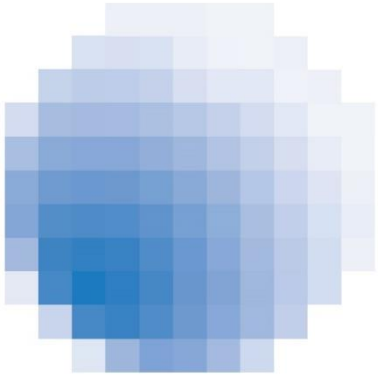

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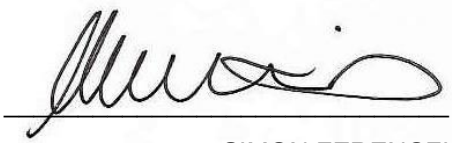
Energy Recovery Centre

Plymouth

Environmental Noise Impact Assessment

P2251-REP01-BDH

21 September 2023

PROJECT:	Energy Recovery Centre Plymouth Environmental Noise Impact Assessment
CLIENT:	Sol Environment Ltd Unit 5.3 Paintworks Arnos Vale Bristol BS4 3EH
DOCUMENT REFERENCE:	P2251-REP01-BDH
SIGNED:	 BRIAN HORNER
CHECKED:	 SIMON FERENCZI
DATE:	21 September 2023

CONTENTS

1 EXECUTIVE SUMMARY

Sol Acoustics Ltd ("Sol") has been appointed to provide an environmental noise impact assessment for the proposed new Energy from Waste ("EfW") site (the "Facility") that is to be located off Haxter Close in Plymouth, PL6 7BP.

This acoustic assessment report considers the environmental noise impact as arising from the operation of all plant and processes associated with the intended installation, as at the nearest Noise Sensitive Receptors (NSRs) during the proposed hours of operation (namely 24/7 operation).

The pre-existing environmental noise climate at the identified NSRs has been measured by Sol, between Thursday 7 September and Monday 11 September 2023 (inclusive).

The environmental noise emissions that shall be arising from the operation of the complete plant have been quantified, modelled, and assessed using proprietary "CadnaA" 3D noise modelling software.

It is the conclusion of this environmental noise impact assessment that the total, aggregate environmental noise impact arising from the proposed operation of the plant in its entirety, in full compliance with the Noise Management Plan and its associated plant noise specification as presented herein, is just below the threshold for a British Standard BS 4142: 2014+A1: 2019 defined "adverse" noise level impact at the worst affected noise sensitive receptor (i.e. is "sub-adverse").

Please refer to the main report and appendices for further information.

2 INTRODUCTION

Sol Acoustics Ltd ("Sol") has been appointed to provide an environmental noise impact assessment for the proposed Energy from Waste ("EfW") site that is to be located off Haxter Close in Plymouth, PL6 7BP (hereinafter referred to as the "Facility"). The purpose of this acoustic assessment is as follows:

- Identify the nearest pre-existing noise sensitive receptors ("NSRs") that are most likely to be affected by environmental noise arising from plant and/or process noise that is associated with the proposed Facility.
- Determine the prevailing, pre-existing baseline background noise climate at the worst affected NSR, through direct, environmental noise measurement.
- Identify all significant noise sources that are to be associated with the proposed Facility.
- Calculate the resultant environmental noise level contribution and impact at the nearest NSRs to the Facility, taking factors such as distance to receptors, acoustic screening, and other environmental features into consideration.
- Carry out an environmental noise assessment of the Facility in accordance with the assessment methodology that is prescribed in relevant Standards (e.g. British Standard 4142: 2014+A1: 2019) and other acoustic guidance, in order to determine the likely significance of the noise impact generated.

This acoustic report is structured as follows:

- Section 3 provides a basic description of the Facility and key surrounding NSRs.
- Section 4 provides summary details of the benchmark environmental noise survey undertaken in order to determine the pre-existing environmental noise climate at the identified NSRs.
- Section 5 provides the results of the benchmark environmental noise survey.
- Section 6 provides a summary of the pertinent acoustic Standards which has been used to assess the magnitude of the noise impact likely to be generated.
- Section 7 provides a summary of the proprietary 3D acoustic models constructed and acoustic calculations undertaken.
- Section 8 provides a BS4142: 2014+A1: 2019 acoustic assessment.
- Section 9 provides a conclusion statement.

- *Appendix A provides a glossary of acoustic terminology.*
- *Appendix B provides details of the noise surveys undertaken and a summary of the data obtained from these.*
- *Appendix C provides a detailed site plan showing the approximate location of significant site plant and environmental noise sources.*
- *Appendix D provides details of the 3D computer noise model as constructed for this project.*
- *Appendix E provides an outline description of all key noise sources and provides indicative plant noise levels which must not be exceeded.*
- *Appendix F provides details of the acoustic louvre used to inform this assessment.*
- *Appendix G gives details and qualifications of contributing Sol Acoustics' staff.*

3 DESCRIPTION OF SITE

3.1 General Overview and Noise Sensitive Receptors (NSRs)

The proposed location for the Facility is within an existing industrial estate on Haxter Close in Plymouth, PL6 7BP. The nearest identified existing residential housing to the proposed Facility are as follows:

A. Housing on Haxter Wood Chase, c.480 metres distance to the north

B. Housing off Tamerton Road, c.180 metres distance to the north east

C. Housing on Lady Fern Road, c.120 metres distance to the east

Figure 1 overleaf indicates the location of the Facility in relation to the identified residential NSRs, and also the corresponding locations of the noise monitoring positions that have been used in order to inform this acoustic assessment (all as discussed in Section 4 of this report).

Sol has not been made aware of any Sites of Special Scientific Interest ("SSSI"), Local Wildlife Sites ("LWS"), Special Areas of Protection ("SAC"), RAMSAR sites etc. (i.e. ecological receptors) that are in the vicinity of the Facility and which are sensitive to noise.

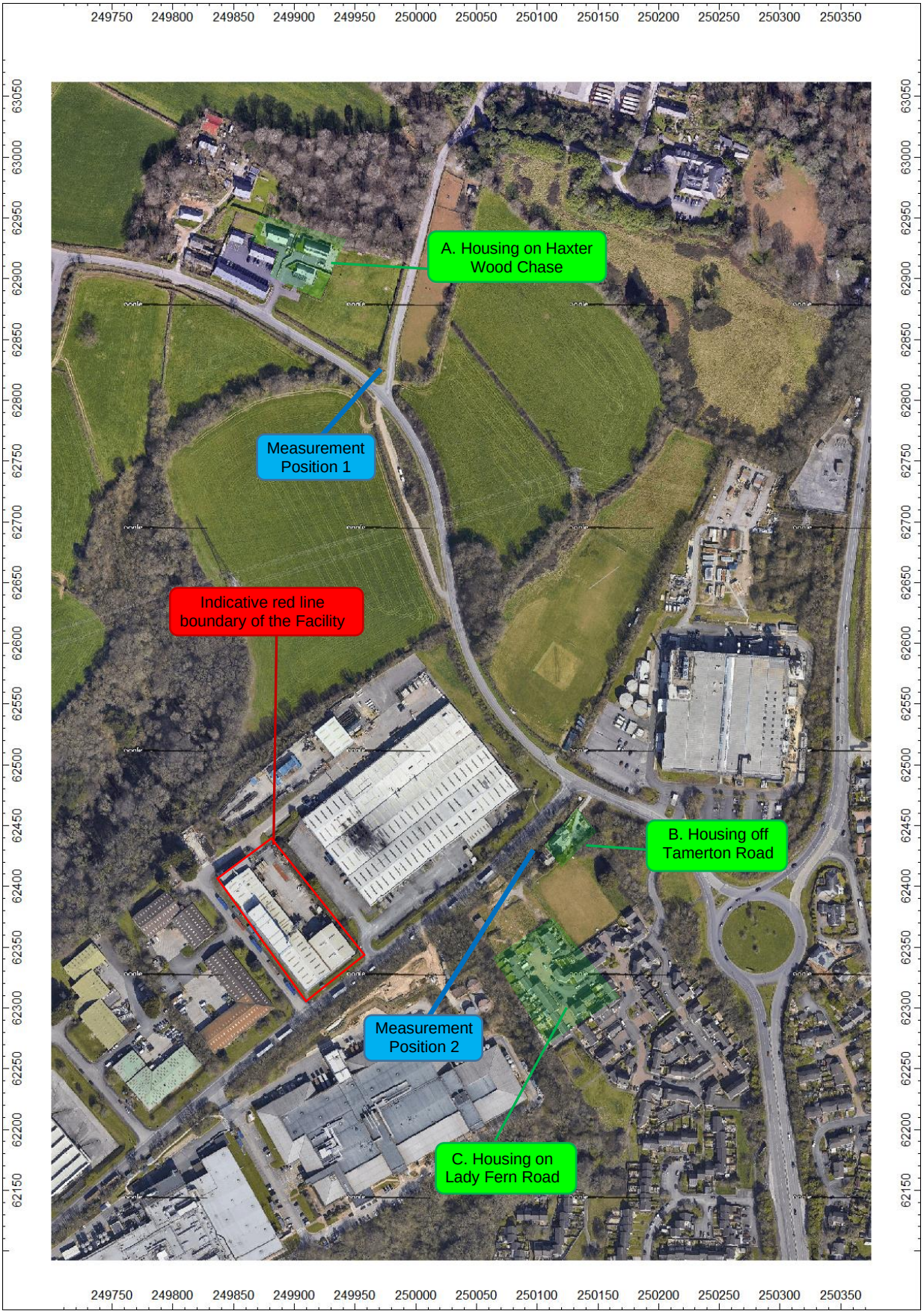


Figure 1: Aerial photo showing the Facility, overlaid with locations of NSRs and monitoring positions (Google 2023)

3.2 Characteristics of the Facility

The proposed Facility is a twin-line Energy Recovery Centre ("ERC") which shall process Refuse Derived Fuel ("RDF") feedstocks. The Facility will include the following key elements:

- Reception hall
- Process hall
- Organic Rankine cycle ("ORC") hall
- Flue stack
- Silos
- Firewater tanks
- Substation

Figure 2 indicates the proposed site layout of the Facility.

3.2.2 External Building Fabric

The proposed Facility is to be housed within an existing building that is located on site; this existing building is of a steel frame construction. The lower walls, below three metres height, are constructed from masonry/brick. The remainder of the façade and the roof are constructed from industrial cladding panels. There are rooflight within the roof of the exiting roof construction.

There are a number of personnel doors, ventilation louvres and roller shutter door located within the façade of the existing building.

3.2.3 Mobile Plant

A telescopic handler/front loader shall operate within the Reception Hall; this shall be used to load the push floor during daytime periods only. Fork lift trucks are also expected to infrequently operate at the Facility.

3.2.4 Site Deliveries and Collections

Details of the number of delivery/collections expected per day are currently not known to Sol. For the purposes of this assessment, it has been assumed that all HGV deliveries and collections to/from the Facility shall occur during daytime periods only, i.e. between 07:00 – 19:00 hours daily. It has also been assumed that, on average, up to one delivery or collection could occur per hour. Deliveries and collections are likely to be undertaken via an articulated lorry via the northern site entrance, and this has been specifically allowed for within Sol's 3D noise modelling of the Facility and its proposed operations.

3.2.5 Anticipated Noise Level Emissions

Appendix E provides a full inventory of all identified acoustically significant plant and processes which have the potential to create an environmental noise impact at nearby NSRs which have been determined based upon this acoustic assessment. The list of the key noise sources has been determined by Sol as based upon the provided site plan of the Facility as well as our in depth experience of similar Facilities as located with the UK.

The list of Facility noise sources will be required to be further developed updated by Sol as further information because available, and prior to any finalisation of the scheme or any commencement of construction or procurement. The Noise Management Plan as presented herein will also similarly need to be updated accordingly by Sol.

