.1	50.7	75.0
19/11/2021 07:45:00	00:15:00	47.6	44.4	49.5	55.9
19/11/2021 08:00:00	00:15:00	46.8	43.4	48.4	65.6
19/11/2021 08:15:00	00:15:00	48.2	45.8	49.7	60.3
19/11/2021 08:30:00	00:15:00	47.4	43.9	49.4	55.7
19/11/2021 08:45:00	00:15:00	46.8	42.6	48.7	63.6
19/11/2021 09:00:00	00:15:00	45.2	41.7	47.2	65.3
19/11/2021 09:15:00	00:15:00	44.6	42.4	46.3	57.5
19/11/2021 09:30:00	00:15:00	46.8	43.1	49.2	64.6
19/11/2021 09:45:00	00:15:00	48.8	44.6	51.8	62.8
19/11/2021 10:00:00	00:15:00	47.2	44.6	49.0	61.8
19/11/2021 10:15:00	00:15:00	47.4	44.3	49.4	59.4
19/11/2021 10:30:00	00:15:00	45.5	42.6	47.2	58.1
19/11/2021 10:45:00	00:15:00	46.9	43.6	48.7	60.0
19/11/2021 11:00:00	00:15:00	47.0	44.3	48.6	65.5
19/11/2021 11:15:00	00:15:00	49.6	43.6	50.1	71.2

Figure NA4: Location B, Histogram of Measured Daytime $L_{A90,15min}$ Background Sound Levels

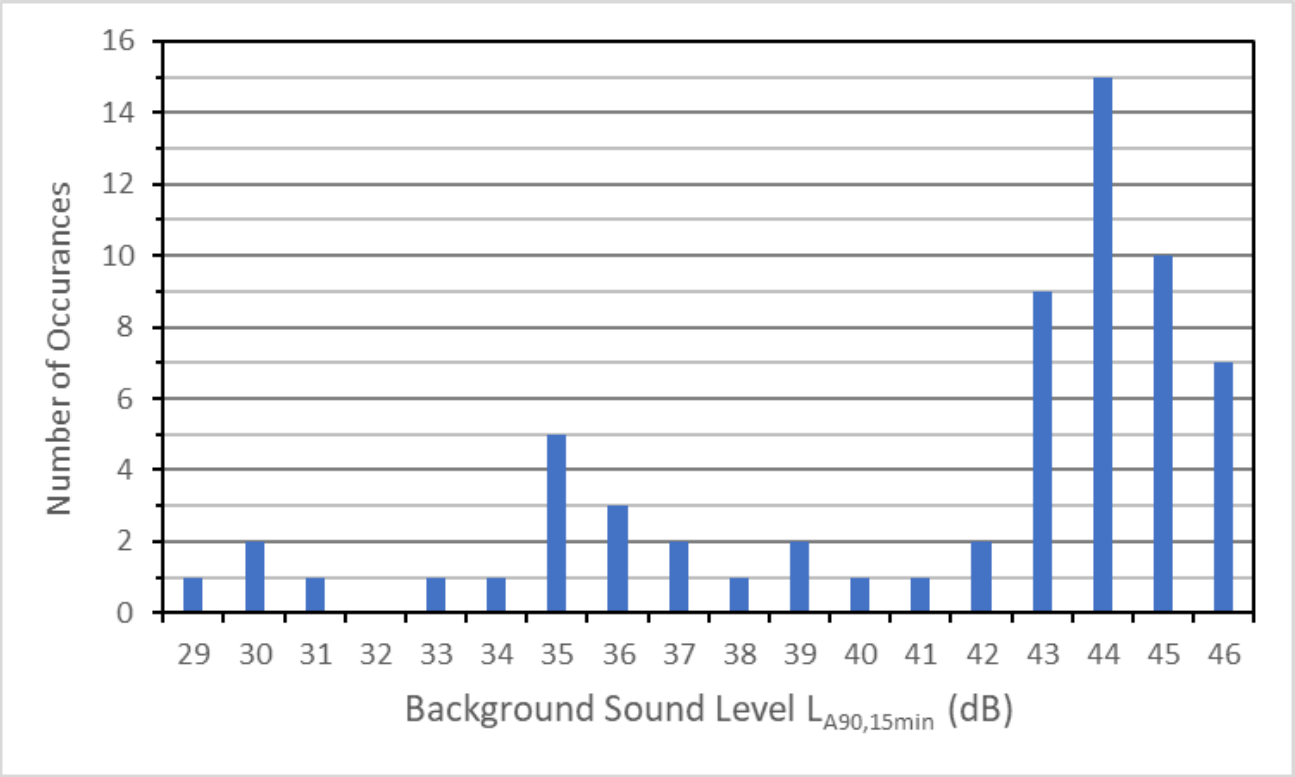


Figure NA5: Location B, Histogram of Measured Night-time $L_{A90,15min}$ Background Sound Levels

