CRESTWOOD ENVIRONMENTAL LTD

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Noise Impact Assessment

Report Reference: CE-WG2417-RP-001_FINAL

Report Date: 6 September 2023

Produced by Crestwood Environmental Ltd.

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ENVIRONMENT	LANDSCAPE	NOISE	LIGHTING
ECOLOGY	HERITAGE	WATER	TREES
MINERALS / WASTE	AIR QUALITY	LAND QUALITY	VISUALISATION

Crestwood Report Reference: CE-WG2417-RP-001_FINAL:

Issued Version Status	Date Produced	Written / Updated by:	Checked & Authorised by:
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0 EXECUTIVE SUMMARY

0.1 Background

0.1.1 Crestwood Environmental Ltd, were commissioned by SED Services Limited ('the Client') to undertake a Noise Impact Assessment in support of the permit variation application for the Inert Recycling Site at:

Bryn Hall Recycling Site
Bryn Hall Fam
Bryn Gates Lane
Bamfurlong
WN2 5JY

0.1.2 Currently, the Client are permitted to operate waste operations as described in standard rules SR2010 No 12 at the site. This variation seeks to:

1. Extend the permitted site boundary.
2. Include an additional EWC code [19 12 12]
3. Increase the annual throughput from 75,000 to 250,000.
4. Apply a minor administrative change to the site name (as above)

0.1.3 This noise impact assessment has been requested by the permitting authority (Environment Agency) in support of the permit application.

0.2 Details of Assessment

0.2.1 The assessment has been carried out following the guidance provided by the Environment Agency and the report structured in accordance with their requirements.

0.2.2 The report includes:

1. Details of the automated noise monitoring exercise carried out around the site.
2. Details of the prediction methodology used, including source noise levels.
3. The predicted noise levels from the site.
4. An assessment of the predicted noise levels in terms of UK Government noise policy.

0.3 Assessment Findings

0.3.1 The assessment shows that:

1. Noise emissions from the site are predicted to be less than the measured prevailing ambient sound levels and equivalent to or less than the prevailing background sound levels.

2. The proposals have included reasonable mitigation measures to minimise the noise impacts from the proposed operations affecting the nearest residential properties.

3. The operator should investigate the feasibility of further measures, identified through on-site observations, which may further reduce the perceived noise impacts from the site.

4. The operations, as currently proposed, comply with the requirements of UK Government Noise Policy and, therefore, the application granted.

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 Crestwood Environmental Ltd ('Crestwood'), were commissioned by SED Services Limited ('the Client') to undertake a Noise Impact Assessment ('NIA') in support of the permit variation application for the Inert Recycling Site ('the Site') at:

Bryn Hall Recycling Site
Bryn Hall Fam
Bryn Gates Lane
Bamfurlong
WN2 5JY

1.1.2 Currently, the Client are permitted to operate waste operations as described in standard rules SR2010 No 12 at the site. This variation seeks to:

1. Extend the permitted site boundary.
2. Include an additional EWC code [19 12 12]
3. Increase the annual throughput from 75,000 to 250,000.
4. Apply a minor administrative change to the site name (as above)

1.1.3 The site is understood to operate as per the requirements of the extant planning permission with all operations possible through its permitted operating times. The Client has provided a list of plant and equipment used at the site and includes:

- 1 No. Crusher
- 1 No. Trommel/Screener
- 1 No. Loading Shovel
- 1 No. Excavator
- 2.5 vehicle movements per hour in and out of the site.

1.1.4 A site location plan is provided at Figure 1 showing the site boundary, noise measurement locations and noise assessment locations.

1.1.5 Crestwood have been engaged undertake the following key tasks:

- Carried out a background sound survey at locations representative of the nearest noise sensitive premises.
- Constructed a 3-dimentional environmental noise model in CadnaA® to predict the expected specific sound levels at the nearest noise sensitive receptors.
- Assessed the predicted sound levels against the descriptors found in British Standard BS 4142:2014+A1:2019 ('the Standard').
- Reviewed Best Available Techniques to determine whether any additional measures could be reasonably employed to reduce operational noise levels from the site.

1.1.6 At the time of preparation, Crestwood are not aware of that there have been any complaints about noise from the site, nor have we been provided with any previous noise assessments for the site, nor have we been made aware of any changes on site since the last systematic assessment.

1.1.7 As this is a technical report it will be necessary to make reference to some technical terms. To assist the reader, a glossary has been included with this report.

1.1.8 Details of the Crestwood Environmental Team compiling this assessment are found in Appendix 4.

2 Assessment Location

2.1 The Site

2.1.1 The Bryn Hall Recycling Site is centred at Ordnance Survey grid reference SD 5922 0146 and is located adjacent to the SED Services Limited Open Windrow Composting (OWS) installation in open countryside to the west of Bryn Gates and Bamfurlong settlements and is accessed via Bryn Gates Lane from A58 Bolton Road.

2.1.2 The site is surrounded by open farmland and is in a slightly elevated position to the south of the track. The site lies approximately 250m to the West of the Police Station where Bryn Gates Lane adjoins the A58 Bolton Road.

2.1.3 The main noise sources on site are mobile items of plant which may be operating in any area of the site and are understood to consist of:

- 1 No. Crusher
- 1 No. Trommel/Screener
- 1 No. Loading Shovel
- 1 No. Excavator

2.1.4 The Client has advised that they expect 2.5 vehicle movements per hour during the operating times to the recycling site.

2.2 Current and Proposed Operation

2.2.1 The current permit allows the Client to store waste at Bryn Hall Recycling Site and treat it to produce soil, soil substrates and aggregate. The permitted wastes do not include hazardous wastes and it is proposed that the total quantity of waste that can be stored and subsequently treated at the site under the permit is increased from no more than 75,000 tonnes to 250,000 tonnes per year.

2.2.2 The recovery operations do not include the burning of any wastes, either in the open, inside buildings or in any form of incinerator.

2.2.3 The Site processes suitable incoming waste materials for, either:

1. Production of products, in line with the relevant Aggregate Quality Protocol (AQP), or,
2. Despatched from site as a waste for use by third parties under suitable exception or waste management operation,
3. A material conforming to RPS190 'Use of manufactured topsoil'.

2.3 Measurement Locations

2.3.1 Background sound levels were measured at the locations shown in Table 1 below.

Table 1 Background Sound Level Measurement Locations

Measurement Location	Grid Reference	Description
Position 1	SD 5947 0141	The microphone was positioned on a tripod at 1.8m above local ground level at the entrance to the site access road opposite the police station. The measurement position was selected as being representative of the residential properties at 1-5 Hall Street and was used as there was a secure location for the monitoring equipment.

Measurement Location	Grid Reference	Description
Position 2	SD 5935 0120	The microphone was positions on a tripod at 1.8m above local ground level on the ownership boundary between Bryn Hall Farm and the Community Garden and allotments. The measurement position was selected as being representative of the rear of the residential properties on Bolton Road which face the recycling facilities.

2.3.2 These locations, along with photographs of the installation, are shown in Figure 1 in Appendix 1.

2.4 Receptor Locations

2.4.1 The noise sensitive receptors used in this assessment have been identified as follows and presented in Table 2 below.