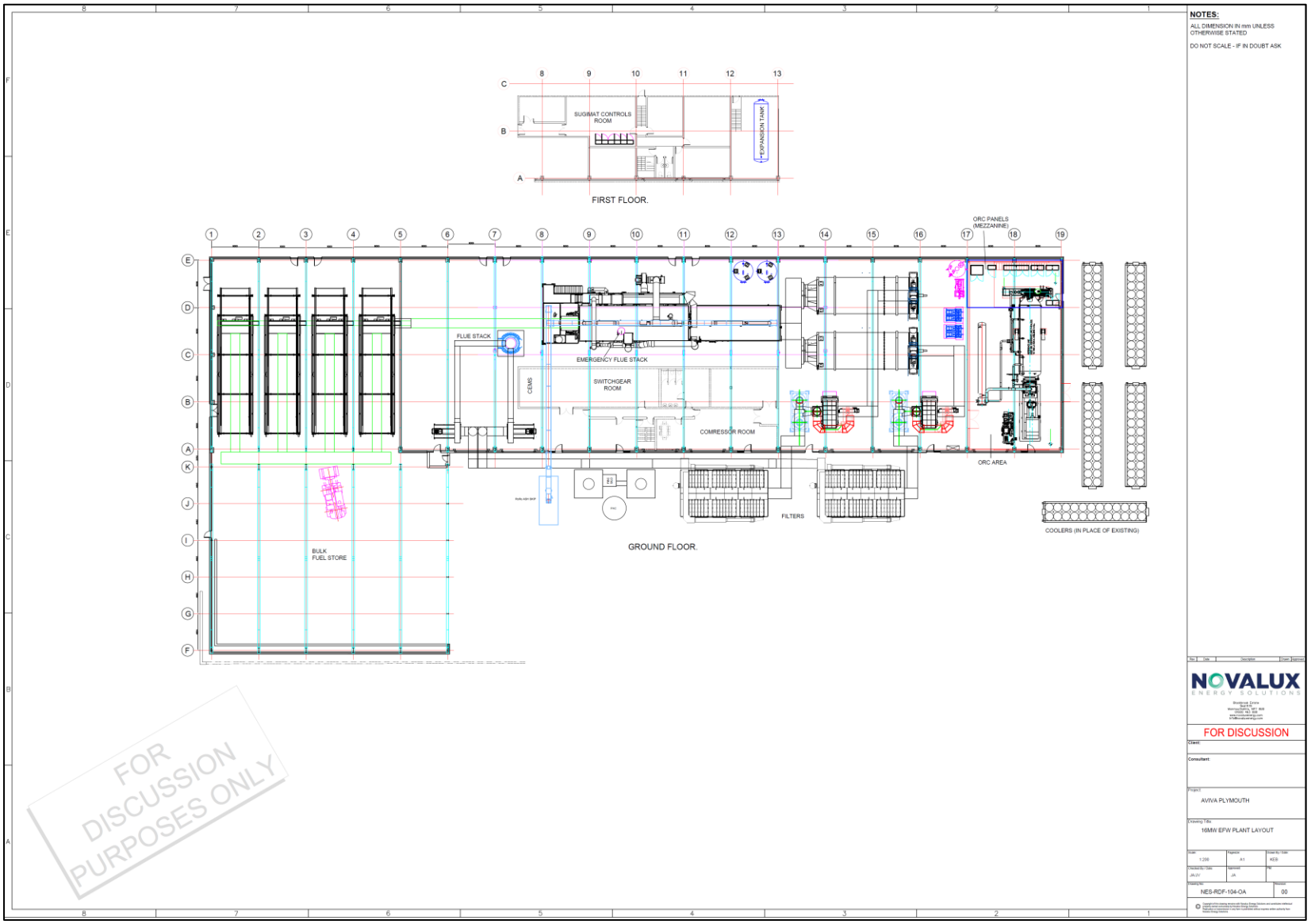


Figure 2: Proposed site plan of the Facility

4 DETAILS OF INVESTIGATION

4.1 Pre-Existing Environmental Noise Climate

In order to inform this environmental noise benchmarking assessment, an environmental noise survey has been conducted by Sol between c.10:30 hours during Thursday 7 September and c.23:00 hours during Monday 11 September 2023. The purpose of the survey was to determine the prevailing pre-existing Background Sound Levels at the nearest noise sensitive premises to the Facility, as during typical weekend and weekday, daytime and night time periods for environmental noise benchmarking and subsequent acoustic impact assessment purposes.

The environmental noise survey consisted of two environmental noise measurement positions, as follows:

- **Noise Monitoring Position 1**: Mast-mounted microphone at c.1.8 metres above local ground level and c.100 metres distance to the southeast of the housing on Haxter Wood Chase. The microphone was mounted in so-called “free-field” acoustic conditions. Key noise sources included road traffic noise from Tamerton Road and faint plant from nearby third-party industry. The Background Sound Levels as recorded at this position are deemed to be representative of those as expected at the housing on Haxter Wood Chase.

- **Noise Monitoring Position 2**: Tripod-mounted microphone at c.1.5 metres above local ground level and c.15 metres distance to the southwest of the housing off Tamerton Way. The microphone was mounted in so-called “free-field” acoustic conditions. Key noise sources included road traffic noise from Belliver Way and Tamerton Road and plant noise largely from Plessey Semiconductors Ltd, albeit the microphone was positions such that it was acoustically screened from this industrial noise source. The Background Sound Levels as recorded at this position are deemed to be representative of those as expected at the housing off Tamerton Road and the housing on Lady Fern Road.

The location of the noise monitoring positions in relation to key existing environmental noise sources is shown in Figure 1.

The full measurement results are as presented in Appendix B.

The noise survey was conducted using Type 1 Precision Grade noise monitoring equipment. The complete sound measuring systems were field calibrated immediately prior to, and following the noise survey period. (Full details of all the instrumentation used are retained on file by Sol, including traceable calibration records; these are available for review if needed).

Meteorological data was recorded at Noise Monitoring Position 2 for the duration of the noise survey, as using a Professional Grade Vaisala “WXT530” weather station. Brief periods of significant rainfall, exceeding $1mmh^{-1}$, occurred on the 9, 10 and 11 September 2023. Noise data as recorded during these periods have been omitted from the assessment; the average wind speed throughout the survey remained below $5ms^{-1}$.

Notwithstanding the weather conditions recorded, the microphone system was entirely weatherproofed and fitted with all-weather environmental windshield, with bird spike also.

5 ENVIRONMENTAL NOISE SURVEY RESULTS

5.1 Pre-Existing Environmental Noise Climate

Appendix B provides fully detailed time history information for the environmental noise levels as recorded for the duration of the environmental noise survey.

Table 1 below and overleaf provides a basic summary of the typical overall, A-weighted noise levels measured at the various noise measurement positions, in $L_{Aeq,T}$ and $L_{A90,15min}$ terms. The specific, measured noise levels pertinent to the required BS 4142: 2014+A1: 2019 environmental noise assessment are highlighted in ***bold, italic*** text.

Measurement Position	Date	Daytime (07:00 – 23:00 Hours)		Night Time (23:00 – 07:00 Hours)	
		dB $L_{Aeq,T}$	dB $L_{A90,15min}$ (Typical)	dB $L_{Aeq,T}$	dB $L_{A90,15min}$ (Typical)
1	Thursday 7 September 2023	59*	39	56	41
	Friday 8 September 2023	59	38	53	***36***
	Saturday 9 September 2023	56	***36***	51	39
	Sunday 10 September 2023	55	37	52	38
	Monday 11 September 2023	60*	38	-	-
2	Thursday 7 September 2023	51*	45	49	44
	Friday 8 September 2023	51	44	47	44
	Saturday 9 September 2023	49	44	51	43
	Sunday 10 September 2023	48	***41***	46	***39***
	Monday 11 September 2023	53	45	-	-
** Measurement not conducted for the full assessment period*					

Table 1: Summary of typical, measured broadband environmental noise levels

6 ENVIRONMENTAL NOISE PERFORMANCE SPECIFICATION REQUIREMENTS

6.1 Noise Related Planning Conditions

Sol is not aware of any noise-related Planning Conditions and/or Covenants appertaining to the proposed Facility.

6.2 Guidance on Noise and vibration Management: Environmental Permits

Published by the Environment Agency ("EA"), Scottish Environment Protection Agency ("SEPA"), Natural Resources Wales ("NRW") and Northern Ireland Environment Agency (collectively referred to as the "Environment Agencies") during 23 July 2021, and subsequently updated 31 January 2022, this guidance sets out the minimum requirements for environmental noise and vibration impact assessments, as required to support a Permit Application. It replaces the Environment Agency's previous Horizontal Guidance for Noise (H3), Parts 1 and 2. The key requirements of the guidance, which are applicable to this assessment, are as presented below:

- The environmental noise impact assessment must be undertaken in accordance with British Standard BS4142: 2014+A1: 2019: '*Method for rating and assessing industrial and commercial sound*'. A summary of this Standard is provided in Section 6.3.

- The acoustic character of the sound generated must be considered – i.e. whether the sound is tonal, impulsive, or intermittent in operation. For industrial noise sources where the sound is neither impulsive nor tonal, but is readily distinguishable against the residual acoustic environment, the Environment Agency will a expect a minimum acoustic character correction of +3dB unless otherwise justified.

- The BS 4142: 2014+A1: 2019 defined Background Sound Levels and Residual Sound Levels as used to inform the assessment must not include noise from the Facility. Where it is pre-existing, the Facility must not be operational during the environmental noise level measurements.

- Noise arising from the normal operation of the Facility (as during both so-called normal operating conditions "NOC" and other than normal operating conditions "OTNOC" conditions) must not result in a BS 4142: 2014+A1: 2019 defined '*significant adverse impact*' (following consideration of the context) at the surrounding NSRs. The "Environment Agencies" will not issue a Permit where a Facility is, or is predicted to be, operating at (or above) this level.

- As stated above, the guidance recognises that the *context* of the situation can affect the outcome of the BS 4142: 2014+A1: 2019 assessment but states that there are practical limits. The guidance stipules that it is unlikely to be acceptable to adjust the magnitude of the impact beyond the next BS 4142: 2014+A1: 2019 assessment magnitude band (e.g., suggesting that a Rating Level of around 10dB above the Background Sound level – defined by the Standard as a "significantly adverse" impact, depending on the context - is actually a "low impact" purely on the grounds of context etc.).

Notwithstanding the above, the assessment must demonstrate that Best Available Techniques (BAT) has been applied to prevent or minimise noise emissions.

6.3 BS4142: 2014+A1: 2019 *'Method for rating and assessing industrial and commercial sound'*

BS 4142: 2014+A1: 2019: *'Method for rating and assessing industrial and commercial sound'* is intended to be used to assess noise of an industrial nature, which includes sound from fixed installations comprising of mechanical and/or electrical plant and equipment. The methods prescribed in this British Standard use outdoor sound levels in order to assess the likely effects of sound on people who might be inside or outside a dwelling or premises that is used for residential purposes upon which sound is incident.

The procedure contained in BS 4142: 2014+A1: 2019 for assessing environmental noise impact is to compare the measured or predicted noise level from the source in question - the "Specific Sound Level" immediately outside the noise sensitive premises - with the corresponding "Background Sound Level". Where the noise contains attention attracting characteristics such as tonal, impulsive and/or intermittent elements, it may be appropriate to apply a correction to the Specific Sound Level in order to obtain the "Rating Level."

BS 4142: 2014+A1: 2019 states that the significance of sound arising from an industrial and/or commercial nature depends upon both the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, and also the context in which the sound occurs:

a) Typically, the greater this difference, the greater the magnitude of the impact;

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

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

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

For the daytime, the assessment is conducted over a one-hour period, and over a 15-minute period at night. The daytime and night time periods are defined as occurring between 07:00 hours to 23:00 hours, and 23:00 hours to 07:00 hours, respectively.

BS 4142: 2014+A1: 2019 states that in using the Background Sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured Background Sound Level, but rather to quantify what is typical during particular time periods.

In full accordance with BS 4142: 2014+A1: 2019 methodology, the context in which the sound occurs must be taken into consideration when demining the magnitude of the noise impact. In this case, the site is situated in close proximity to other various other industrial units with external plant. Industrial noise from the proposed Facility is expected to be within context of the site and its surroundings. Given the presence of existing industrial units within the vicinity of the noise monitoring positions and residential premises, the *lowest measured* typical Background Sound Level (per daytime and night time period) has been used to derive the maximum permissible Rating Level limits.