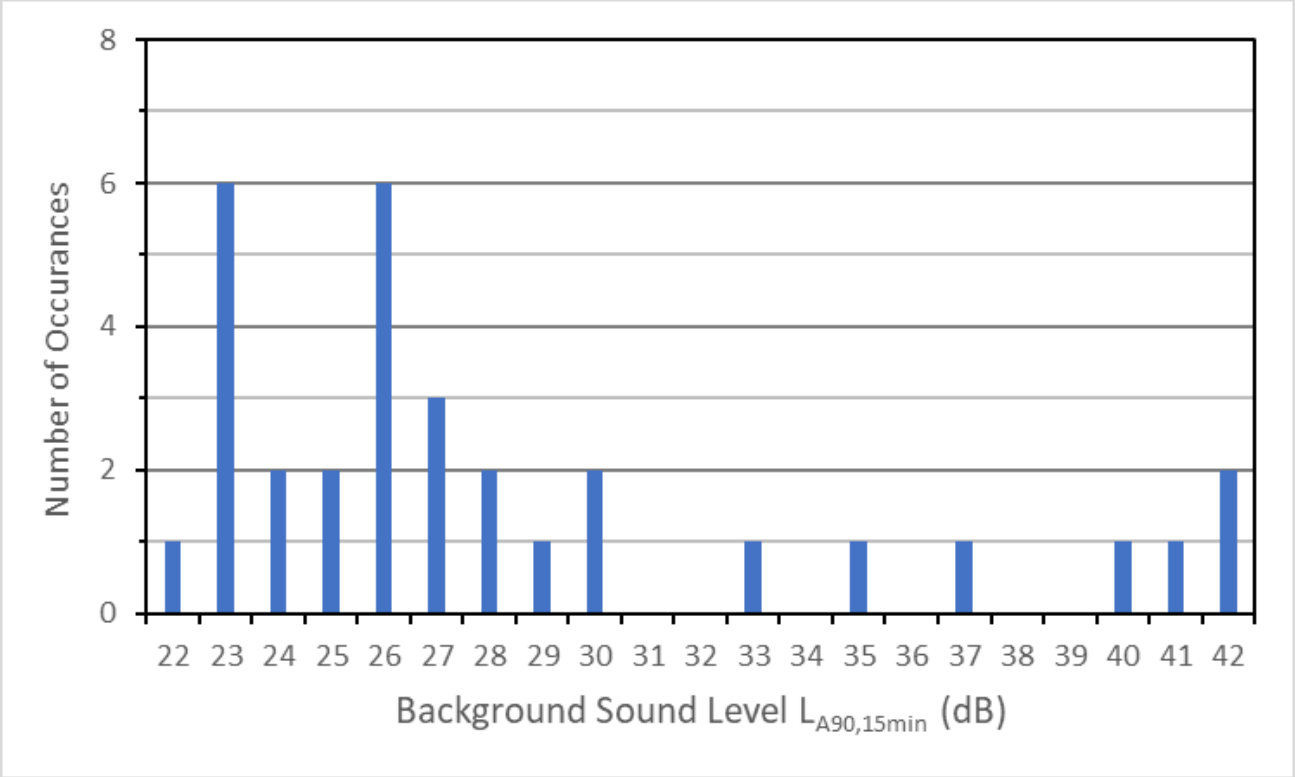


Table NA20: Location A Background Noise Levels - Statistical Analysis, dB

Parameter	Daytime $L_{A90,15\ mins}$	Night-Time $L_{A90,15\ mins}$
Max	46	42
Min	29	22
Linear Average	41	28
Log Average	43	34
Most Commonly Occurring	44	23
Period $L_{A90,T}$	37	25
Selected Value Representative Background Value	**35**	**25**

Table NA21: Location B Period Values, dB

Period	$L_{Aeq,T}$	$L_{A90,T}$
16 hour daytime (07:00 to 23:00)	46.5	37.2
8 hour night-time (23:00 to 07:00)	38.6	24.5
Proposed weekday operational working hours (07:00 to 18:00)	48.2	43.7
Proposed Saturday operational working hours (8:00 to 13:00)*	47.6	43.3
* Level data determined from weekday survey period		

Measurement Location C

Table NA22: Location C – Tabulated 15 Minute Measurement Data

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 10:30:00	00:15:00	59.7	48.5	60.0	85.2
18/11/2021 10:45:00	00:15:00	55.4	48.8	57.6	80.8
18/11/2021 11:00:00	00:15:00	56.7	49.2	59.8	74.6
18/11/2021 11:15:00	00:15:00	57.6	48.8	60.7	77.8
18/11/2021 11:30:00	00:15:00	57.0	49.8	59.6	80.2
18/11/2021 11:45:00	00:15:00	56.1	49.4	59.3	75.7
18/11/2021 12:00:00	00:15:00	57.6	50.0	60.8	75.5
18/11/2021 12:15:00	00:15:00	56.8	49.9	59.4	77.9
18/11/2021 12:30:00	00:15:00	53.7	46.7	56.5	78.1
18/11/2021 12:45:00	00:15:00	55.6	47.9	57.3	82.0
18/11/2021 13:00:00	00:15:00	57.9	47.9	60.3	81.5
18/11/2021 13:15:00	00:15:00	55.9	49.1	57.9	79.0
18/11/2021 13:30:00	00:15:00	56.1	49.9	59.1	73.9
18/11/2021 13:45:00	00:15:00	55.1	47.4	57.6	78.2
18/11/2021 14:00:00	00:15:00	52.8	46.6	54.7	73.2
18/11/2021 14:15:00	00:15:00	55.0	49.4	57.7	75.6
18/11/2021 14:30:00	00:15:00	51.3	44.1	53.8	75.1
18/11/2021 14:45:00	00:15:00	48.2	43.6	50.7	65.0
18/11/2021 15:00:00	00:15:00	50.2	43.1	50.4	74.3
18/11/2021 15:15:00	00:15:00	52.9	44.5	51.8	83.1
18/11/2021 15:30:00	00:15:00	49.7	45.1	51.9	73.6
18/11/2021 15:45:00	00:15:00	52.8	47.1	55.8	77.0
18/11/2021 16:00:00	00:15:00	51.6	45.5	54.5	69.3
18/11/2021 16:15:00	00:15:00	48.6	43.5	49.8	73.0
18/11/2021 16:30:00	00:15:00	48.8	43.5	50.9	72.4
18/11/2021 16:45:00	00:15:00	54.2	47.3	57.5	64.1
18/11/2021 17:00:00	00:15:00	54.7	48.6	57.7	65.3
18/11/2021 17:15:00	00:15:00	51.2	45.8	53.8	63.5
18/11/2021 17:30:00	00:15:00	47.3	42.7	50.6	57.3
18/11/2021 17:45:00	00:15:00	49.4	45.4	51.7	57.0
18/11/2021 18:00:00	00:15:00	45.6	41.0	48.2	55.1
18/11/2021 18:15:00	00:15:00	42.6	38.9	45.1	53.2
18/11/2021 18:30:00	00:15:00	45.0	40.5	47.6	53.6