Table 2 Noise Assessment Locations

Receptor Number	Grid Reference	Description
Rec_01	SD 5947 0127	631 - 637 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_02	SD 5946 0125	623 - 629 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_03	SD 5946 0124	619 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_04	SD 5945 0122	611 - 613 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_05	SD 5944 0120	607 - 609 Bolton Road, , Bamfurlong, Wigan, WN2 5JZ
Rec_06	SD 5943 0118	601 - 605 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_07	SD 5942 0114	Holly Well Cottages, Lily Lane, Bamfurlong, Wigan, WN2 5JT
Rec_08	SD 5943 0116	599 Bolton Road, Bamfurlong, Wigan, WN2 5JZ
Rec_09	SD 5947 0130	Hall Street Cottages, Bamfurlong, Wigan, WN2 5JX
Rec_10	SD 5947 0132	Hall Street Cottages (Rear), Bamfurlong, Wigan, WN2 5JX
Rec_11	SD 5951 0131	218 - 230 Lily Lane, Bamfurlong, Wigan, WN2 5JT
Rec_12	SD 5882 0158	Bryn Hall Cottages, Bryn Gates Lane, Bamfurlong, Wigan, WN2 5JY
Rec_13	SD 5869 0166	Bryn Hall Farm, Bryn Gates Lane, Bamfurlong, Wigan, WN2 5JY
Rec_14	SD 5954 0134	208 Lily Lane, Bamfurlong, Wigan, WN2 5JT
Rec_15	SD 5956 0135	194 Lily Lane, Bamfurlong, Wigan, WN2 5JT
Rec_16	SD 5958 0137	188 - 190 Lily Lane, Bamfurlong, Wigan, WN2 5JT

2.4.2 These locations are shown in Figure 2 in Appendix 1.

2.4.3 The ground between the site and the receivers is soft, uncultivated agricultural land in all directions. From the first row of residential properties, it is acoustically hard ground.

3 Equipment and Meteorology

3.1 Noise Monitoring Equipment

3.1.1 The noise monitoring equipment used during the background sound survey is presented in Table 3. Copies of the laboratory calibration certificates are found in Appendix 2.

Table 3 Schedule of Noise Monitoring Equipment

Measurement Position	Description	Make and Model	Serial Number	Last Calibration Date	Certificate Number
Position 1	Integrating Sound Level Meter	NTi XL2-TA	A2A-08072-E0	27 January 2023	2023-0195
	Pre-Amplifier	NTi MA220	3341	27 January 2023	2023-0196
	Microphone	NTi MC230	A21516	27 January 2023	2023-0197
Position 2	Integrating Sound Level Meter	NTi XL2-TA	A2A-21412-E0	08 September 2022	UK-22-090
	Pre-Amplifier	NTi MA220	10699	08 September 2022	UK-22-090
	Microphone	NTi MC230A	A22991	08 September 2023	UK-22-090
Position 1&2	Acoustic Calibrator	Larson Davis CAL 200	20189	31 July 2023	UCRT23/2004

3.1.2 An on-site field sensitivity check was carried out at both measurement positions on deployment and collection of the automated noise monitoring systems provided above. The results are presented in Table 4 below.

Table 4 Results of on-site sensitivity check

Measurement Position	Calibration Level	Initial Offset	Final Offset	Drift
Position 1	114.0 dB @ 1kHz	+0.8dB	+0.9dB	+0.1dB
Position 2	114.0dB @ 1kHz	+0.4dB	+1.3dB	+0.9dB

3.1.3 The measured sensitivity check at Position 1 is less than ±0.5dB and, therefore, these measurements are considered acceptable. However, the measured sensitivity at Position 2 is between ±0.5dB and ±1.0dB and, normally, this would indicate that the results would need be treated with caution where the measurements are attended. However, since the measurements are unattended and the equipment left for several days, the Standard advises that this can be considered acceptable provided this is reported.

3.2 Meteorological Conditions

3.2.1 The meteorological conditions during the background sound survey were monitored using a Davis Vantage Vu weather station located at Position 1. The results presented in the Charts below.