Table 2 specifies the typical Background Sound Levels as recorded during the survey period:

Noise Sensitive Receptors	**Representative Noise Measurement Position**	**BS 4142: 2014+A1: 2019 defined Typical Background Levels, dB $L_{A90,15min}$**	
		Daytime (07:00 hours – 23:00 hours)	**Night Time (23:00 hours – 07:00 hours)**
A. Haxter Wood Chase (c.480 metres to the north)	1	36	36
B. Tamerton Road (c.180 metres to the north east)	2	41	39
C. Lady Fern Road (c.120 metres to the east)	2	41	39

Table 2: Typical Background Sound Levels

7 ENVIRONMENTAL NOISE MODEL

7.1 Methodology and Basis of 3D Environmental Noise Models

In order to predict the likely noise levels impinging on the surrounding NSRs, proprietary 3D computer noise models were created using the DataKustik "CadnaA" noise mapping software. The following assumptions have been made when generating the noise model:

(a) The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2: '*Acoustics – Attenuation of Sound propagation outdoors – Part 2: General Method of Calculation'*.

(b) The model was set to include third order reflected noise from solid structures.

(c) Ground absorption, as defined in ISO 9613-2, has been taken into consideration. The base ground absorption for the model has been set to G=1.0 (soft ground). The ground absorption for large tarmacked areas has been set to G=0.0 (hard ground).

(d) The existing land topography of the site and surrounding area up to and including the nearest NSR has been taken into consideration in the assessment. Topographical information has been obtained using the open source LiDAR data made available by the Department for Environmental Food and Rural Affairs.

(e) The noise impact as expected the surrounding residential receptors has typically been modelled at a height of 4 metres above local ground level (first floor height).

(f) The noise model assumes that all identified noise sources for all site operating modes including normal operating conditions ("NOC") in addition to all other than normal operating conditions ("OTNOC", such as start-up, shutdown, and bypass etc.) are operating simultaneously. Noise sources associated with emergency operation are not considered at this stage.

(g) The noise model assumes that on average up to one HGVs could arrive at and depart from the Facility during a typical 1-hour daytime assessment period. No HGVs are expected to arrive at, nor depart from the Facility during any night-time period.

(h) All externally sited plant noise sources have been modelled as point, line, or area sources, as appropriate, as based on physical size of the plant.

(i) For modelling purposes, the effective sound power level of each identified noise source has been determined broadly in accordance with the principles presented in International Standard ISO 3744: 2010: *'Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods',* taking into due consideration the physical dimensions of each noise source and the specified sound pressure level. In the absence of a detailed 3D BIM model (Navisworks) for the project or detailed plans, Sol has made certain assumptions regarding the physical dimensions of the plant in each case. ***These aspects must be checked at later design stages.***

(a) Octave band noise data has not been provided by the Client for the various noise source. Therefore, Sol has assumed a typical noise spectrum for each modelled noise source as based upon experience of similar plant on other projects. ***However, it must be confirmed that these accurately reflect the proposed plant, as the project design progresses (and prior to any finalisation of the scheme).***

(b) Noise egress from key existing façade elements, including the masonry wall, cladding and roller shutters has been modelled as separated horizontal or vertical area sources in each case. Noise egress from the personnel doors and rooflights has not been specifically modelled, as the surface area of these are small in comparison (and the assumed acoustic performance is similar to the acoustic performance afforded by the building cladding). Table 3 provides an acoustic specification for the key elements of the external façade to all buildings. *This stated minimum building element acoustic performance is required in all cases, and this forms part of the required Noise Management Plan appertaining to the Facility.* The location and construction details of other building elements, such as building roller shutters, personnel doors and building ventilation louvres have been determined based upon Google Maps imagery:

Building Element	**Location**	**Construction**	**Sound Reduction Index (SRI, dB) @ Octave Band Centre Frequency (Hz)**							**dB R_w**
			63	**125**	**250**	**500**	**1k**	**2k**	**4k**	
Masonry wall	Walls up to 3m	Brick	36	39	35	40	47	53	58	45
Cladding	Roof and façade above 3m	Kingspan KS1000RW	15	16	19	23	26	22	39	25
Rooflights	Roof	Kingspan KS1000 DLTR	13	9	12	17	22	24	19	21
Roller shutter	Façade	Ascot Doors Roller Shutter	14	14	17	18	15	19	19	18
Personnel doors	Façade	Booths 29H 45mm Metal Door	18	24	25	28	30	29	34	30
Ventilation louvres	Façade	Allaway Acoustics AL3015 single banked acoustic louvre or similar *(note c.30% free area)*	5	6	8	11	18	25	20	17

Table 3: Minimum required acoustic performance of external building fabric elements

(c) The noise contribution from the identified plant proposed to be installed within the buildings has been predicted from the derived sound power level of each identified noise source (refer to Appendix E). This data has been used to determine the resultant reverberant sound pressure level within the building. Specifically, a reverberation time of 2 seconds has been assumed within all buildings.

Figure 3 provides a three-dimensional visualisation of the noise model used to inform the noise impact assessment.

Appendix D provides further information in respect of the 3D computer environmental noise model. Appendix E provides an inventory of plant and process source noise level data; these form the basis of the 3D noise model underpinning the report. These should not be exceeded.

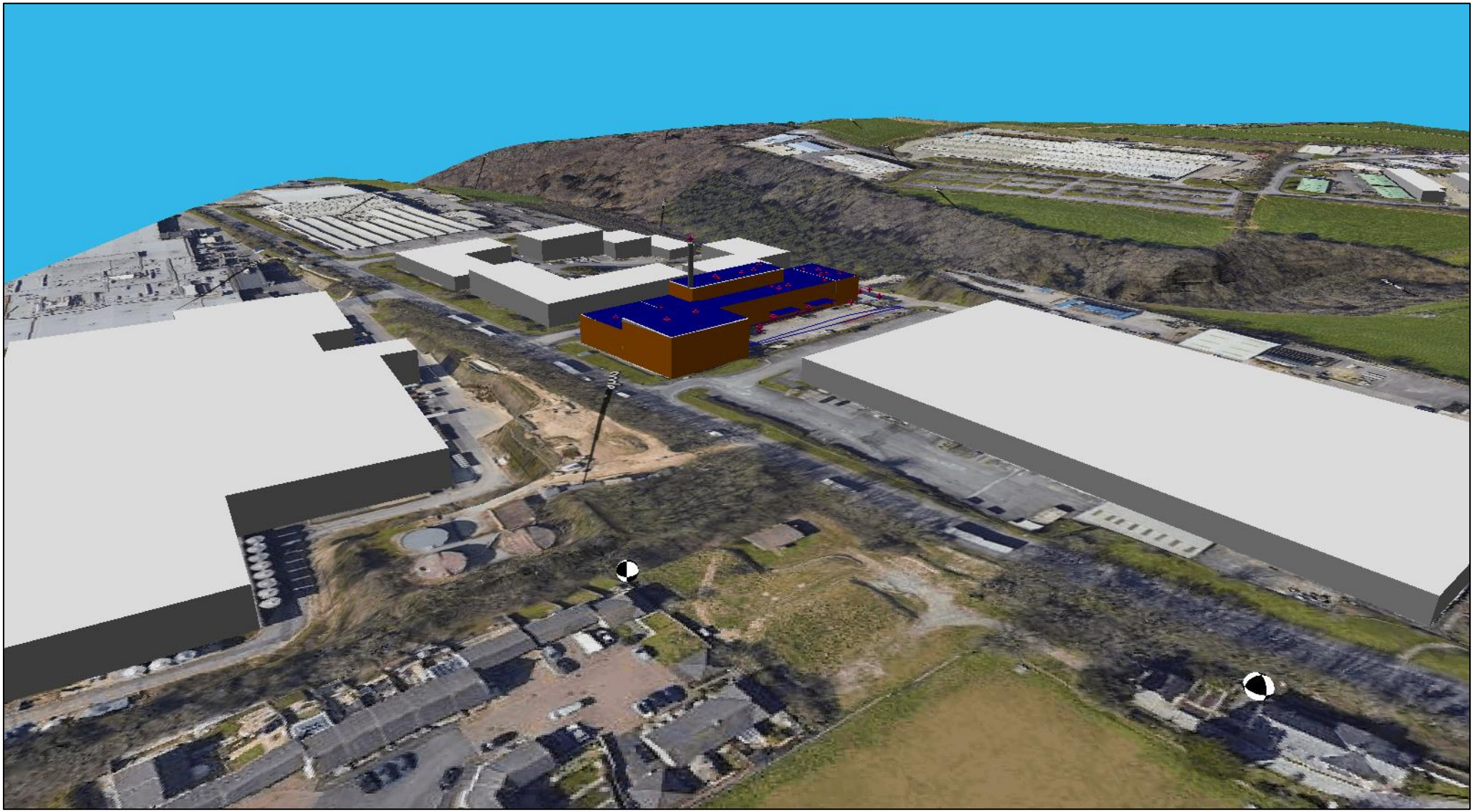


Figure 3: 3D view of the Sol noise model of the Facility (Google 2023)

8 ENVIRONMENTAL NOISE IMPACT ASSESSMENT

8.1 BS 4142: 2014+A1: 2019 Assessment

Table 4 presents the predicted overall A-weighted, BS 4142: 2014+A1: 2019-defined Rating Level at the identified NSRs.

Appendix D provides full details of CadnaA noise maps which present the daytime and night-time Specific Sound Levels expected.

It shall be noted from the at-receptor partial noise level tables as presented within Appendix D that the noise contributions from all individual noise sources are each below the existing typical Background Sound Level, at each receptor. As a result, any acoustic character associated with individual noise sources is not expected to be clearly discernible at any NSR, for either daytime or night periods.

On this basis (and in accordance with the specific guidance as presented within BS 4142: 2014+A1: 2019), a conservative correction of +3dB has been applied to the calculated Specific Sound Level, per NSR, as arising at the noise sensitive receptors from the Facility. This is in order to allow for any residual "readily distinctive" acoustic features, in order to determine the BS 4142: 2014+A1: 2019 defined Rating Level for acoustic assessment purposes:

Noise Sensitive Receptor	Assessment Period	Predicted Specific Level, dB $L_{Aeq,T}$	Acoustic Character Correction, dB	Predicted Rating Level, dB $L_{Ar,Tr}$	Typical Background Sound Level, dB L_{A90}	Rating Level sub. Background ±dB
A. Haxter Wood Chase (c.480 metres to the north)	Daytime (07:00hrs – 23:00hrs) *T* = 1 hour	33	+3	36	36	+0
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	33	+3	36	36	+0
B. Tamerton Road (c.180 metres to the north east)	Daytime (07:00hrs – 23:00hrs) T = 1 hour	38	+3	41	41	+0
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	38	+3	41	39	+2
C. Lady Fern Road (c.120 metres to the east)	Daytime (07:00hrs – 23:00hrs) T = 1 hour	41	+3	44	41	+3
	Night Time (23:00hrs – 07:00hrs) T = 15 minutes	40	+3	43	39	+4

Table 4: BS 4142: 2014+A1: 2019 summary assessment (per NSR, for both daytime and night time periods)

The total, aggregate environmental noise impact as arising at any NSR from the proposed operation of the Facility does not exceed the typical Background Sound Level by more than +4dB at any identified noise sensitive receptor. This is just below the threshold for an indication of an '*… adverse impact, depending on the context*…' in BS 4142: 2014+A1: 2019 terms (and is thus "sub-adverse"). In this case, the context in which the sound occurs is not expected to affect the outcome of the assessment.

8.2 Preliminary Noise Management Plan (NMP)

Appendix E provides a preliminary Noise Management Plan, ergo an itemised list of mandatory, required noise source mitigation measures, which in part form the basis of Sol's acoustic calculations and 3D acoustic modelling.

However, the finalised, actual noise mitigation strategy to be implemented must be reviewed, further developed, refined, and approved by Sol (as the detailed design of the Facility further progresses, and prior to any finalisation of the Facility or the commencement of plant and materials procurement etc.) . The provisional, outline noise mitigation measures that are assumed to be in place (and are specifically required by this acoustic assessment report) are as summarised below.