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
18/11/2021 18:45:00	00:15:00	43.4	39.1	46.3	52.5
18/11/2021 19:00:00	00:15:00	40.8	37.5	43.0	49.9
18/11/2021 19:15:00	00:15:00	41.5	38.4	43.5	47.5
18/11/2021 19:30:00	00:15:00	45.0	40.8	48.2	52.8
18/11/2021 19:45:00	00:15:00	49.5	43.7	52.9	58.5
18/11/2021 20:00:00	00:15:00	44.8	38.9	47.6	55.0
18/11/2021 20:15:00	00:15:00	43.1	38.5	45.6	53.8
18/11/2021 20:30:00	00:15:00	39.2	35.5	41.6	49.5
18/11/2021 20:45:00	00:15:00	42.7	37.7	45.4	55.1
18/11/2021 21:00:00	00:15:00	46.8	41.8	49.5	57.9
18/11/2021 21:15:00	00:15:00	45.1	39.1	48.8	55.5
18/11/2021 21:30:00	00:15:00	42.2	36.9	45.2	53.1
18/11/2021 21:45:00	00:15:00	45.9	42.4	48.3	52.0
18/11/2021 22:00:00	00:15:00	48.1	43.0	51.3	57.1
18/11/2021 22:15:00	00:15:00	50.8	43.0	54.1	62.0
18/11/2021 22:30:00	00:15:00	39.3	34.4	41.9	49.9
18/11/2021 22:45:00	00:15:00	36.9	32.0	39.7	45.4
18/11/2021 23:00:00	00:15:00	35.1	31.1	37.8	45.0
18/11/2021 23:15:00	00:15:00	39.0	34.1	41.9	48.6
18/11/2021 23:30:00	00:15:00	36.9	30.9	39.9	47.9
18/11/2021 23:45:00	00:15:00	31.8	27.4	34.5	44.1
19/11/2021 00:00:00	00:15:00	33.9	28.3	36.5	56.8
19/11/2021 00:15:00	00:15:00	37.0	32.7	39.7	45.9
19/11/2021 00:30:00	00:15:00	33.2	29.6	35.7	40.5
19/11/2021 00:45:00	00:15:00	35.6	30.6	38.2	49.9
19/11/2021 01:00:00	00:15:00	37.1	32.7	39.7	47.2
19/11/2021 01:15:00	00:15:00	39.3	33.1	42.9	49.8
19/11/2021 01:30:00	00:15:00	39.6	33.5	42.9	50.4
19/11/2021 01:45:00	00:15:00	34.1	29.5	37.2	44.5
19/11/2021 02:00:00	00:15:00	33.9	30.3	36.0	45.1
19/11/2021 02:15:00	00:15:00	33.2	28.8	35.9	47.3
19/11/2021 02:30:00	00:15:00	40.2	33.1	43.8	49.9
19/11/2021 02:45:00	00:15:00	39.4	34.9	42.3	47.6
19/11/2021 03:00:00	00:15:00	34.9	30.6	37.4	47.6
19/11/2021 03:15:00	00:15:00	32.1	27.6	34.8	42.2