Chart 1 Measured External Temperature during the Monitoring Period

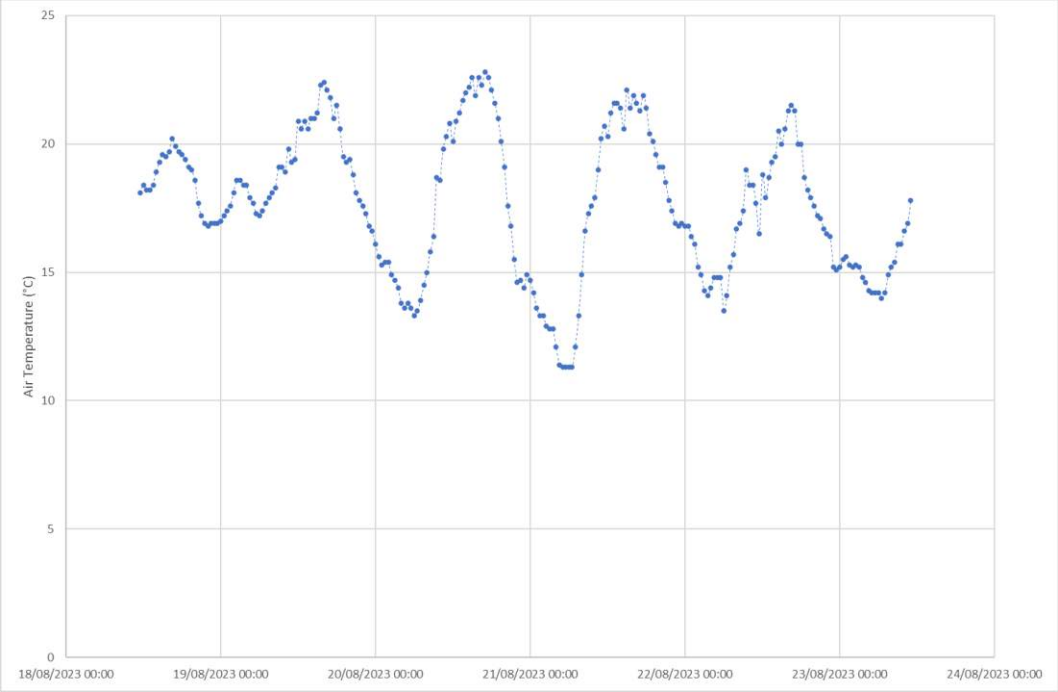


Chart 2 Measured Wind Speed

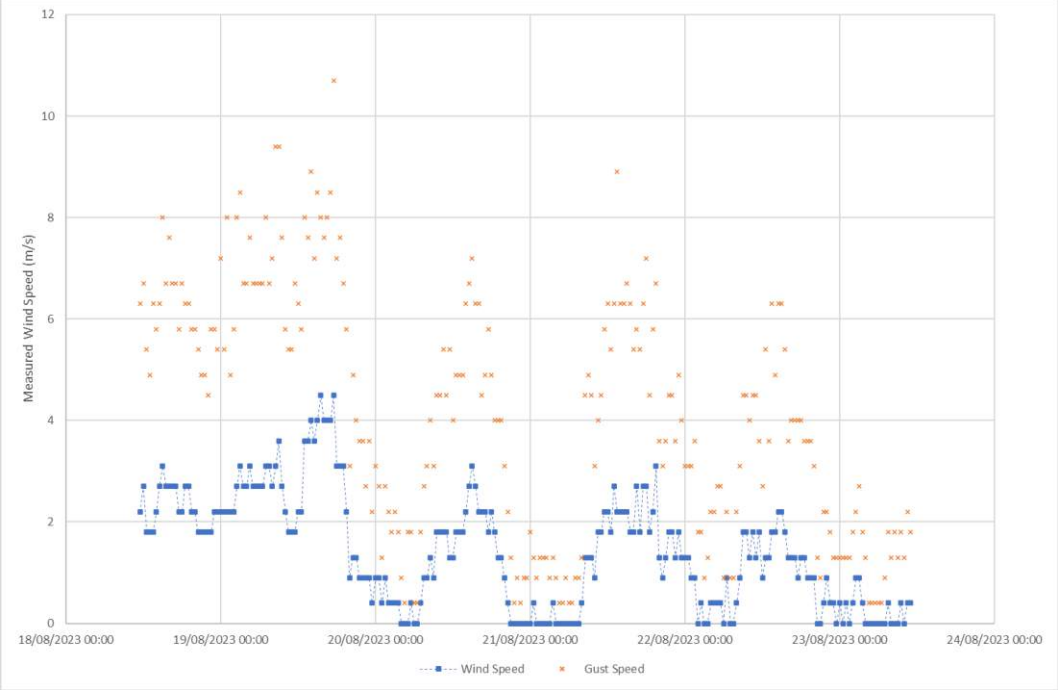
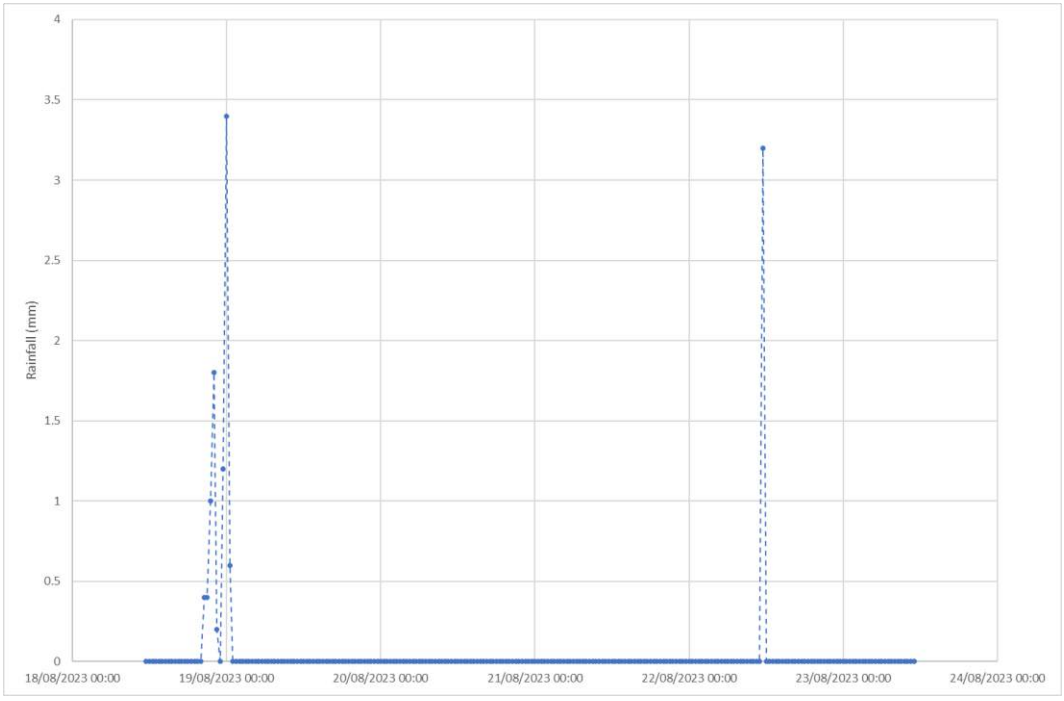


Chart 3 Measured Wind Direction

Chart 4 Measured Rainfall



3.3 Assessment Methods

3.3.1 The assessment has made use of:

- Measured background sound levels recorded during our background sound survey.
- Library specific sound levels for the proposed plant and equipment, established from BS 5228-1:2009+A1:2014.
- Three-dimensional environmental noise model constructed in CadnaA® implementing the calculation methodology of ISO 9613-2:1996.

4 Assessment Methodology

4.1 Standards Used

4.1.1 For this assessment, the following standards and guidance have been used:

- British Standard BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' [1] ('the Standard').
- Association of Noise Consultants Technical Note on BS 4142:2014+A1:2019, Version 1.0, March 2020 [2]. ('the ANC Guidance').
- Environment Agency Guidance 'Noise and vibration management: environmental permits', Updated January 2022 [3] ('the EA Guidance').
- Environment Agency Guidance 'Method Implementation Document for BS 4142', Published March 2023 [4] ('the MID')
- Noise emission data from British Standard BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites Part 1: Noise' [5].

4.2 Deviations

4.2.1 The Standard does not specifically preclude measurements either during or after periods of rainfall. The ANC Guidance recommends that the consultant consider the likely effects of the meteorological conditions on the measurement results which is consistent with what is implied by the EA Guidance. However, the MID specifically says that measurements during or immediately after periods of rain should not be used.

4.2.2 The dataset for both measurement positions has been reviewed and the measured background sound levels are considered not to have been significantly affected during and immediately after the periods of measured rainfall.

4.2.3 Similarly, the measured average windspeeds were below 5m/s as given in the standard although gusts were measured in excess of this. Other guidance (e.g. Calculation of Road Traffic Noise) advises that gusts should not exceed 10m/s and, aside from one period in the afternoon of Saturday 19 August gusts were below 10m/s.

4.2.4 Again, a review of the datasets for both measurement positions indicates that the measured background sound levels are considered not to have been significantly affected due to the higher wind speeds.

5 Noise Monitoring and Predictions

5.1 Background Sound Levels

5.1.1 The background sound levels at each monitoring position have been derived using a combination of modal analysis and 'line of best fit'. Both of these methods are considered acceptable and the use of the 'line of best fit' should identify whether the data set has been skewed by an additional source (e.g. an unseen air handling unit near to the measurement position on a timer) affecting the modal background sound levels.

5.1.2 The measured background sound levels used in this assessment are presented in Table 5, and the modal analysis presented in Chart 5 and Chart 6 for Position 1 and Position 2 respectively.

Table 5 Measured Background Sound Levels

Measurement Position	Measured Background Sound Level ($L_{A90, 15mins}$)		
	Day (07:00 – 19:00)	**Evening (19:00 – 23:00)**	**Night (23:00 – 07:00)**
Position 1	42	35	30
Position 2	42	36	32

Chart 5 Modal Analysis for Position 1

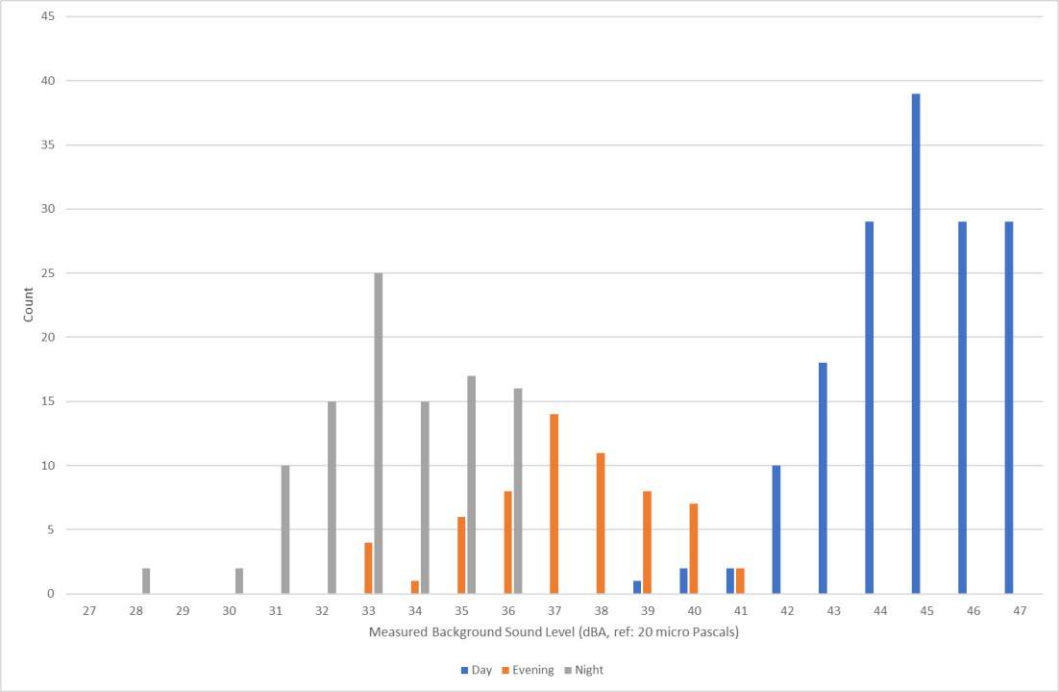
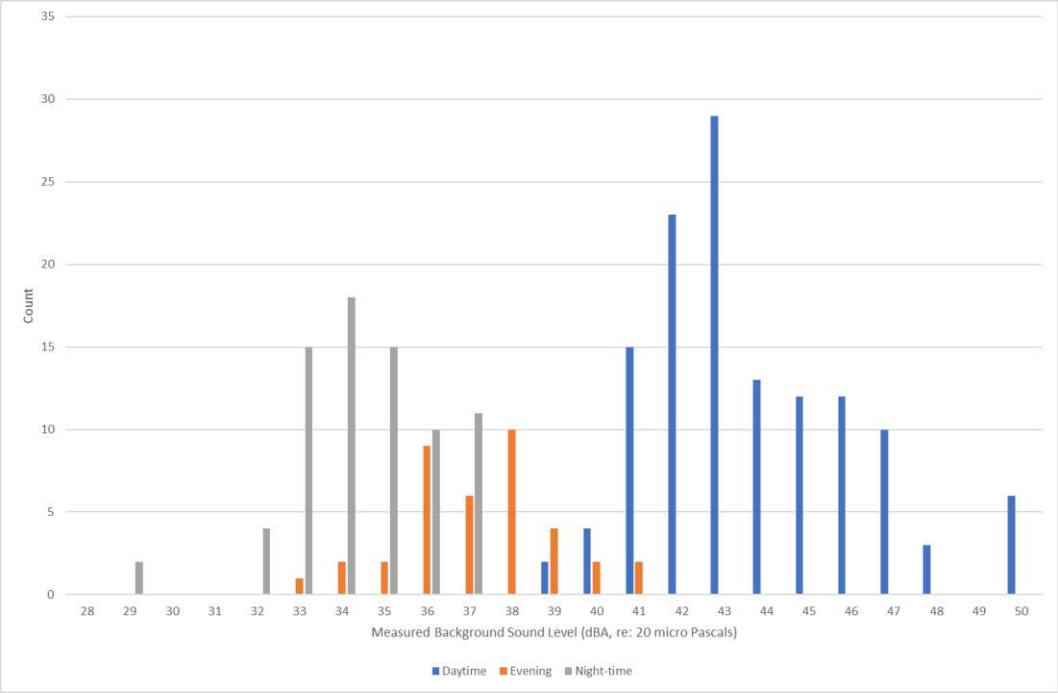