Please note that the noise impact from any plant which not listed in Appendix E must be duly assessed. (Sol is to be advised by the Client if this list is not fully exhaustive and inclusive, please). The actual/anticipated noise level emissions as expected from the plant must be confirmed and reviewed by Sol once wholly available in full detail. The acoustic assessment and Noise Management Plan herein presented must be reviewed and updated by Sol once this information becomes fully available.

8.2.1 Site Buildings

(a) **Roller shutter and personnel doors**: Roller shutters and personnel doors must always be kept closed at all times when not in use. The momentary, brief opening of doors shall be for vehicle/personnel ingress/egress only (and not for any other purpose, e.g. heat dissipation, ventilation). Induction loop automatic open/close operation is recommended in the case of large vehicular access (roller shutter) doors.

(b) **External Building Fabric**: The construction of the external building fabric to the Reception Hall, Process Hall and ORC Hall must achieve the minimum as-built sound insulation performance as set out in Table 5:

Building Element	Location	Construction	Sound Reduction Index (SRI, dB) @ Octave Band Centre Frequency (Hz)							dB R_w
			63	125	250	500	1k	2k	4k	
Masonry wall	Walls up to 3m	Brick	36	39	35	40	47	53	58	45
Cladding	Roof and façade above 3m	Kingspan KS1000RW	15	16	19	23	26	22	39	25
Rooflights	Roof	Kingspan KS1000 DLTR	13	9	12	17	22	24	19	21
Roller shutter	Façade	Ascot Doors Roller Shutter	14	14	17	18	15	19	19	18
Personnel doors	Façade	Booths 29H 45mm Metal Door	18	24	25	28	30	29	34	30
Ventilation louvres	Façade	Allaway Acoustics AL3015 single banked acoustic louvre or similar *(note c.30% free area)*	5	6	8	11	18	25	20	17

Table 5: Minimum required sound insulation performance to be achieved by external building fabric

(NB: the requirement for acoustic louvres, including louvred doors where applicable, should be particularly noted. The specified acoustic louvres have a depth of 300mm and a free area of c.30%. Others must advise whether this will provide the minimum required ventilation to the building. Further details of the proposed ventilation louvres are provided in Appendix F).

(c) **Internal reverberant sound pressure levels**: Table 6 sets out the predicted maximum permissible reverberant sound pressure levels (i.e. maximum allowable noise levels) to be achieved within the Reception Hall, Process Hall and ORC Hall, as based upon the list of anticipated internal noise sources and the assumed noise level emissions (as listed in Appendix E):

Location	Period	Maximum Permissible Reverberant Sound Pressure Level (dB $L_{eq,T}$) @ Octave Band Centre Frequency (Hz)								dB $L_{Aeq,T}$
		63	125	250	500	1k	2k	4k	8k	
Reception Hall	Daytime (07:00hrs – 23:00hrs)	87	91	84	78	78	75	70	69	83
	Night Time * (23:00hrs – 07:00hrs)	57	72	72	69	69	67	64	62	74
Process Hall	Anytime	86	86	80	79	80	78	76	69	85
ORC Hall	Anytime	78	80	81	82	83	83	84	82	90
** No mobile plant operations permitted between (23:00hrs – 07:00hrs)*										

Table 6: Maximum permissible reverberant sound pressure levels within buildings

8.2.2 Reception Hall

(d) **Loading Shovels (1 no.)**: The loading shovel within the Reception Hall is only permitted to operate during the daytime period: 07:00 – 23:00 hours.

(e) **Deliveries**: Deliveries to and from the site must only take place between the hours of 07:00 to 23:00 hours, unless otherwise additionally restricted by any Planning or Permit Condition.

8.2.3 Process Hall

(f) **Over fire air ("OFA") fan casing and motor (2 no.)**: An acoustic enclosure is required to both of the OFA fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (for reasons of plant resilience, the ability of the enclosed OFA fan to continue to be adequately cooled and ventilated via the operation of the standby fan, in the event of the failure of the duty auxiliary ventilation fan).

(g) **OFA intake (2 no.)**: Noise from OFA fan air intake grilles must not exceed 80dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.

(h) **Under fire air ("UFA") fan casing and motor (2 no.)**: An acoustic enclosure is required to both of the UFA fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (plant resilience as per OFA fan enclosure vent system).

(i) **UFA intake (2 no.)**: Noise from UFA fan air intake grilles must not exceed 80dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.

(j) **ID fan casing and motor (2 no.)**: An acoustic enclosure is required to both of the ID fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (plant resilience as per OFA fan enclosure vent system).

(k) **Diesel generator (1 no.)**: The diesel generator to be mounted within the Process Hall and fitted with an acoustic enclosure (complete with exhaust gas silencer – separate item). Noise from the casing of the generator enclosure must not exceed sound pressure level of 75dB $L_{Aeq,T}$ at one metre from any surface.

(l) **Sootblowing (var.)**: All sootblowers plant and activities to occur during the daytime period (i.e. between 07:00 - 23:00 hours) only.

8.2.4 External

(m) **ID fan stack outlet (1 no.)**: Noise from the ID fan stack outlet must not exceed a sound pressure level of 75dB $L_{Aeq,T}$ at one metre from stack outlet edge (and 90º off longitudinal axis of the stack) at any design speed/mode. Make provisions for duct attenuator(s) to be fitted to the discharge side of both ID fans (including an allowance for the ensuing attenuator static pressure loss can be accommodated at maximum required gas flowrates).

(n) **ID fan inlet (2 no.)**: An attenuator is required to be fitted to the inlet of the ID fan intake to provide a minimum of c.12dB dynamic insertion loss performance at 125Hz octave centre frequency band in order to reduce noise levels emissions from the externally sited ductwork and baghouse plant.

(o) **Gas relief outlet (TBC)**: A silencer must be fitted to the outlet of any required gas blowoff (and also any pressure relief valve exhausting to atmosphere), in order to achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre from each outlet (90º off longitudinal axis), for all possible modes of operation, including worst case.

(p) **Heating ventilation and air condition ("HVAC") fan outlet (c.4 no.)**: Noise from the roof mounted HVAC fans must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuators are likely to be required.

(q) **Roof extract fan outlet (c.10 no.)**: Noise from each roof mounted extract fans must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuators are likely to be required.

(r) **Dry air coolers ("DAC") (5 no.)**: Noise from the DAC must not exceed 75dB $L_{Aeq,T}$ at one metre distance. It is likely that a bespoke acoustic package shall be required to be fitted to each DAC.

(s) **ORC bypass (1 no.)**: A silencer must be fitted to the outlet of any required ORC bypass, in order to achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre from each outlet (90º off longitudinal axis), for all possible modes of operation, including worst case.

(t) **Powdered activated carbon ("PAC") blower (1 no.)**: Make provisions for acoustic enclosures to be fitted to the material blowers ensure that the noise levels produced do not exceed 75dB $L_{Aeq,T}$ at one metre from any surface in each case. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).

(u) **Ash blowers (2 no.)**: Make provisions for acoustic enclosures to be fitted to the material blowers ensure that the noise levels produced do not exceed 75dB $L_{Aeq,T}$ at one metre from any surface in each case. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).

(v) **Baghouse (2 no.)**: Both baghouses are to be externally acoustically lagged to achieve to each achieve a maximum allowable sound pressure level of 60dB $L_{Aeq,T}$ at one metre measuring distance from any surface.

(w) **Baghouse "penthouse" upper plantroom fans (4 no.)**: Noise from the baghouse penthouse fans must not exceed of 75dB $L_{Aeq,T}$ at one metre measuring distance when operating at maximum design duty.

(x) **Pneumatic blow-offs (var.)**: All pneumatic blow-offs and solenoids *et al*, such as those associated with the baghouse plant must be fitted with high performance "Silvent" pneumatic silencers or similar:

http://www.silvent.com/en-uk/products/?group=1702-air-nozzles

(y) **External conveying system (1 no.)**: Noise from the externally sited conveyor must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load).

(z) **Air compressor outlet (1 no.)**: Noise from the externally sited air compressor outlets must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load).

(aa) **External ductwork (1 no.)**: External ductwork is to be externally acoustically lagged to achieve to each achieve a maximum allowable sound pressure level of 60dB $L_{Aeq,T}$ at one metre measuring distance from any surface.

(bb) **Diesel generator exhaust outlet (1 no.)**: The diesel generator exhaust must be ducted to the roof/façade of the Process Hall. Noise from the exhaust must not exceed 75dB $L_{Aeq,T}$ at one metre from the exhaust outlet (90º off longitudinal axis of the exhaust outlet) at any design speed/mode including when fully on load. Make provisions for an exhaust gas silencer to be fitted to the discharge side of the generator exhaust.

(cc) **Mobile plant**: All HGVs, loading shovels and forklift trucks etc. under the direct control of the Operator must only use non-intrusive broadband noise type vehicle reversing alarms and/or reversing cameras. There must be no use of pulsed and/or tonal reversing alarms (e.g. reversing bleepers).

8.3 Uncertainty

Section 10 of BS 4142: 2014+A1: 2019 states the following with regards to uncertainty:

> '… *Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty*…'

In accordance with the requirements of BS 4142: 2014+A1: 2019, Sol has undertaken the following steps to limit the level of uncertainty in the acoustic assessment:

1. All noise measurements have been carried out using Type 1 Precision Grade noise mounting equipment. All noise measuring instruments have traceable laboratory calibration certification.

2. All noise measurements were accompanied by continuous meteorological measurements as conducted at, or close to, the measurement position in order to ensure that the measurement data was not adversely affected by unfavourable weather conditions.

3. Calculations have been conducted in line with appropriate and nationally recognised acoustic standards (ISO 9613-2, BS12354: 2000), and using proprietary 3D noise modelling software, CadnaA.

4. The assessment assumes downwind propagation in all cases as this represents the worst case.

5. At the time of reporting (August 2023), no plant-specific noise data has been provided to Sol for any of the proposed plant. In the absence of noise data provided by the Client, Sol has provided a specification for the various plant to achieve based upon noise measurements as based on its detailed noise source database of very similar plant as assessed by Sol at similar Facilities. It will need to be subsequently confirmed that the various acoustic specifications as presented in both Section 8.2 and Appendix E can be satisfactorily achieved in all instances, as the detailed design process of the Facility progresses.

9 CONCLUSION

Sol has been appointed to provide an environmental noise impact assessment for the proposed EfW site that is to be located off Haxter Close in Plymouth, PL6 7BP.

The pre-existing environmental noise climate has been determined by direct measurement at the existing noise sensitive receptors (NSRs). Using this benchmark environmental noise measurement data, it has been possible to set appropriate environmental noise limits for the proposed Facility, all as based on applicable BS 4142:2014+A1: 2019 guidance.

It is the conclusion of this environmental noise impact assessment that the total, aggregate environmental noise impact arising from the proposed operation of the plant in its entirety, in full compliance with the Noise Management Plan and its associated plant noise specification as presented herein, is just below the threshold for a British Standard BS 4142: 2014+A1: 2019 defined "adverse" noise level impact at the worst affected noise sensitive receptor (i.e. is "sub-adverse").