Period start	Measurement Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
19/11/2021 03:30:00	00:15:00	36.4	29.8	38.4	51.9
19/11/2021 03:45:00	00:15:00	34.8	30.4	37.6	43.6
19/11/2021 04:00:00	00:15:00	35.6	32.0	38.0	45.4
19/11/2021 04:15:00	00:15:00	33.1	30.1	35.1	42.1
19/11/2021 04:30:00	00:15:00	31.9	28.9	33.9	43.4
19/11/2021 04:45:00	00:15:00	32.6	30.3	34.3	40.4
19/11/2021 05:00:00	00:15:00	35.2	32.5	37.1	41.9
19/11/2021 05:15:00	00:15:00	36.3	33.4	38.2	50.0
19/11/2021 05:30:00	00:15:00	40.2	35.7	41.6	56.2
19/11/2021 05:45:00	00:15:00	38.5	36.3	40.3	48.6
19/11/2021 06:00:00	00:15:00	41.5	38.2	43.8	48.8
19/11/2021 06:15:00	00:15:00	47.3	42.6	49.7	56.6
19/11/2021 06:30:00	00:15:00	43.9	41.0	45.6	61.2
19/11/2021 06:45:00	00:15:00	42.9	40.7	44.5	51.9
19/11/2021 07:00:00	00:15:00	42.7	39.8	44.6	55.6
19/11/2021 07:15:00	00:15:00	45.5	43.0	47.3	57.6
19/11/2021 07:30:00	00:15:00	46.3	43.5	47.9	61.1
19/11/2021 07:45:00	00:15:00	47.1	44.4	48.6	66.0
19/11/2021 08:00:00	00:15:00	44.4	41.4	46.1	56.9
19/11/2021 08:15:00	00:15:00	45.5	43.4	46.8	63.1
19/11/2021 08:30:00	00:15:00	46.1	42.4	47.3	69.6
19/11/2021 08:45:00	00:15:00	46.0	40.6	48.2	57.8
19/11/2021 09:00:00	00:15:00	42.9	40.3	44.4	56.0
19/11/2021 09:15:00	00:15:00	45.1	42.0	46.7	66.0
19/11/2021 09:30:00	00:15:00	48.2	43.3	49.9	73.4
19/11/2021 09:45:00	00:15:00	47.9	43.5	48.7	76.1
19/11/2021 10:00:00	00:15:00	46.7	42.7	48.0	69.6
19/11/2021 10:15:00	00:15:00	49.4	42.4	49.1	81.3
19/11/2021 10:30:00	00:15:00	45.7	41.3	47.8	64.0
19/11/2021 10:45:00	00:15:00	48.1	40.7	46.8	75.6
19/11/2021 11:00:00	00:15:00	48.2	41.4	48.2	75.4
19/11/2021 11:15:00	00:15:00	45.8	41.3	48.0	64.6
18/11/2021 11:30:00	00:15:00	51.6	42.8	51.1	79.3
18/11/2021 11:45:00	00:15:00	47.5	41.0	47.3	73.1
18/11/2021 12:00:00	00:15:00	57.9	43.9	54.3	84.1

Figure NA6: Location C, Histogram of Measured Daytime $L_{A90,15min}$ Background Sound Levels

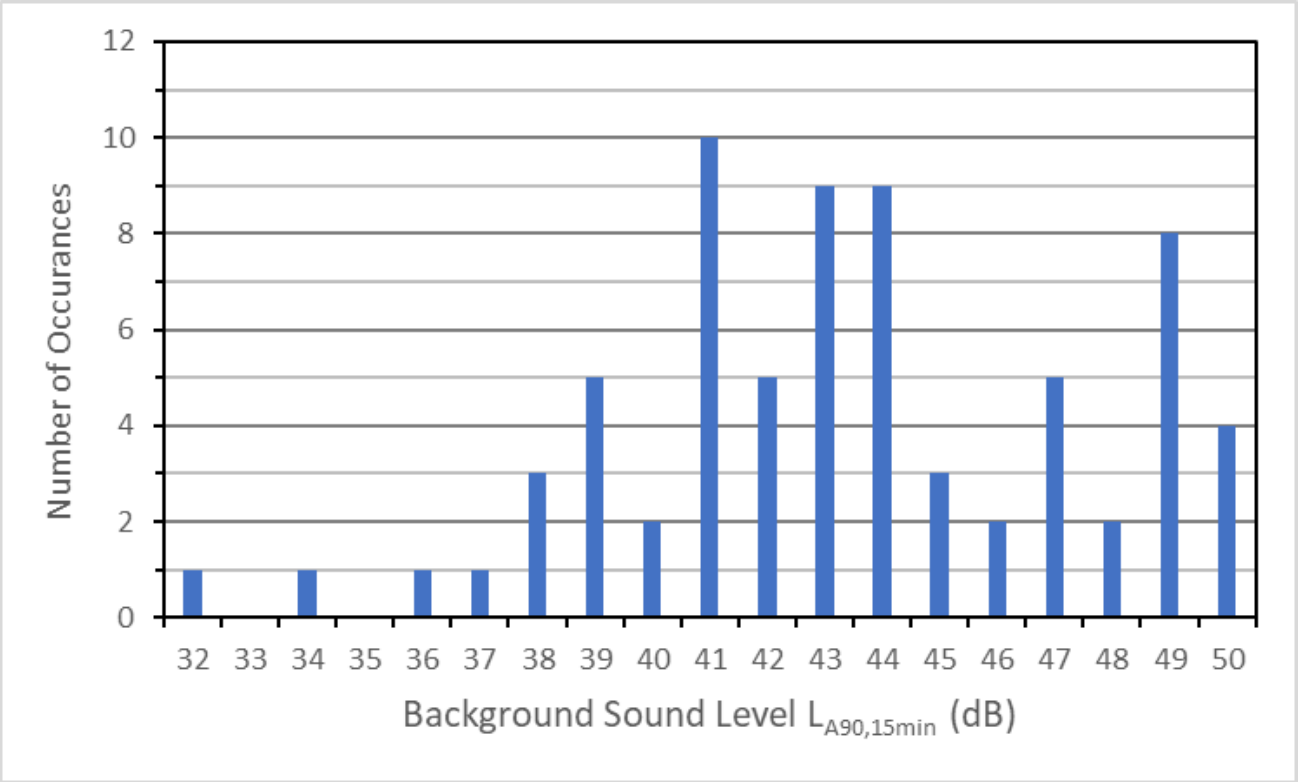


Figure NA7: Location C, Histogram of Measured Night-time $L_{A90,15min}$ Background Sound Levels