Chart 6 Modal Analysis for Position 2



5.2 Source Sound Power Levels

5.2.1 The Source Sound Power Levels have been extracted from the library data found within British Standard BS 5228-1:2009+A1:2014 and corrected for distance (10m) and hemispherical radiation. The sound power levels, standard reference, and source type used are presented in Table 6.

Table 6 Source Sound Power Levels Used

Description	Reference	Sound Power Level (L_w)								Source Type
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Trommel	C.10.20	99	97	96	99	103	95	91	85	Area(1)
Crusher	C.1.15	114	112	112	109	106	103	99	94	Area(1)
Screener	C.10.21	101	103	101	101	98	96	94	87	Area(1)
Excavator	C.10.1	110	115	110	105	100	98	94	87	Area(1)
Loader	C.10.17	105	111	119	103	103	100	93	87	Area(1)
Haul Road	C.9.16	114	117	116	116	114	111	104	98	Line(2)

Notes:

(1) Area sources configured as moving point sources across the area of the site. Number of proposed items of plant included within the model.

(2) Line sources configured as moving point sources along the length of the road. The total number of vehicles per hour included within the model.

5.3 Predicted Specific Sound Levels

5.3.1 The specific sound levels at the identified receptors were predicted for three scenarios as follows:

1. Site noise only – no contribution from vehicles on the access road.
2. Site noise and private access road only – contribution from vehicle noise associated with the operations on the public roads.
3. Site noise and access road – including contribution from vehicle noise on public roads to the junction with A58 Bolton Road.

5.3.2 The predicted specific sound levels at each receptor are presented in Table 7 below.

Table 7 Predicted Specific Sound Levels at Receptors

Receiver	Predicted Specific Sound Levels ($L_{Aeq,T}$, dB ref: 20 micro Pascals)	
	Scenario 1	Scenario 2
Receiver 01	40	42
Receiver 02	40	42
Receiver 03	40	42
Receiver 04	40	42
Receiver 05	39	41
Receiver 06	41	43
Receiver 07	39	41
Receiver 08	40	42
Receiver 09	44	44
Receiver 10	43	46
Receiver 11	42	46
Receiver 12	44	45
Receiver 13	37	38
Receiver 14	42	45
Receiver 15	41	43
Receiver 16	40	43

5.3.3 The predicted noise contours are presented in Figure 3 and Figure 4 in Appendix 1.

6 Noise Impact Assessment

6.1 Acoustic Feature Corrections

6.1.1 On site observations as confirmed through audio recordings have confirmed that the noise from the site is not audible at the nearest residential properties. However, sound from the vehicle movements along the private access drive is audible. Noise from the vehicle movements along the public roads have not been assessed further as this is specifically excluded under sub clause 1.3 of the Standard.

Paragraph 1.3
... Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems. ...

6.1.2 Therefore, the following feature corrections have been applied:

- Generic Site Noise attracts +3dB for intermittency as required by the EA Guidance.
- Vehicle Movements on the private access road attract a +6dB impulsivity correction.

6.2 Noise Impact at Receivers

Assessment Criteria

6.2.1 The Standard provides the following semantic descriptors for assessing the noise impact. These have been considered alongside the descriptors used in the Noise Policy Statement for England [6]:

- Typically, the greater the difference between the rating sound level and the background level, the greater the magnitude of the impact.
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context. This could be considered as equivalent to the significant observed adverse effect level (SOAEL).
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context. This could be considered as equivalent to the Observed Effect Level.
- 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.
- For completeness, where the rating level is equal to the background sound level this could be considered equivalent to the Lowest Observed Adverse Effect Level (LOAEL) and where the specific sound level is between 7dB and 10dB below the background sound level this could be considered equivalent to the No Observed Effect Level (NOEL).

6.2.2 The local authority, Wigan Council, are understood to have the following noise condition associated with the development:

Example Planning Condition (extracted from Condition 7 of decision notice A/16/83334/MAJMIN)		
The Rating Level (as defined in British Standard 4142: 1997 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas) shall not exceed the following levels at the nearest noise sensitive properties at Bryn Hall Cottages and residential properties on Bolton Road/Lily Lane:		
Daytime	07:00 to 18:00	L_{A90} + 8dB

6.2.3 The UK Government noise policy does not say that events occurring between the LOAEL and the SOAEL cannot occur at any time only that they are to be mitigated and reduced to a minimum within the context of sustainable development.

Predicted Noise Impact at Receptors

6.2.4 The predicted noise impact, determined from the noise modelling exercise, at each identified receptor is presented in Table 8.

Table 8 Predicted Noise Rating Levels at Identified Receptors

Receiver	Noise Rating Level $L_{Ar,Tr}$	Difference to Background	Description
Receiver 01	47 dB	+4 dB	Adverse Impact Site noise complies with planning condition
Receiver 02	47 dB	+4 dB	Adverse Impact Site noise complies with planning condition
Receiver 03	48 dB	+5 dB	Adverse Impact Site noise complies with planning condition
Receiver 04	47 dB	+4 dB	Adverse Impact Site noise complies with planning condition
Receiver 05	46 dB	+3 dB	Adverse Impact Site noise complies with planning condition
Receiver 06	48 dB	+5 dB	Adverse Impact Site noise complies with planning condition
Receiver 07	46 dB	+3 dB	Adverse Impact Site noise complies with planning condition
Receiver 08	47 dB	+4 dB	Adverse Impact Site noise complies with planning condition
Receiver 09	49 dB	+6 dB	Adverse Impact Site noise complies with planning condition
Receiver 10	52 dB	+9 dB	Possible Significant Adverse Impact Site noise complies with planning condition
Receiver 11	51 dB	+8 dB	Possible Significant Adverse Impact Site noise complies with planning condition
Receiver 12	50 dB	+7 dB	Adverse Impact Site noise complies with planning condition
Receiver 13	42 dB	-1 dB	Low Adverse Impact Site noise complies with planning condition
Receiver 14	51 dB	+8 dB	Possible Significant Adverse Impact Site noise complies with planning condition
Receiver 15	49 dB	+6 dB	Adverse Impact Site noise complies with planning condition
Receiver 16	49 dB	+6 dB	Adverse Impact Site noise complies with planning condition

Contextual Discussion

6.2.5 The noise modelling exercise indicates the noise emissions may cause an adverse impact and possible significant adverse impact at some receptors based on the descriptors given in the Standard.