APPENDIX A
GLOSSARY OF ACOUSTIC TERMS

Term	Abbreviation	Description
Decibel	dB	A scale for comparing the ratios of two quantities, including sound pressure and sound power.
A-weighting	dB(A)	The unit of sound level, weighted according to the A-scale, which considers the change in sensitivity of the human ear at varying frequencies.
Sound Pressure Level	L_{pA}	A measure of the sound pressure at a particular location. Typically expressed in dB(A) referenced to $2x10^{-5}$ Pascals.
Equivalent Continuous Sound Level	$L_{Aeq,T}$	The steady level of sound over a prescribed period of time which would contain the same total sound energy as the actual fluctuating noise under consideration in the same period of time.
Statistical Sound Levels	L_{A10} and L_{A90}	The level of noise exceeded for a percentage of the time period being sampled, namely 10% or 90% respectively.
Background Sound Level	$L_{A90,T}$	The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of the time period being sampled.
Maximum Sound Level	L_{Amax}	The maximum sound or noise level determined with instrumentation set to either a fast time weighting, L_{AFmax}, or a slow time weighting, L_{Asmax}, as occurring during the time period being sampled.
Sound Power Level	L_{wA}	A measure of the total sound energy radiated from a source. Like sound pressure levels, this is also expressed in dB(A) terms, but it is referenced to 1×10^{-12} W.
Broadband		Sound sampled over a wide range of frequencies.
Narrow band		Sound sampled over a specific, restricted frequency range. Used to ascertain the amplitude and significant of individual, audible tones, and to assist in identifying particular sources of noise within a complex, multi-source soundscape environment.
Ambient Sound	$L_{eq,T}$	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far.
Specific Sound Level	$L_{eq,T}$	The Equivalent Continuous A-Weighted Sound Level at an assessment position produced by a specific sound over a given reference time interval, *Tr*
Rating Level	$L_{Ar,Tr}$	The Specific Sound Level plus any adjustment for the acoustic characteristic features of the noise (e.g. intermittency, tones etc.).
Residual Noise	$L_{Aeq,T}$	The ambient sound remaining at given position in a given situation, when the specific sound source is suppressed to such an extent that it no longer contributes to the ambient sound.
Sound Reduction Index	*SRI*	The reduction in sound energy when transmitted through a panel or similar planar element, typically used in relation to single octave or one-third octave frequency band values.
Weighted Sound Reduction Index	R_w	The Sound Reduction Index expressed as a single figure, as expressed against a reference curve.
Dynamic Insertion Loss	*DIL*	Reduction in acoustic energy resulting from the insertion of a noise control element (e.g. an attenuator, acoustic enclosure etc.).
Free Field		Noise measuring location that is free from the presence of sound reflecting objects (except the ground), usually taken to mean being at least 3.5 metres distance from reflective surface(s) or greater.

APPENDIX B

NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Roborough, Plymouth, PL6 7BP.

DATES, TIMES, AND WEATHER CONDITIONS

Date	Daytime (07:00 hours – 23:00 Hours)				Night Time (23:00 hours – 07:00 hours)			
	Temp, °C	Rain, mm/h	Wind Direction	Mean Wind Speed, ms^{-1}	Temp, °C	Rain, mm/h	Wind Direction	Mean Wind Speed, ms^{-1}
07/09/2023	24	0.0	N	0.4	18	0.0	W	0.2
08/09/2023	22	0.0	SW	0.3	20	0.2	W	0.2
09/09/2023	23	0.0	N	0.2	19	0.1	N	0.5
10/09/2023	21	0.0	N	0.5	18	0.0	SE	0.4
11/09/2023	18	0.4	SE	0.5	-	-	-	-

PERSONNEL

Chris Downing MMath – Sol Acoustics

INSTRUMENTATION

Measurement Position 1

01dB Cube Sound level meter (serial no. 11117)

01dB Pre22 Microphone preamplifier (serial no. 1610404)

GRAS 40CD Microphone capsule (serial no. 260827)

01dB Cal21 acoustic calibrator (serial no. 34375244)

Measurement Position 2

01dB Cube Sound level meter (serial no. 12069)

01dB Pre22 Microphone preamplifier (serial no. 1936019)

GRAS 40CD Microphone capsule (serial no. 330553)

01dB Cal21 acoustic calibrator (serial no. 34375244)

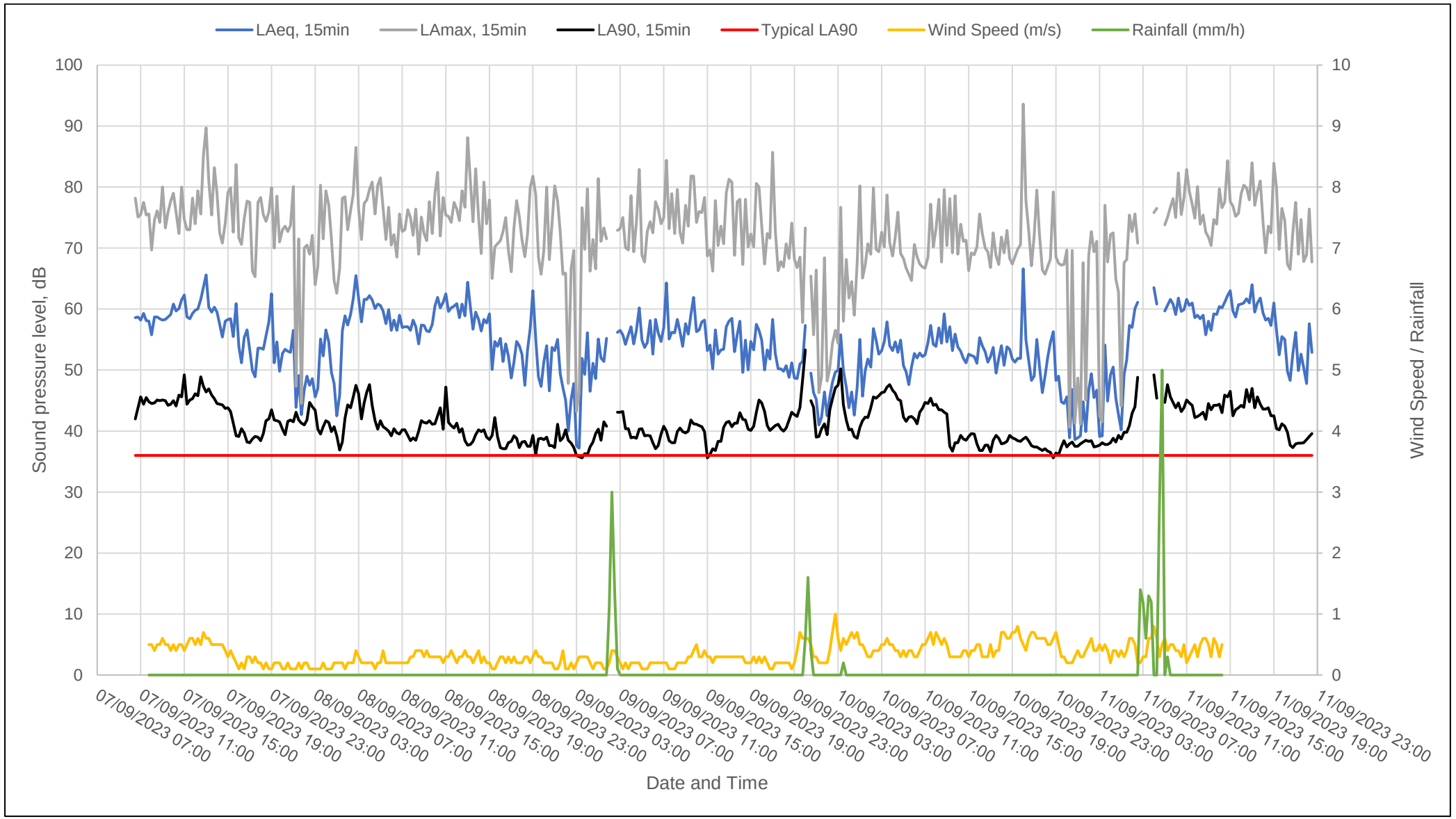
Vaisala WXT520 Weather Station

METHODOLOGY

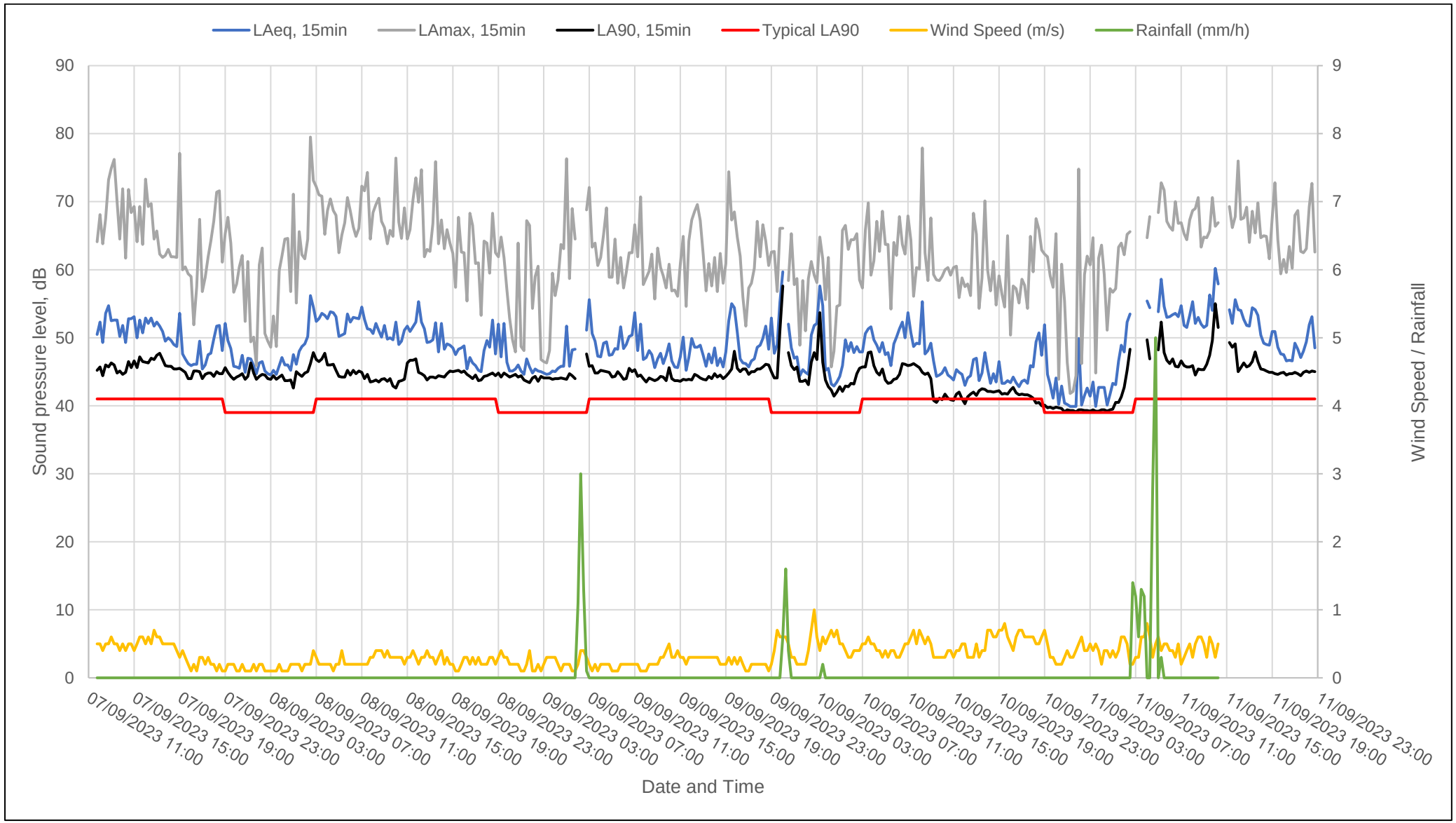
Before and after the measurements the noise monitoring equipment was calibrated to an accuracy of ±0.1dB using the Cal 21 Calibrator. The calibrator produces a sound pressure level of 94dB re 2 x 10^{-5} Pa @ 1kHz.

MEASUREMENT RESULTS

Graphs B1 and B2 summarises the broadband A-weighted results obtained at Measurement Positions 1 and 2, respectively.