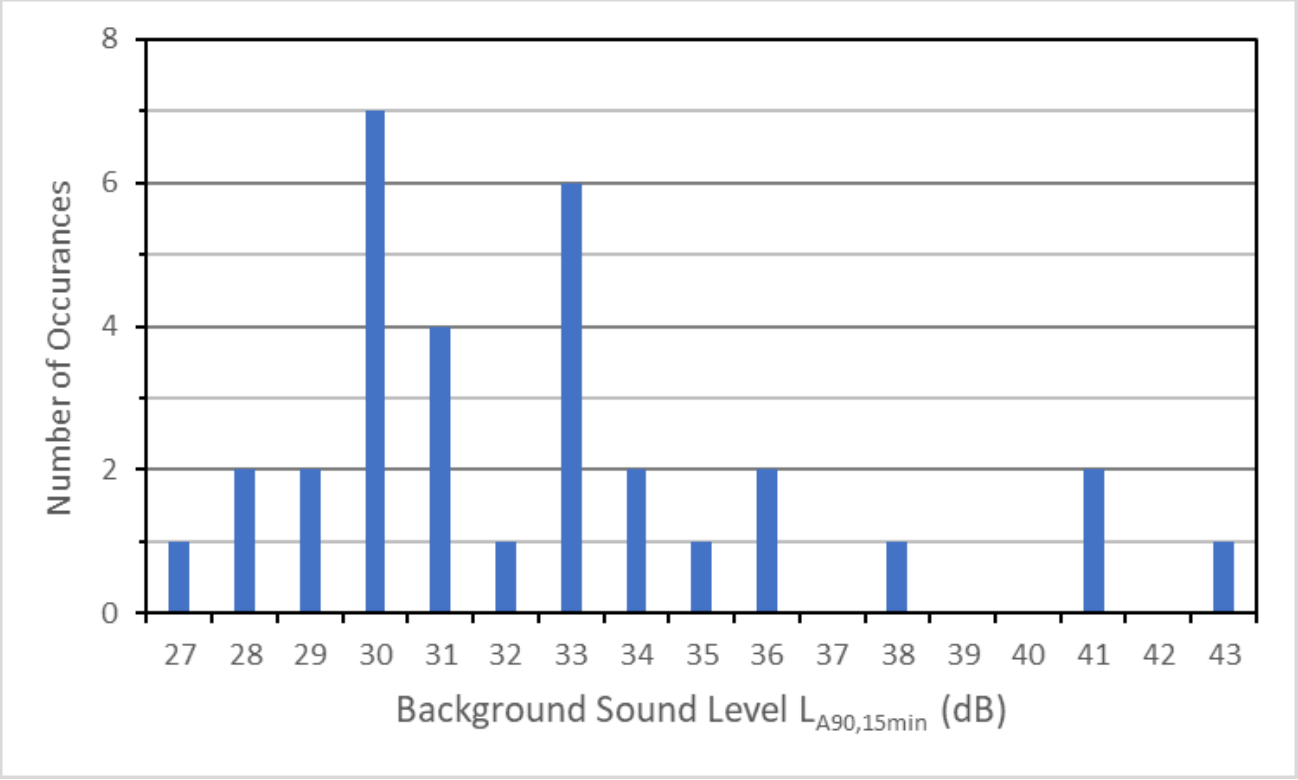


Table NA23: Location C Background Noise Levels – Statistical Analysis, dB

Parameter	Daytime $L_{A90,15\ mins}$	Night-Time $L_{A90,15\ mins}$
Max	50	43
Min	32	27
Linear Average	43	33
Log Average	45	35
Most Commonly Occurring	41	30
Period $L_{A90,T}$	40	30
Selected Value Representative Background Value	**39**	**30**

Table NA24: Location C Period Values, dB

Period	$L_{Aeq,T}$	$L_{A90,T}$
16 hour daytime (07:00 to 23:00)	50.6	40.3
8 hour night-time (23:00 to 07:00)	38.7	30.3
Proposed weekday operational working hours (07:00 to 18:00)	51.9	42.5
Proposed Saturday operational working hours (8:00 to 13:00)*	51.0	41.8
* Level data determined from weekday survey period		

Measurement Location D

The following table presents a breakdown on the measurement results obtained at Location D, and a comparison with the corresponding data simultaneously obtained at Location C for the same measurement periods.

Table NA25: Location D Measurement Data, and Comparison with Location C, Free-field, dB

Measurement Start	Duration	Location D		Location C		Difference	
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$
18/11/2021 15:00:03	00:20:00	50.5	42.7	50.1	43.4	0.4	-0.7
18/11/2021 15:57:32	00:20:00	51.8	45.2	51.6	45.3	0.2	-0.1
19/11/2021 09:25:16	00:20:00	48.6	43.8	47.9	42.8	0.7	1.0
19/11/2021 10:21:00	00:20:00	51.8	42.5	51.1	41.4	0.7	1.1

Measurement Location E

The following table presents a breakdown on the measurement results obtained at Location E, and a comparison with the corresponding data simultaneously obtained at Location A for the same measurement periods.