6.2.6 The possible significant adverse impacts are primarily due to vehicle movements along the access road. Whereas the adverse impacts are mainly derived from the +3dB 'other' correction required under the EA Guidance to the noise from the site although noise from the site was not audible at the receptor positions.

6.2.7 However, the predicted specific sound levels at the receptors are typically less than the prevailing ambient noise level measured in terms of $L_{Aeq,15mins}$ and, equivalent to or less than the prevailing background sound level, therefore, this is considered to be an indication of a low adverse effect.

6.2.8 This assessment shows that noise from the proposed activities is between the LOAEL and the SOAEL

6.2.9 The requirements of the Noise Policy Statement for England are that noise effects between the LOAEL and the SOAEL are to be managed and reasonable mitigation put in place to minimise such effects. It does not say that such effects cannot occur.

6.2.10 From our onsite observations and the proposals from the Client, detailed in Section 7.1, reasonable mitigation measures have been proposed albeit some further measures should be investigated for feasibility.

6.2.11 Therefore, the proposals should comply with the requirements of the Noise Policy Statement for England and the application granted.

7 Additional Noise Control Measures

7.1 Proposed Mitigation Measures

7.1.1 The client has proposed that a 4.5m high earth bund be constructed on three sides of the facility to minimise site noise. The predictions show that this is likely to be effective in controlling site noise and specific sound levels at the nearest receptors are likely to be equal to or below the prevailing background sound levels at the identified receptors.

7.1.2 The site is understood to operate with restricted hours, namely 07:00hrs to 18:00hrs Monday to Friday and 08:00hrs to 13:00hrs on a Saturday with vehicle movements into and out of the site restricted to these times. It is not proposed to reduce these hours any further.

7.1.3 Site vehicles were observed to follow a one-way system within the site, minimising the use of reversing alarms and where reversing alarms were used these were observed to be mainly the “white-noise” type.

7.1.4 The site access road was observed as being very smooth with very few potholes or cracks thus reducing the risk of any banging or thuds from the passage of lorries and other vehicles.

7.2 Additional Control Measures

7.2.1 Onsite observations showed that empty lorries leaving the site park at a lay-by near to the site entrance (Position 1) and the restarting of engines when these vehicles depart is a potential source of increased disturbance to the residents, particularly at Receiver 10, Receiver 11 and Receiver 14.

7.2.2 If it is an operational necessity that empty vehicles wait to depart, then consideration should be given to relocating this lay-by further away from the residential receivers and closer to the site compound entrance.

7.2.3 Whilst the site access road is in good condition, the public road leading to the site access road has a number of potholes which cause clearly perceptible impulsive banging sounds when empty lorries drive over these or “bounce” across them. Consideration should be given to negotiating and discussion with the local highways authority to resurface this road or, as a minimum, repair any potholes to reduce these instances.

7.2.4 Furthermore, the interface between the public road and the access road should be smoothed out to reduce any bangs and thuds as lorries cross between the two roads.

7.2.5 Should it be feasible to implement these mitigation measures then this should reduce any adverse effect to equal to or below the Observed Effect Level at the significant majority of the receivers.

8 Uncertainty

8.1 Minimising Uncertainty

8.1.1 The uncertainty in this assessment has been minimised by:

- Sampling background sound levels over a number of days in more than one location and supplementing the measurements with audio recordings.
- Using library sound source levels correcting to sound power using accepted methodologies.
- Using sophisticated computer modelling to carryout predictions of operational sound level.
- Using open access data to generate the digital terrain model within the noise model.

8.2 Calculation of Uncertainty

8.2.1 Nevertheless, the uncertainty within the assessment has been predicted following the methodology provided by the National Physical Laboratory (NPL) using Type B analysis and summation in quadrature. The uncertainty budget for the elements within this assessment are given in Table 9, below.

Table 9 Uncertainty Budget

Assessment Element	Uncertainty Budget
Background Sound Level Measurements	± 1.0 dB
Source sound pressure levels	± 1.0 dB
Source distance measurements	± 0.9 dB
Source divergence	± 3.0 dB
Acoustic feature correction (subjective method)	± 3.0 dB
Modelling correction	± 3.0 dB

8.2.2 Following the NPL method, the uncertainty budget in the assessment is predicted to be **± 3.1 dB**.

9 Conclusions and Next Steps

9.1 Conclusion

9.1.1 Crestwood Environmental Ltd, were commissioned by SED Services Limited ('the Client') to undertake a Noise Impact Assessment in support of the permit variation application for the Inert Recycling Site at:

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Bryn Gates Lane
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9.1.2 Currently, the Client are permitted to operate waste operations as described in standard rules SR2010 No 12 at the site. This variation seeks to:

1. Extend the permitted site boundary.
2. Include an additional EWC code [19 12 12]
3. Increase the annual throughput from 75,000 to 250,000.
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9.1.3 The site is understood to operate as per the requirements of the extant planning permission with all operations possible through its permitted operating times. The Client has provided a list of plant and equipment used at the site and includes:

- 1 No. Crusher
- 1 No. Trommel/Screener
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- 1 No. Excavator
- 2.5 vehicle movements per hour in and out of the site.

9.1.4 A period of environmental noise monitoring was carried out on the site over a number of days to determine the prevailing background sound levels at the nearest noise sensitive receptor, whether noise from the operations of the existing facility is audible at the nearest receptors and to identify any further mitigation measures which could be employed to further reduce the noise emissions from the operation of the facility.

9.1.5 Noise levels at the nearest receptors were predicted at the identified noise receptors and, with the assistance of audio recordings, assessed following the methodology found in British Standard BS 4142:2014+A1:2019.

9.1.6 The assessment showed that predicted noise emissions from the facility are typically equivalent to the Observed Effect Level with some receptors experiencing levels close to the Significant Observes Adverse Effect Level due, in part, to vehicles using the private access road.

9.1.7 The client has already proposed and implemented some noise mitigation measures and Crestwood has identified other areas which should be investigated which, if implemented, are predicted to further reduce noise emissions associated with the operation of the facility.

9.2 Next Steps

9.2.1 The following next steps have been identified:

- Finalise the bund construction and layout against and implement in the final proposed design.
- Consider relocating the lay-by at the junction of the access road with the public road further away from the residential receivers and closer to the site compound entrance.
- Consider negotiating and discussing with the local highways authority to resurface the public road or, as a minimum, repair any potholes leading to the site access road.
- Repairing and levelling the interface between the public road and the access road to reduce any bangs and thuds as lorries cross between the two roads.

REFERENCES:

[1] British Standards Institution, “BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound,” British Standards Institution, 2019.

[2] Associaition of Noise Consultants, “Technical Note: BS 4142:2014+A1:2019,” 2020.

[3] Environment Agency, “Noise and vibration management: environmental permits,” 31 January 2022. [Online]. Available: https://www.gov.uk/government/publications/noise-and-vibration-management-environmental-permits/noise-and-vibration-management-environmental-permits#NIA-report. [Accessed 01 September 2023].

[4] Environment Agency, “Method implementation document (MID) for BS 4142,” 27 March 2023. [Online]. Available: https://www.gov.uk/government/publications/method-implementation-document-mid-for-bs-4142. [Accessed 01 September 2023].

[5] British Standards Institution, “BS 5228-1:2009+A1:2014 - Code of Practice for noise and vibration control on construction and open sites - Part 1: Noise,” 2014.