Graph B1: A-weighted environmental noise levels at Noise Monitoring Position 1, 7 September to 11 September 2023



Graph B2: A-weighted environmental noise levels at Noise Monitoring Position 2, 7 September to 11 September 2023

APPENDIX C

SITE PLAN INDICATING THE LOCATION OF THE NOISE SOURCES

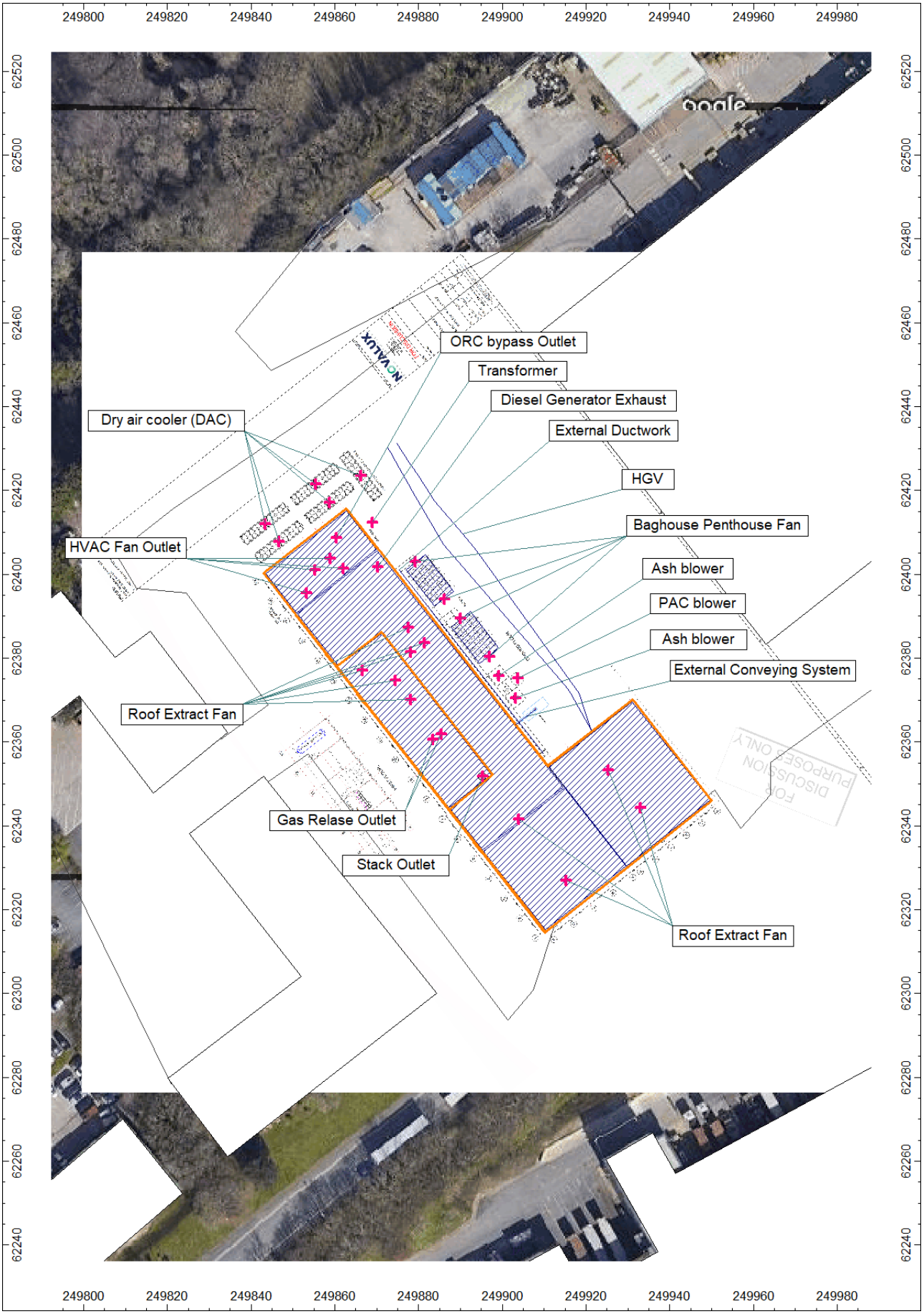


Figure C1: Site plan indicating grid coordinate references x, y coordinates for all external modelled noise sources

APPENDIX D

ENVIRONMENTAL NOISE MODELLING RESULTS

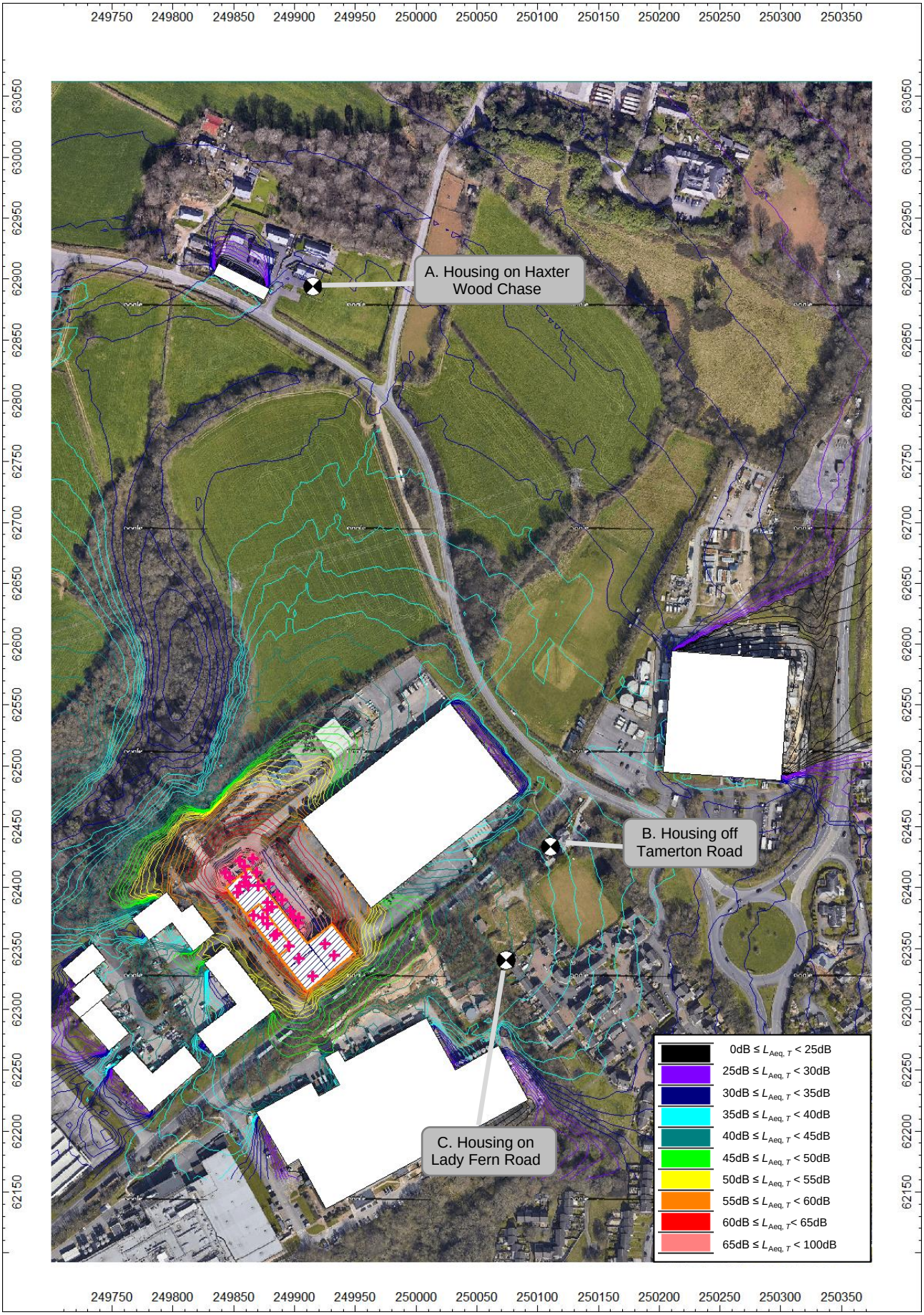


Figure D1: Predicted daytime Specific Sound Level, $L_{Aeq,1hour}$, from the installation, at 4 metres grid height (Google 2023)

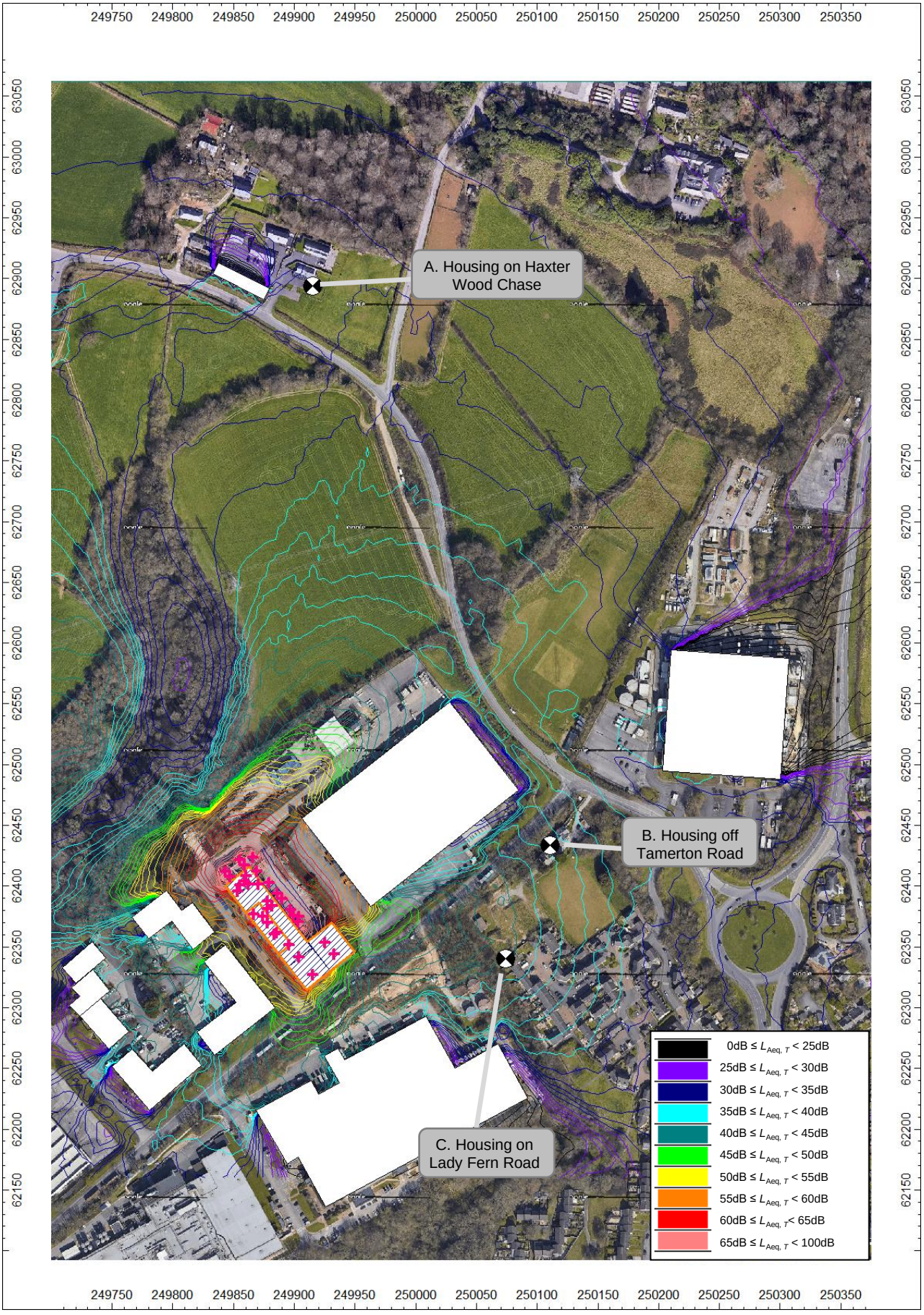


Figure D2: Predicted night time Specific Sound Level, $L_{Aeq,1hour}$, from the installation, at 4 metres grid height (Google 2023)

A. Haxter Wood Chase Predicted Specific Sound Levels Daytime (07:00 – 23:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
Dry air cooler (DAC)	24.0
Dry air cooler (DAC)	22.9
External conveying system	22.7
Dry air cooler (DAC)	21.7
Dry air cooler (DAC)	21.5
Dry air cooler (DAC)	21.1
Ash blower	18.1
PAC blower	17.8
Ash blower	17.7
Reception Hall - cladding - day	17.4
HGV	17.0
Process Hall - roof	16.5
Reception Hall - roof - day	15.9
Process Hall - cladding	15.5
ORC Hall - cladding	15.4
Process Hall - cladding (upper)	15.0
Roof extract Fan	14.9
Roof extract fan	14.8
Stack outlet	14.7
Diesel generator exhaust	13.2
Baghouse	13.1
Baghouse	12.8
Baghouse penthouse fan	12.7
Baghouse penthouse fan	12.6
Baghouse penthouse fan	12.5
Baghouse penthouse fan	12.4
Transformer	12.2
Roof extract fan	12.1
Roof extract fan	12.1
Roof extract fan	12.0
Roof extract fan	12.0
Roof extract fan	12.0
Process Hall - roof	12.0
Reception Hall - roof - day	11.1
HVAC fan outlet	10.8
…	…
Total	**33.1**