Table NA26: Location E Measurement Data, and Comparison with Location A, Free-field, dB

Measurement Start	Duration	Location E		Location A		Difference	
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$
18/11/2021 14:30:48	00:20:00	58.1	48.7	50	46.6	8.1	2.1
18/11/2021 15:30:00	00:20:00	56.8	48.2	50.5	47.2	6.3	1.0
19/11/2021 09:53:23	00:20:00	59.4	51.5	50.7	47.1	8.7	4.4
19/11/2021 10:50:10	00:20:00	58.7	51.2	50.8	47.3	7.9	3.9

Source Specific Measurements

Table NA27: Source Specific Measurements Including Spectral Data, Free-field, dB

Ref.	Plant	Dir.	Distance (m)	Octave Band Centre Frequency (Hz)										$L_{Aeq,T}$
				31.5	63	125	250	500	1k	2k	4k	8k	16k	
1	Existing Gas Flare Compressor	Right	2	67.7	71.0	68.2	67.5	64.0	64.9	60.8	61.5	56.7	50.2	**69.6**
2	Existing Gas Flare Generator	-	5	77.5	71.8	78.6	72.0	68.0	59.7	56.5	51.6	43.9	41.5	**68.9**
3	Existing Upgraded Gas Flare and Generator	Front	10	80.0	68.1	65.6	59.5	52.6	49.3	47.0	43.5	37.7	40.1	**56.7**
4	Existing Upgraded Gas Flare and Generator	Back	3	74.3	68.1	65.8	59.2	55.5	51.1	47.7	53.4	52.6	47.9	**59.8**
5	Existing Upgraded Gas Flare and Generator + Compressor	Back	3	79.2	74.0	66.4	61.0	58.0	57.2	54.0	56.6	55.6	50.1	**63.5**
6	Existing Upgraded Gas Flare	Front	2	83.2	76.2	67.7	72.6	64.6	61.5	51.3	49.5	41.4	40.8	**68.1**
7	Existing Upgraded Gas Flare	Front	5	80.4	72.6	66.7	64.9	57.3	54.3	47.6	44.7	36.8	37.9	**60.6**
8	Existing Upgraded Gas Flare	Left	5	83.4	73.8	69.3	64.7	60.2	54.9	50.4	46.6	39.4	40.4	**62.0**
9	Existing Upgraded Gas Flare	Right	2	79.3	73.4	66.6	64.2	59.3	55.0	45.7	41.2	35.0	35.4	**61.2**
10	Existing Upgraded Gas Flare + Compressor	Right	5	73.1	69.2	65.5	59.9	56.6	54.0	47.1	44.5	36.8	29.7	**59.4**

Appendix NA3 – Plant Specifications and Noise Emission Data

MANUFACTURERS DATA

Scania SGI-13 (190kW) (Candidate Landfill Gas Powered Electricity Generator for Installation)

Key data used to inform assessment work highlighted in yellow.

SANDFIRDEN TECHNICS *Professionals in TOP performance*

INDUSTRIAL (BIO) GAS ENGINES

Innovatie op basis van jarenlange ervaring

Dit is wat Sandfirden heeft gebruikt tijdens het ontwikkelen van de range 'lean burn' (bio) gas-motoren.

BIOGAS en aardgas als duurzame brandstof waarmee tevens veel betere emissies worden behaald.

De uiterst moderne motoren worden vanwege de hoge efficiëntie breed ingezet in bijvoorbeeld WKK installaties, waarbij zowel de elektriciteit als ook de warmte wordt gebruikt.

Het robuuste design zorgt er tevens voor dat de motoren bijzonder geschikt zijn voor biogas toepassingen, zoals bijvoorbeeld stortgas, tuinbouw en mesterijen.

De Sandfirden gasmotoren zijn vanwege het ontwerp en 'lean-burn technology' uitermate schoon en zuinig. Door de bewezen betrouwbaarheid worden de motoren 24 uur per dag en 7 dagen per week ingezet. Operationele kosten zijn laag door lange onderhoudsintervallen en laag olieverbruik.

Heeft u vragen, neem dan contact met ons op. U bent er niet voor ons, Sandfirden is er voor u!

Innovation based on years of experience

This is what Sandfirden used while developing the range 'lean burn' (bio) gas engines.

BIOGAS and natural gas as a sustainable fuel which produces much lower emissions.

Because of high efficiency, the ultra modern engines are widely used in many applications including CHP installations, where both electricity and heat are produced.

The robust design also ensures that the engines are particularly suitable for biogas applications such as landfill gas, horticulture and farm waste.

Design and lean-burn technology make the Sandfirden gas engines extremely clean and economical. The proven reliability allows the engines to be operated 24 hours a day, 7 days a week. Operating costs are low due to long maintenance intervals and low oil consumption.

Please contact us if you have any questions. You're not there for us, Sandfirden is there for you!

www.sandfirden.nl

8.NEN5

INDUSTRIAL (BIO) GAS ENGINES

Sandfirden engine type	Engine	Normal rating (kWm) COP		Dimensions (mm)			Weight (kg)
		50 Hz	60 Hz	Length	Width	Height	
SGI-4	Agco	53	n.a.	1089	757	1076	440
SGI-7	Agco	110	120	1270	792	1253	800
SGI-13	Scania	163	184	1670	930	1465	1100
SGI-13	Scania	215	242	1670	930	1465	1100
SGI-13	Scania	266	301	1670	930	1465	1100

Rating COP: Continuous Power according to the international performance standard ISO 3046

Standard equipment:
- Natural gas / biogas engine
- Ignition system
- Fuel supply system
- Speed governing
- Cable harness

Optional equipment:
- Cooling equipment
- Gas fuel train
- Emission control
- Knock detection
- Oil refill system

Dealer

Haventerrein 1
1779 GS Den Oever
The Netherlands

Tel.: +31 (0)227 513 613
Fax: +31 (0)227 513 800
E-mail: sales@sandfirden.nl

www.sandfirden.nl

WITHOUT Acoustic Enclosure

INDUSTRIAL GAS ENGINE SGI-13

Contents - Engine Technical Data

Exhaust system	**1500 rpm**	**1800 rpm**
Max. back pressure without power loss	500 mmwc	
Exhaust flow	22,4 kg/min	27,1 kg/min
Exhaust temperature after turbo	540°C	525°C