[6] Department for Environment, Food and Rural Affairs, “Noise Policy Statement for England,” Department for Environment, Food and Rural Affairs, Nobel House, 17 Smith Square, London, SW1P 3JR, London, 2010.

GLOSSARY:

For the avoidance of confusion, the terms used in this report follow the definitions given below:

Fundamentally, 'sound' are vibrations of the air which are detectable by the ear. Noise is defined as a sound or sounds which is unwanted, considered unpleasant or loud. Sound or noise levels are commonly measured in terms of the sound pressure level in terms of decibels (dB). The sound pressure level is commonly given as 'A'-weighted to simulate the human ear's response to sounds at different frequencies. Examples of typical A-weighted sound pressure levels from typical noise sources are shown in the table below.

Sound Level (dBA)	Typical Noise Source
130	Threshold of pain
120	Large jet aircraft on take-off
110	Rock Band
100	Pneumatic Drill
90	Heavy lorry
80	Medium-sized lorry
70	Passenger car
60	Normal conversation
50	Suburban residential neighbourhood
40	Quiet living room
30	Quiet rural setting, within a bedroom at night
20	Speaking in a whisper
10	
0	

In this report, the terms sound and noise are used interchangeably.

Noise levels are usually expressed with an associated measurement parameter. Commonly used measurement parameters are presented below.

Parameter	Definition
dB	Decibel – A logarithmic scale applied to acoustic units such as sound pressure and sound power.
L_{PA}	The instantaneous A-weighted sound pressure level measured in terms of dB
L_{A90}	This is the 'A'-weighted sound pressure level exceeded for 90% of the measurement period over which the measurement is taken. It is commonly used to represent the "background noise level".
L_{Aeq}	This is the equivalent 'A'-weighted sound pressure level of steady noise which, under the period under consideration, contains the same amount of (A-Weighted) sound energy as the time-varying noise over the same period. Also called the time-averaged sound level.
L_{A10}	This is the 'A'-weighted sound pressure level exceeded for 10% of the measurement period over which the measurement is taken. It is the accepted noise metric for describing road traffic noise.
L_{AMax}	This is the maximum root-mean-square (RMS) 'A'-weighted sound pressure level measured during the measurement period.

Other relevant acoustic parameters are defined below:

Parameter	Definition
R_w	The weighted Sound Reduction Index is the single figure value of laboratory measured sound reduction according to the procedures in British Standard BS EN ISO 717-1 and used for rating and comparing partitions and based on the measured sound reductions at different frequencies

Parameter	Definition
$D_{nT,w}$	The weighted standardised level difference is a single figure value of airborne sound insulation performance, derived according to the procedures in British Standard BS EN ISO 717-1 and used for rating and comparing partitions and based on the measured sound level difference at different frequencies and standardised to a reverberation time (normally 0.5 seconds).
$D_{ne,w}$	The weighted normalised sound level difference is used to describe the sound insulation provided by small building elements and derived according to the procedures in British Standard BS EN ISO 717-1 and used for rating and comparing partitions and based on the measured sound level difference at different frequencies and normalised to an absorptive area (normally $10m^2$).
C	A spectral adaptation term used in connection with the measurement and assessment of airborne sound insulation and defined in British Standard BS EN ISO 717-1. This is considered equivalent to the A-weighted weighted normalised sound level difference ($D_{nT,A}$)
C_{tr}	A spectral adaptation term used in connection with the measurement and assessment of airborne sound insulation and defined in British Standard BS EN ISO 717-1. This is considered equivalent to the normalised sound level difference weighted for road traffic noise ($D_{nT,tr}$)
$L'_{nT,w}$	The weighted standardized impact sound pressure level is a single-figure value of impact sound insulation performance, derived according to the procedures in British Standard BS EN ISO 717-2, used for comparing and rating floors and based on the values of measured impact sound pressure level at different frequencies and standardised to a reverberation time (normally 0.5 seconds).

APPENDICES:

APPENDIX 1 REPORT FIGURES

Position 1

Position 2

401750

401500

401250

358750

359000

359250

359500

© Google 2023

Legend:

- Site Boundary
- Noise Measurement Positions

Final Revision:	Date:	Description:	By:	Chk:

Consultant:

Crestwood Environmental Ltd

Science, Technology & Prototyping Centre
University of Wolverhampton Science Park
Glaisher Drive, Wolverhampton
WV10 9RU

Tel: 01902 229563
info@crestwoodenvironmental.co.uk
www.crestwoodenvironmental.co.uk

Client:

SED Services Limited

Site: Bryn Hall Recycling Site

Drawing Title: **Site Plan Shoiwng Noise Measurement Locations**

Date:	Scale	Paper Size:
1 / 9 / 2023		A3 (420×297mm)

Drawn By:	Checked By:	Status:	Final Revision:
CT	KB	FINAL	-

Drawing Ref:	Drawing No:
CE-WG-2417-GDW-001	**Figure 1**

Legend:

- Site Boundary
- Noise Assessment Locations

Final Revision:	Date:	Description:	By:	Chk:

Consultant:

Crestwood Environmental Ltd

Science, Technology & Prototyping Centre
University of Wolverhampton Science Park
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Tel: 01902 229563
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Client:

SED Services Limited

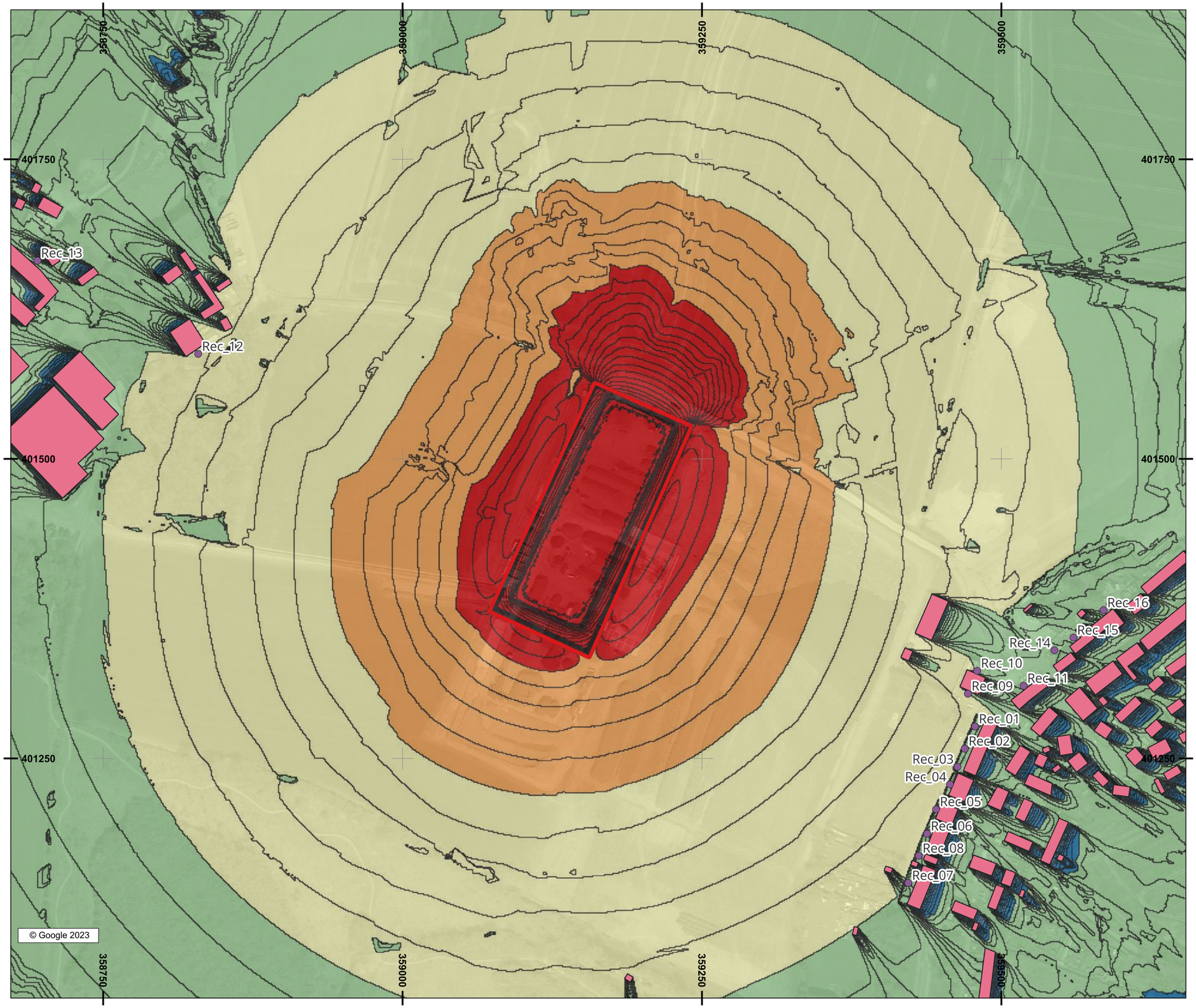
Site: Bryn Hall Recycling Site

Drawing Title: **Site Plan Shoiwng Noise Assessment Locations**

Date:	Scale	Paper Size:
1 / 9 / 2023		A3 (420×297mm)

Drawn By:	Checked By:	Status:	Final Revision:
CT	KB	FINAL	-

Drawing Ref:	Drawing No:
CE-WG-2417-GDW-002	**Figure 2**



Legend:

- Site Boundary
- Existing Buildings
- Identified Noise Sensititve Receivers

Predicted Specific Sound Levels (Site noise only, LAeq,T)

- 23 dB - 33 dB
- 33 dB - 43 dB
- 43 dB - 48 dB
- 48 dB - 53 dB
- 53 dB - 78 dB

Final Revision:	Date:	Description:	By:	Chk:

Consultant:

Crestwood Environmental Ltd

Science, Technology & Prototyping Centre
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WV10 9RU

Tel: 01902 229563
info@crestwoodenvironmental.co.uk
www.crestwoodenvironmental.co.uk

Client:

SED Services Limited

Site: Bryn Hall Recycling Site

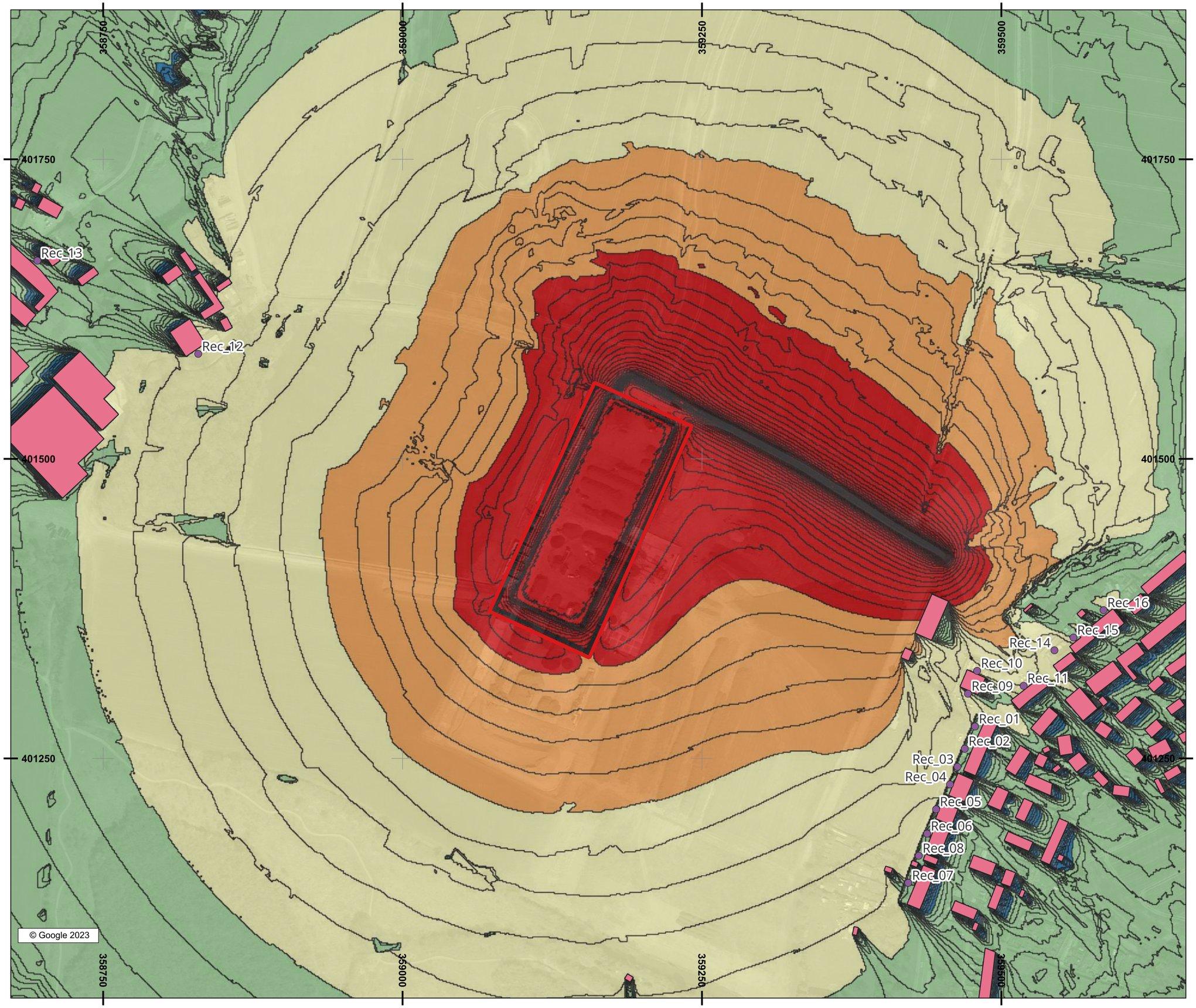
Drawing Title:

Site Plan Showing Predicted Specific Sound Levels (Site Only)

Date:	Scale	Paper Size:
6 / 9 / 2023		A3 (420×297mm)

Drawn By:	Checked By:	Status:	Final Revision:
CT	KB	FINAL	-

Drawing Ref:	Drawing No:
CE-WG-2417-GDW-003	**Figure 3**



Legend:

- Site Boundary
- Existing Buildings
- Identified Noise Sensitive Receivers

Predicted Specific Sound Levels
(Site and Access Road, LAeq,T)

- 23 dB - 33 dB
- 33 dB - 43 dB
- 43 dB - 48 dB
- 48 dB - 53 dB
- 53 dB - 90 dB

Final Revision:	Date:	Description:	By:	Chk:

Consultant:

Crestwood Environmental Ltd

Science, Technology & Prototyping Centre
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Glaisher Drive, Wolverhampton
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Tel: 01902 229563
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www.crestwoodenvironmental.co.uk

Client:

SED Services Limited

Site: Bryn Hall Recycling Site

Drawing Title:
Site Plan Shoiwng Predicted Noise Levels from the Site and Access Drive

Date:	Scale	Paper Size:
6 / 9 / 2023		A3 (420×297mm)

Drawn By:	Checked By:	Status:	Final Revision:
CT	KB	FINAL	-

Drawing Ref:	Drawing No:
CE-WG-2417-GDW-004	**Figure 4**

APPENDIX 2 CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 31 July 2023

Certificate Number: UCRT23/2004

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	Crestwood Environmental Limited Science, Technology and Prototyping Centre University of Wolverhampton Science Park Glashier Drive Wolverhampton WV10 9RU
Order No.	CE-PO-1824
Test Procedure	Procedure TP 14 Calibration of Sound Calibrators (60942:2017)
Description	Acoustic Calibrator

Identification

Manufacturer	*Instrument*	*Model*	*Serial No.*
Larson Davis	Calibrator	CAL200	20189

Public evidence of Type Approval Yes Approved by PTB

The calibrator has been tested as specified in Annex B of IEC 60942:2017. As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2017.