Table D1: A. Haxter Wood Chase Specific Sound Levels, daytime

A. Haxter Wood Chase Predicted Specific Sound Levels Night time (23:00 – 07:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
Dry air cooler (DAC)	24.0
Dry air cooler (DAC)	22.9
External conveying system	22.7
Dry air cooler (DAC)	21.7
Dry air cooler (DAC)	21.5
Dry air cooler (DAC)	21.1
Ash blower	18.1
PAC blower	17.8
Ash blower	17.7
Process Hall - roof	16.5
Process Hall - cladding	15.5
Orc Hall - cladding	15.4
Process Hall - Cladding (upper)	15.0
Roof extract fan	14.9
Roof extract fan	14.8
Stack outlet	14.7
Diesel generator exhaust	13.2
Baghouse	13.1
Baghouse	12.8
Baghouse penthouse fan	12.7
Baghouse penthouse fan	12.6
Baghouse penthouse fan	12.5
Baghouse penthouse fan	12.4
Transformer	12.2
Roof extract fan	12.1
Roof extract fan	12.1
Roof extract fan	12.0
Roof extract fan	12.0
Roof extract fan	12.0
Process Hall - roof	12.0
HVAC fan outlet	10.8
HVAC fan outlet	10.7
HVAC fan outlet	10.7
HVAC fan outlet	10.5
Orc Hall - roof	10.4
…	…
Total	**32.7**

Table D2: A. Haxter Wood Chase Specific Sound Levels, night time

B. Tamerton Road Predicted Specific Sound Levels Daytime (07:00 – 23:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
External conveying system	31.8
Reception Hall - cladding - day	29.0
Dry air cooler (DAC)	26.5
Dry air cooler (DAC)	23.9
Stack outlet	23.7
Dry air cooler (DAC)	23.7
Reception Hall - roof - day	23.3
Process Hall - roof	23.3
Ash blower	23.0
PAC blower	22.0
Process Hall - cladding	21.7
Ash blower	21.5
Process Hall - cladding	21.5
Roof extract fan	20.8
Roof extract fan	20.8
Roof extract fan	20.7
HGV	20.5
Process Hall - Cladding (upper)	20.4
Roof extract fan	20.2
Roof extract fan	20.0
Gas release outlet	19.2
Baghouse	19.2
Roof extract fan	18.7
Roof extract fan	18.6
Gas release outlet	18.6
Diesel generator exhaust	18.6
Process Hall - roof	18.5
HVAC fan outlet	18.2
Orc Hall - roof	18.2
Baghouse	18.2
HVAC fan outlet	18.1
HVAC fan outlet	18.0
Baghouse penthouse fan	18.0
HVAC fan outlet	17.9
Roof extract fan	17.9
…	…
Total	**38.4**

Table D3: B. Tamerton Road Specific Sound Levels, daytime

B. Tamerton Road Predicted Specific Sound Levels Night time (23:00 – 07:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
External conveying system	31.8
Dry air cooler (DAC)	26.5
Dry air cooler (DAC)	23.9
Stack outlet	23.7
Dry air cooler (DAC)	23.7
Process Hall - roof	23.3
Ash blower	23
PAC blower	22
Process Hall - cladding	21.7
Ash blower	21.5
Process Hall - cladding	21.5
Roof extract fan	20.8
Roof extract fan	20.8
Roof extract fan	20.7
Process Hall - Cladding (upper)	20.4
Roof extract fan	20.2
Roof extract fan	20
Gas release outlet	19.2
Baghouse	19.2
Roof extract fan	18.7
Roof extract fan	18.6
Gas release outlet	18.6
Diesel generator exhaust	18.6
Process Hall - roof	18.5
HVAC fan outlet	18.2
Orc Hall - roof	18.2
Baghouse	18.2
HVAC fan outlet	18.1
HVAC fan outlet	18
Baghouse penthouse fan	18
HVAC fan outlet	17.9
Roof extract fan	17.9
Reception Hall - cladding - night	17.8
Baghouse penthouse fan	17.7
ORC bypass outlet	17.6
…	…
Total	**37.7**

Table D4: B. Tamerton Road Specific Sound Levels, night time

C. Lady Fern Road Predicted Specific Sound Levels Daytime (07:00 – 23:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
Dry air cooler (DAC)	32.3
Reception Hall - cladding - day	31.8
Dry air cooler (DAC)	30.0
Dry air cooler (DAC)	28.9
Baghouse	26.8
Reception Hall - roof - day	26.2
Stack outlet	25.4
Baghouse	25.4
Process Hall - cladding	25.2
HGV	25.1
Ash blower	25.0
PAC blower	24.8
Process Hall - cladding	24.5
Diesel generator exhaust	23.5
Roof extract fan	23.3
Roof extract fan	23.2
Roof extract fan	22.7
Orc hall - cladding	22.5
Baghouse penthouse fan	22.2
Baghouse penthouse fan	22.2
Process Hall - roof	22.2
Roof extract fan	22.0
Roof extract fan	21.9
Baghouse penthouse fan	21.9
Roof extract fan	21.8
Reception Hall - roof - day	21.5
Ash blower	20.9
HVAC fan outlet	20.8
HVAC fan outlet	20.6
HVAC fan outlet	20.5
HVAC fan outlet	20.5
ORC bypass Outlet	20.5
Process Hall - roof	20.5
Gas release outlet	20.4
Gas release outlet	20.3
…	…
Total	**41.0**

Table D5: C. Lady Fern Road
Specific Sound Levels, daytime

C. Lady Fern Road Predicted Specific Sound Levels Night time (23:00 – 07:00 Hours)	
Source Description	**Specific Sound Level, dB $L_{Aeq,T}$**
Dry air cooler (DAC)	32.3
Dry air cooler (DAC)	30.0
Dry air cooler (DAC)	28.9
Baghouse	26.8
Stack outlet	25.4
Baghouse	25.4
Process Hall - cladding	25.2
Ash blower	25.0
PAC blower	24.8
Process Hall - cladding	24.5
Diesel generator exhaust	23.5
Roof extract fan	23.3
Roof extract fan	23.2
Roof extract fan	22.7
Orc Hall - cladding	22.5
Baghouse penthouse fan	22.2
Baghouse penthouse fan	22.2
Process Hall - roof	22.2
Roof extract fan	22.0
Roof extract fan	21.9
Baghouse penthouse fan	21.9
Roof extract fan	21.8
Ash blower	20.9
HVAC fan outlet	20.8
Reception Hall - cladding - night	20.7
HVAC Fan Outlet	20.6
HVAC Fan Outlet	20.5
HVAC Fan Outlet	20.5
ORC bypass Outlet	20.5
Process Hall - roof	20.5
Gas release outlet	20.4
Gas release outlet	20.3
Transformer	20.3
Orc Hall - roof	20.2
Baghouse penthouse fan	20.1
…	…
Total	**40.2**

Table D6: C. Lady Fern Road
Specific Sound Levels, night time

APPENDIX E

NOISE SOURCE SCHEDULE

Equipment Name	Location	Data type	Data Source / Specification	Number of Sources	Average Sound Pressure Level, dB, at Octave Band Centre Frequency Hz									Average Sound Pressure Level on Measurement Surface, L_{pA}	Measurement Distance, m	Measurement Surface area at Measurement Position, m^2	Overall Sound Power Level, dB L_{wA}	Utilisation		Source: Area (A) Line (L) Point (P) or internal (I)	Comment	Outline Noise Mitigation Design
					32	63	125	250	500	1k	2k	4k	8k					Daytime (07:00 - 23:00)	Night Time (23:00 - 07:00)			
Duty																						
Internal																						
Reception Hall																						
Mobile telehandler / loading shovel	Reception Hall	Sound pressure level at 10m distance	Noise spectrum taken from BS5228 Table C.10 reference 5 ("Wheeled loader": 232kW 39t)	1		84	88	81	74	74	71	66	65	80	10	628	108	100%	0%	I		Daytime (07:00 – 23:00 hours) operation only
Push floor / moving grate	Reception Hall	Sound pressure level at 1m distance	Low noise, not deemed significant	4	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	100%	I		
Push floor power pack	Reception Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	4	58	58	73	73	70	70	68	65	63	75	1	64	93	100%	100%	I		
Process Hall																						
OFA fan	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	73	76	82	72	70	69	66	67	62	75	1	133	96	100%	100%	I		An acoustic enclosure is required to both of the OFA fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).
OFA fan intake	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	81	78	92	80	77	72	63	54	45	80	1	1	80	100%	100%	I		Noise from OFA fan air intake grilles must not exceed 80dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.
UFA fan	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	73	76	82	72	70	69	66	67	62	75	1	133	96	100%	100%	I		An acoustic enclosure is required to both of the OFA fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).
UFA fan intake	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	81	78	92	80	77	72	63	54	45	80	1	1	80	100%	100%	I		Noise from UFA fan air intake grilles must not exceed 80dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.
Boiler	Process Hall	Sound pressure level at 1m distance	No data provided. Assumed unattenuated sound pressure level of 75dB(A) at 1m	1	77	76	72	68	73	69	68	65	59	75	1	217	98	100%	100%	I		
Gasifier	Process Hall	Sound pressure level at 1m distance	No data provided. Assumed unattenuated sound pressure level of 75dB(A) at 1m	1	77	76	72	68	73	69	68	65	59	75	1	217	98	100%	100%	I		
Boiler feed water pumps	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	4 (2 standby)	68	73	74	77	79	78	80	73	71	84	1	21	97	100%	100%	I		
ID fan casing and motor	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	68	68	67	61	64	76	74	72	60	80	1	133	101	100%	100%	I		An acoustic enclosure is required to both of the ID fans (including scroll casing and fan motor), to each achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre measuring distance from any surface. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).

Equipment Name	Location	Data type	Data Source / Specification	Number of Sources	Average Sound Pressure Level, dB, at Octave Band Centre Frequency Hz									Average Sound Pressure Level on Measurement Surface, L_{pA}	Measurement Distance, m	Measurement Surface area at Measurement Position, m^2	Overall Sound Power Level, dB L_{wA}	Utilisation		Source: Area (A) Line (L) Point (P) or internal (I)	Comment	Outline Noise Mitigation Design
					32	63	125	250	500	1k	2k	4k	8k					Daytime (07:00 - 23:00)	Night Time (23:00 - 07:00)			
Internal conveying system	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2		79	78	77	73	76	73	67	50	80	1	107	100	100%	100%	I		
Internal ductwork	Process Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	4	84	82	75	72	68	67	70	67	61	75	1	126	96	100%	100%	I		
Diesel generator	Process Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	1	82	79	84	78	72	69	63	57	51	75	1	71	94	100%	100%	I	OTNOC operation only	The diesel generator to be mounted within the Process Hall and fitted with an acoustic enclosure (complete with exhaust gas silencer – separate item). Noise from the casing of the generator enclosure must not exceed sound pressure level of 75dB $L_{Aeq,T}$ at one metre from any surface.
ORC Hall																						
ORC	ORC Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1	71	73	75	76	77	78	78	79	77	85	1	169	107	100%	100%	I		
Gland condenser fan	ORC Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1	59	62	71	77	82	79	79	78	69	86	1	21	99	100%	100%	I		
External																						
ID fan stack outlet	Process Building Roof	Sound pressure level at 1m distance	Client advised sound pressure level of 85dB(A). Typical octave band noise spectrum (post silencer) assumed.	1	93	94	87	73	66	63	62	64	59	75	1	6	83	100%	100%	P		Noise from the ID fan stack outlet must not exceed a sound pressure level of 75dB $L_{Aeq,T}$ at one metre from stack outlet edge (and 90º off longitudinal axis of the stack) at any design speed/mode. Make provisions for duct attenuator(s) to be fitted to the discharge side of both ID fans (including an allowance for the ensuing attenuator static pressure loss can be accommodated at maximum required gas flowrates).
Gas relief outlet	Process Building Roof	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	4	74	73	81	74	71	66	70	64	57	75	1	6	83	100%	100%	P	Bypass operation	A silencer must be fitted to the outlet of any required each gas blowoff, in order to achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre from each outlet (90º off longitudinal axis), for all possible modes of operation, including worst case.
HVAC fan outlet	ORC Hall Roof	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	4	78	87	80	73	70	68	69	64	60	75	1	6	83	100%	100%	P		Noise from roof mounted HVAC fans must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.
Roof extract fan outlet	Process building roof	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	10	78	87	80	73	70	68	69	64	60	75	1	6	83	100%	100%	P		Noise from roof mounted extract fans must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load and as measured on-axis). Attenuator required.
Dry air cooler (DAC)	North of ORC Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	5		70	71	71	68	64	61	56	51	70	1	206	93	100%	100%	P		Noise from the DAC must not exceed 75dB $L_{Aeq,T}$ at one metre distance. It is likely that a bespoke acoustic package shall be required to be fitted to the coolers.
ORC bypass outlet	ORC Hall Roof	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	1	84	82	75	72	68	67	70	67	61	75	1	6	83	100%	100%	P	Bypass operation	A silencer must be fitted to the outlet of any required ORC bypass, in order to achieve a maximum allowable sound pressure level of 75dB $L_{Aeq,T}$ at one metre from each outlet (90º off longitudinal axis), for all possible modes of operation, including worst case.
PAC blower	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	1	72	64	66	74	72	71	65	63	54	75	1	21	88	100%	100%	P		Make provisions for acoustic enclosures to be fitted to the material blowers ensure that the noise levels produced do not exceed 75dB $L_{Aeq,T}$ at one metre from any surface in each case. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).