Electric system	
Control system	Optional Electronic
Starter motor electric capacity	6 kW
Start aid relay capacity min.	64 Amp
Cold start ability CCA10 min.	800 Amp

Heat rejection	**1500 rpm**	**1800 rpm**
Base power	266 kWm	301 kWm
HT circuit	154 kWm	178 kWm
LT circuit	49 kW	63 kW
Exhaust gas (if cooled back to 120°C)	114 kW	126 kW
Surrounding air	25 kW	30 kW

Sound level	**1500 rpm**	**1800 rpm**
Over-all sound pressure level at 1m from engine block (corrected for free field condition)	106 dB(A) at 250 Kwe	109 dB(A) at 285 Kwe

WITHOUT Acoustic Enclsoure

Contents - Defintions

Base load rating	Continous power according to the international performance standard ISO 3046.
Standard reference conditions	Note: standard reference conditions 27°C air inlet temperature, 152,4m A.S.L. 60% relative humidity. All engine performance data based on the abovementioned maximum continuous ratings.

www.sandfirden.nl

4

WITH Acoustic Enclosure

[redacted]

From: [redacted]@alphagenrenewables.co.uk>
Sent: 26 January 2022 15:34
To: [redacted]
Subject: Re: FW: Scania SGI-13 190kW fuel and emmissions

EXTERNAL EMAIL

EXTERNAL EMAIL - We could not verify the authenticity of this message. Please be cautious when clicking on links or opening attachments.

Hi [redacted]

They will be housed in acoustic enclosures with a noise specification of 65bBA at 10m.

Regards
[redacted]

> On 26/01/2022 15:06 [redacted]@golder.com> wrote:
>
> Hello Richard,
>
> In relation to the proposed Scania engines for Sandsfield at Milegate Landfill, for the noise assessment we also need the noise emission ratings for them please – it looks from the chain below that you may have been sent the spec sheets by the manufacturer – if so please could you forward to me? I have found the attached in their website downloads section but was not sure if this was the exact same model to be installed – please could you advise?
>
> Kind Regards
>
> [redacted]

[redacted] (BSc, MSc, MIEnvSc, FGS)
[redacted]
Golder, member of WSP in the UK
T: [redacted] | D: [redacted] | M: [redacted]

Cummins 250 DQDDA (Adopted Example Worst-case Spectral Data)

PS GEN-B

Sound data

250DQDAA 60 Hz

Sound pressure level @ 7 meters, dB(A)

See notes 1-8 listed below

Configuration		Measurement location number								Average
		1	2	3	4	5	6	7	8	
Standard – unhoused	Infinite exhaust	86	90	89	93	89	95	90	90	91
F183 – skin tight	Mounted muffler	88	91	91	94	90	95	91	91	92
F201 – quiet site II first stage	Mounted muffler	80	81	83	91	91	91	83	83	88
F202 – quiet site II second stage	Mounted muffler	72	74	73	72	73	72	69	71	72

Sound power level, dB(A)

See notes 2-6, 9, 10 listed below

Configuration		Octave band center frequency (Hz)								Overall sound power level
		63	125	250	500	1000	2000	4000	8000	
Standard – unhoused	Infinite exhaust	79	94	108	111	113	111	107	107	118
F183 – skin tight	Mounted muffler	95	104	112	113	114	112	108	103	120
F201 – quiet site II first stage	Mounted muffler	104	111	108	109	110	108	103	97	117
F202 – quiet site II second stage	Mounted muffler	84	94	93	96	98	97	93	87	103

Exhaust sound pressure level @ 1 meter, dB(A)

Open exhaust (no muffler) @ rated load	Octave band center frequency (Hz)								Sound pressure level
	63	125	250	500	1000	2000	4000	8000	
	98	109	118	121	123	127	126	124	131.9

Sound-attenuated and weather-protective enclosures

> For generator sets from 10 to 1000 kW

Our energy working for you.™

Power Generation

> Diesel generator set enclosures
10 to 1000 kW
Weather-protective
Level I, Level II, Level III

> Spark-ignited generator set enclosures
20 to 150 kW
Weather-protective
Level I, Level II

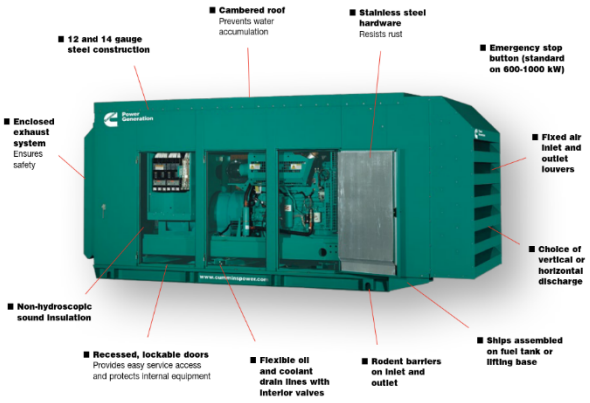
Sound-attenuated and weather-protective enclosures from Cummins Power Generation Inc. meet even the strictest sound requirements and provide optimum protection from inclement weather.