Equipment Name	Location	Data type	Data Source / Specification	Number of Sources	Average Sound Pressure Level, dB, at Octave Band Centre Frequency Hz									Average Sound Pressure Level on Measurement Surface, L_{pA}	Measurement Distance, m	Measurement Surface area at Measurement Position, m^2	Overall Sound Power Level, dB L_{wA}	Utilisation		Source: Area (A) Line (L) Point (P) or internal (I)	Comment	Outline Noise Mitigation Design
					32	63	125	250	500	1k	2k	4k	8k					Daytime (07:00 - 23:00)	Night Time (23:00 - 07:00)			
Ash blowers	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	2	67	59	61	69	67	66	60	58	49	70	1	21	83	100%	100%	P		Make provisions for acoustic enclosures to be fitted to the material blowers ensure that the noise levels produced do not exceed 75dB $L_{Aeq,T}$ at one metre from any surface in each case. Attenuated forced draught ventilation to the enclosure will be needed, complete with run and standby fans (resilience).
Baghouse	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	2	69	67	60	57	53	52	55	52	46	60	1	230	84	100%	100%	A		Both baghouses are to be externally acoustically lagged to achieve to each achieve a maximum allowable sound pressure level of 60dB $L_{Aeq,T}$ at one metre measuring distance from any surface.
Baghouse penthouse fans	Within Baghouse, east of Processing Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	4	88	85	77	68	68	63	60	55	49	70	1	12	81	100%	100%	P		Noise from the baghouse penthouse fans must not exceed of 75dB $L_{Aeq,T}$ at one metre measuring distance when operating at maximum design duty.
Pneumatic blowoffs	Within Baghouse, east of Processing Hall	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	var	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	100%	-		All pneumatic blow-offs and solenoids et al, such as those associated with the baghouse plant must be fitted with high performance “Silvent” pneumatic silencers or similar
External conveying system	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1		74	73	72	68	71	68	62	45	75	1	55	92	100%	100%	L		Noise from the externally sited conveyor must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load).
Air compressor outlet	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	2	73	76	73	73	73	69	67	64	61	75	1	1	75	100%	100%	A		Noise from the externally sited air compressor outlets must not exceed 75dB $L_{Aeq,T}$ at one metre distance (maximum, when on full load).
External ductwork	East of Processing Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1	69	67	60	57	53	52	55	52	46	60	1	126	81	100%	100%	L		External ductwork is to be externally acoustically lagged to achieve to each achieve a maximum allowable sound pressure level of 60dB $L_{Aeq,T}$ at one metre measuring distance from any surface.
Transformer	East of ORC Hall	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1	78	78	78	73	68	62	58	55	52	70	1	12	81	100%	100%	P		
Diesel generator exhaust	Process Building Roof	Sound pressure level at 1m distance	No data provided. Noise data taken from similar project	1	75	77	79	75	73	68	66	63	61	75	1	6	83	100%	100%	P	OTNOC operation only	The diesel generator exhaust must be ducted to the roof/facade of the Process Building. Noise from the exhaust must not exceed 75dB $L_{Aeq,T}$ at 1m distance from exhaust outlet edge (90º off longitudinal axis of the outlet) at any design speed/mode including when on full load. Make provisions for exhaust gas silencer to be fitted to the discharge side of the generator exhaust.
Mobile Plant																						
HGV		Sound pressure Level at 10m	Noise spectrum taken from BS5228 Table C.2 reference 34 ("Lorry": 4-axle wagon)	1		73	78	78	78	74	73	68	66	80	10	628	108	1/hour	nil	L		Daytime operation only
Fork lift truck		Sound pressure Level at 10m	. Manufacturer sound power level of 93dB LwA. Noise spectrum taken from BS5228 Part 1 2009, Table C.9, ref. no.5	1		72	67	61	62	60	57	52	47	65	10	628	93	20%	0%	x		Daytime operation only
Emergency																						
External																						
Firewater pumps	Fire Water Tank	Sound pressure level at 1m distance	No data provided. Typical octave band noise spectrum assumed	1	74	79	80	83	85	84	86	79	77	90	1	12	101			x		

Table E1: Noise source schedule (plant noise levels shall not be exceeded)

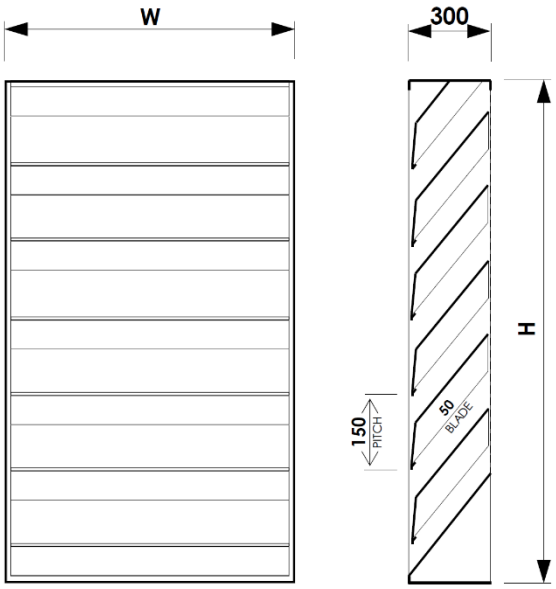
APPENDIX F

DETAILS OF ACOUSTIC LOUVRES USED TO INFORM THE ASSESSMENT

DATA SHEET **L70E**
ACOUSTIC LOUVRE
MODEL **AL3015**

THIS IS NOT A STAND ALONE DOCUMENT AND UNLESS REFERRED TO IN A DATED EQUIPMENT SCHEDULE IS SUBJECT TO REVISION WITHOUT NOTICE.

DIMENSIONS



SPECIFICATION

LOUVRES ARE CONSTRUCTED FROM FOLDED SHEET METAL AND HAVE A SERIES OF HORIZONTAL BLADES CONTAINED WITHIN A FOUR SIDED EXTERNAL FRAME.

THE MATERIAL OF CONSTRUCTION MAY BE PRE-GALVANISED STEEL (SUFFIX G) OR ALUMINIUM (SUFFIX A).

GALVANISED BIRD SCREENS ARE FITTED AS STANDARD.

CASING SIDES ARE PROVIDED WITH 10mm DIA HOLES FOR FIXING ADJACENT SECTIONS TOGETHER, OR FIXING THE LOUVRE INTO THE BUILDERSWORK OPENING.

LOUVRES ARE SUPPLIED SELF FINISH AS STANDARD OR WITH AN OPTIONAL POLYESTER POWDER FINISH (SUFFIX P).

NOTES

THIS DATA SHEET IS TO BE READ IN CONJUNCTION WITH THE EQUIPMENT SCHEDULE.

WIDTH **(W)** AND HEIGHT **(H)** DIMENSIONS GIVEN ON THE EQUIPMENT SCHEDULE ARE AS MANUFACTURED. ADEQUATE CLEARANCE MUST BE ALLOWED WHEN CONSTRUCTING THE BUILDERSWORK OPENING, A MINIMUM OF 10 mm IS RECOMMENDED.

LOUVRES WILL BE SUPPLIED WITHOUT SUPPORT STEELWORK, CLEATS, BRACKETS, FIXINGS, FLASHING, MASTIC, OR OTHER SUCH ITEMS, UNLESS OTHERWISE STATED.

EXCESSIVELY LARGE OR HEAVY LOUVRES MAY BE MANUFACTURED IN MATING SECTIONS FOR EASE OF HANDLING.

LOUVRES ARE MANUFACTURED TO STANDARD SHEET METAL TOLERANCES OF +/- 3 mm.

SUFFIX

THE SUFFIX DEFINES ADDITIONAL FEATURES OR SPECIAL CONSTRUCTIONAL DETAILS

G GALVANISED STEEL CONSTRUCTION.

A ALUMINIUM CONSTRUCTION.

P POLYESTER POWDER COAT.

X SPECIAL CONSTRUCTION - REFER TO EQUIPMENT SCHEDULE FOR DETAILS.

WEIGHT

LOUVRE WEIGHTS ARE GIVEN ON THE EQUIPMENT SCHEDULE. APPROXIMATELY:

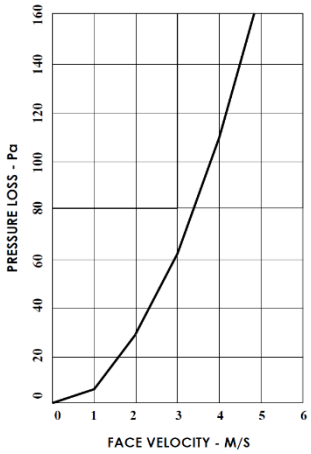
52kg/M² GALVANISED CONSTRUCTION
37kg/M² ALUMINIUM CONSTRUCTION

ACOUSTIC PERFORMANCE

SOUND REDUCTION INDEX: BS EN ISO 10140 - 2

63	125	250	500	1000	2000	4000	8000	HZ
5	**6**	**8**	**11**	**18**	**25**	**20**	**16**	**dB**

PRESSURE LOSS



STANDARD SIZES

THERE ARE NO STANDARD SIZES. ALL LOUVRES ARE MADE TO ORDER.

ALLAWAY ACOUSTICS LIMITED Old Police Station, 1 Queens Road, Hertford SG14 1EN
T | 01992 550825 E | enquiries@allawayacoustics.co.uk W | allawayacoustics.co.uk

Figure F1: Details of the proposed AL3015 single banked acoustic louvre

APPENDIX G
DETAILS AND PROFESSIONAL QUALIFICATIONS OF CONTRIBUTING SOL STAFF

Company Details

Name of Organisation:	Sol Acoustics Limited
Status:	Private Limited Company
Address:	Unit 11, Brunel Court, Gadbrook Park CW9 7LP
Telephone Number:	01565 632535
E-Mail:	info@solacoustics.co.uk
Nature of Business:	Acoustic Consultancy
Directors:	Simon Ferenczi
Company Registration Number:	4218702

Key Technical Personnel & Qualifications

Simon Ferenczi	Institute of Acoustics Diploma (with additional modules), MIOA
Brian Horner	BSc (Hons), MIOA
Chris Downing	MMath

Company Accreditations

Sol Acoustics is a member of The Association of Noise Consultants (ANC) and is qualified to perform sound insulation testing under the ANC's accredited testing scheme to demonstrate compliance with the requirements of Approved Document E of the Building Regulations.