Cummins Power Generation diesel and spark-ignited generator sets are available with sound-attenuated and weather-protective enclosures. Pre-assembled, pre-integrated and delivered as part of the entire power system, these enclosures are designed to speed installation time and reduce costs.

Choose from three levels of sound-attenuation, depending on model size, to comply with even the strictest noise requirements. Enclosures are constructed of steel or aluminum, which is preferred in coastal regions or other environments where corrosion is a concern.

www.cumminspower.com

Features:



> Three levels of sound attenuation
  Level I: 70 to 89 d(B)A*
  Level II: 63 to 78 d(B)A*
  Level III: 68 to 70 d(B)A*
> Compact footprint, low profile design
> Easy access to all major generator and engine control components for servicing
> Fully-house, enclosed exhaust silencer ensures safety and protects against rust
> Enclosure, generator set, exhaust system and tank are pre-assembled, pre-integrated and shipped as one package, saving time and labor costs
> All-steel construction with stainless steel hardware offers durability
> Upgrade kits
> Enclosures mounted directly to a sub-base fuel tank or lifting base
> UL2200-listed
> Customer options available to meet your application needs

Enclosure options

> Aluminum enclosure is wind-rated to 150 mph (per ASCE 7-05 exposure D, category 1 importance factor)
> Kits available to up-fit existing generator sets or to upgrade existing enclosures with additional sound attenuation
> Exterior oil and coolant drains with interior valves for ease of service
> Overhead 2-point lifting brackets (some models)

* Full load at 7 meters, steel enclosures

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Choose from weather protective enclosure or three levels of sound attenuation:

kW	Model	Sound levels (dB(A))* Weather-protective	Level I	Level II
Diesel				
10	DSKAA	78	68	65
15	DSKAB	81	69	66
20	DSKBA	80	70	67
25	DSKFA	82	72	69
35	DGBB	82	71	63
35	DGGD	81	72	66
40	DGBC	82	72	63
40	DGHD	79	71	64
50	DGCA	83	72	66
50	DGHE	79	70	65
60	DGCB	84	73	67
60	DSFAD	87	79	71
80	DGCG	84	76	67
80	DSFAE	87	82	72
100	DGDB	86	77	70
100	DSGAA*	87	-	73
100	DSHAF	95	88	78
125	DGDK	86	80	71
125	DSGAB*	87	-	74
125	DSHAE	95	88	78
150	DGFA	89	77	72
150	DSGAC*	88	-	75
150	DSHAA	95	88	78
175	DGFB	90	78	72
175	DSHAB	95	88	78
200	DGFC	91	80	74
200	DSHAC	95	88	78
230	DGFS	91	81	75
230	DSHAD	96	89	78
250	DQDAA	90	86	71
275	DQDAB	89	86	71
275	DQHAA	86	85	74
300	DFCB	86	84	71
300	DQDAC	89	86	71
300	DQHAB	89	88	76
350	DFCC	87	85	72
350	DFEG	85	83	72
400	DFCE	89	85	73
400	DFEG	89	85	73
450	DFEJ	87	84	73
500	DFEK	88	85	76
600	DFGB	85	78	74
600	DQCA	87	79	74
750	DFGE	87	80	75
750	DFHA	91	81	77
750	DQCB	87	79	74
750	DQFAA	89	79	75
800	DFHB	91	81	77
800	DQCC	87	79	74
800	DQFAB	89	79	75
900	DFHC	93	83	78
900	DQFAC	88	80	76
1000	DFHD	90	80	76
1000	DQFAD	90	80	76

kW	Model	Sound levels (dB(A))* Weather-protective	Level I	Level II
Spark-ignited				
20	GGMA	77	N/A	66
25	GGMB	78	N/A	66
30	GGMC	79	N/A	67
35	GGFD	80	73	65
42/47	GGFE	83	73	66
60	GGHE	86	77	68
70/75	GGHF	87	77	69
85	GGHG	85	79	75
100	GGHH	86	80	76
125	GGLA	85	79	75
150	GGLB	85	79	75

***Also available Level III**

100 kW	DSGAA	68 dB(A)
125 kW	DSGAB	69 dB(A)
150 kW	DSGAC	70 dB(A)

Diesel generator sets from 100 to 150 kW (models **DSGAA, DSGAB, DSGAC**) are available in **Level III** sound attenuation.

Shown: 100 kW Tier 3 diesel generator set (model DSGAA).

* Full load at 7 meters, steel enclosures

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Gas Flare

Upgraded Gas Flare

[redacted]

From: [redacted]
Sent: 19 May 2021 14:10
To: [redacted]
Subject: FW: GW and Gas Data

EXTERNAL EMAIL

See below

Kind Regards,
[redacted]
Waste Manager
Email: [redacted]
Tel: [redacted]
Mob: [redacted]

Sandsfield

Gravel Co Limited

Registered office:
Sandsfield,
Catwick Lane,
Brandesburton,
East Yorkshire,
YO25 8SA

Registered in England No: 873555

Dacre Lakeside Park Bert's Pizzeria • Cafe Coneygarth Lakes and Lodges Holiday Resort

From: [redacted]@landfillsystems.co.uk [redacted]
Sent: 19 May 2021 14:00
To: [redacted]@Sandsfield.co.uk [redacted]@landfillsystems.co.uk
Subject: RE: GW and Gas Data

Hi [redacted]

It's a 1,000Nm3/hr flare, 1000°C combustion temperature, with >0.3s residence time. Noise level should be better than 70dBA at 10m.

Let me know if you need anything further.

Best regards,

[redacted]
Director

1

golder.com