ANV Job No.	UKAS23/07524
Date Received	28 July 2023
Date Calibrated	31 July 2023
Previous Certificate	*Dated* Initial Calibration *Certificate No.* *Laboratory*

Measurements

The sound pressure level generated by the calibrator (averaged over a 20 to 25 second period) in its WS2 configuration was measured five times (rotating the calibrator on the microphone each time) by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below.

The frequency of the sound from the calibrator was measured five times over a 20 to 25 second period and the average frequency calculated.

The total distortion + noise of the sound from the calibrator was measured, using a rejection filter distortion factor meter, five times over a 20 to 25 second period and the average distortion + noise calculated.

Test Microphone

Manufacturer	*Type*
Brüel & Kjær	4134

Nominal Setting dB / Hz	Mean Level dB rel 20 µPa	Frequency	Distortion + Noise
94 / 1000	94.05 ± 0.10	1000.26 ± 0.12Hz	(0.21 ± 0.03) %
114 / 1000	114.07 ± 0.10	1000.26 ± 0.12Hz	(0.26 ± 0.03) %

Environmental conditions during tests	Start	End		
Temperature	22.96	22.92	± 0.30	°C
Humidity	39.7	39.6	± 3.0	%RH
Ambient Pressure	99.319	99.377	± 0.030	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

Note: Calibrator adjusted prior to calibration? NO

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

Calibrated by: K. Zablocki R 1

END

Manufacturer Calibration Certificate

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3. All tests are traceable in accordance with ISO/IEC 17025.

This model of sound level meter submitted for periodic testing successfully completed the applicable pattern-evaluation tests given in IEC 61672-2. The pattern approval certificate is available at www.nti-audio.com/XL2.

Sound Level Meter

Manufacturer	NTi Audio		
Type	XL2-TA	S/N	A2A-21412-E0
Firmware	V4.71		
Microphone Model	M2230		
Preamplifier	MA220	S/N	10699
Microphone Capsule	MC230A	S/N	A22991
Performance class	Class 1		
Customer Inventory Nr.			

Customer

Crestwood Environmental Ltd
University Of Wolverhampton Science Park
Glaisher Drive
Wolverhampton
WV10 9RU

Date 08 September 2022

Certificate UK-22-090

Results PASSED
(for detailed report see next pages)

Operator David Young

NTi AUDIO

Measurement equipment

Test System

Model	NTi Audio FX100, S/No. 11095
Last Calibration	22 October 2021
Cal Certificate	FX100 Cal #7000
Next Calibration	22 October 2022

Reference Microphone

Model	M2230 S/N #9565, Mic Capsule MC230A S/No. #A19844
Last Calibration	22 October 2021
Cal Certificate	44491-9565-M2230
Next Calibration	22 October 2022

Sound Calibrator

Model	Norsonic 1255 S/No. #125525354
Reference Level	114.21 dB
Calibration Frequency	1000 Hz
Last Calibration	04 March 2022
Cal Certificate	#40365
Next Calibration	03 March 2024

Environmental conditions

Temperature	24.4 °C
Humidity	54 %
Pressure	994 hPa

Notes

- This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International Systems of Units (SI).

- The user is obliged to have the object recalibrated at appropriate intervals.
- This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.
- All limits listed in this report are acceptance limits in accordance with IEC61672.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the regulations of the GUM.

NTi AUDIO

1. Indication at the calibration check frequency

The indication of the sound level meter at the calibration check frequency is checked by application of the sound calibrator and adjusted, if necessary, to indicate the required sound level for the environmental conditions under which the tests are performed. All levels in [dB].

Sensitivity before calibration	Sensitivity after calibration	Meas level	Limit -	Limit +	Uncert.	Status
44.2 mV/Pa	44.2 mV/Pa	114.2	113.21	115.21	0.2	Passed

2. Self-generated noise

2.1 Microphone cartridge installed

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level with frequency-weighting A and an averaging time of 30 seconds. All levels in [dB].

Weighting	Meas level	Limit +	Uncert.	Status
A	16.7	18.0	0.1	Passed

2.2 Microphone cartridge replaced by the capsule replacement NTI-K65-15

The self-generated noise is measured in the most-sensitive level range as a time-averaged sound pressure level for all frequency-weightings and an averaging time of 30 seconds. All levels in [dB] referenced to S = 42 mV/Pa.

Weighting	Meas level	Limit +	Uncert.	Status
A	8.6	13.0	0.1	Passed
C	12.6	16.0	0.1	Passed
Z	19.0	24.0	0.1	Passed

3. Acoustic signal tests of a frequency weighting

The frequency weighting is tested for frequency-weighting A, using an acoustic test facility. The sound level meter is set to a fast time-weighted sound level in the reference level range. All levels in [dB].

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
125	69.8	69.9	0.1	-1.0	1.0	0.4	Passed
250	77.4	77.4	0.0	-1.0	1.0	0.4	Passed
500	82.8	82.8	0.0	-1.0	1.0	0.4	Passed
1000	86.0	86.0	0.0	-0.7	0.7	0.4	Passed
2000	87.2	87.2	0.0	-1.0	1.0	0.4	Passed
4000	87.0	86.9	-0.1	-1.0	1.0	0.4	Passed
8000	84.9	85.0	0.1	-2.5	1.5	0.4	Passed

NTi AUDIO

4. Electric signal tests of frequency weightings

Frequency weightings are determined relative to the response at 1 kHz using steady sinusoidal electrical input signals. The sound level meter is set to display F-time-weighted sound level in the reference level range. All available frequency weightings provided in the sound level meter are verified. All levels in [dB].

4.1 A-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	106.2	79.9	-0.1	-1.0	1.0	0.1	Passed
125	96.1	79.9	-0.1	-1.0	1.0	0.1	Passed
250	88.6	79.9	-0.1	-1.0	1.0	0.1	Passed
500	83.2	79.9	-0.1	-1.0	1.0	0.1	Passed
2000	78.8	80.0	0.0	-1.0	1.0	0.1	Passed
4000	79.0	79.9	-0.1	-1.0	1.0	0.1	Passed
8000	81.1	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	84.3	79.8	-0.2	-2.5	1.5	0.1	Passed
16000	86.6	79.7	-0.3	-2.5	1.5	0.1	Passed

4.2 C-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.8	79.9	-0.1	-1.0	1.0	0.1	Passed
125	80.2	80.0	0.0	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
2000	80.2	80.0	0.0	-1.0	1.0	0.1	Passed
4000	80.8	79.9	-0.1	-1.0	1.0	0.1	Passed
8000	83.0	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	86.2	79.8	-0.2	-2.5	1.5	0.1	Passed
16000	88.5	79.7	-0.3	-2.5	1.5	0.1	Passed

4.3 Z-Weighting

Freq. [Hz]	Gen. level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
1000	80.0	80.0	0.0	-0.7	0.7	0.1	Passed
63	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
125	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
250	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
500	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
2000	80.0	80.0	0.0	-1.0	1.0	0.1	Passed
4000	80.0	79.9	-0.1	-1.0	1.0	0.1	Passed
8000	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed
12500	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed
16000	80.0	79.9	-0.1	-2.5	1.5	0.1	Passed

NTi AUDIO

5. Frequency and time weightings at 1kHz

While injecting a constant steady signal at the reference frequency of 1 kHz the F-time-weighted sound level, S-time-weighted sound level and time-averaged sound level are verified with frequency weighting A. Additionally the F-time-weighted sound level for frequency weightings C and Z is measured. The first measurement serves as reference and differences in the reading with respect to this first one are determined. All levels in [dB].

Level	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LAS	114.0	113.8	-0.2	-0.7	0.7	0.1	Passed
LAeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LCeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZF	114.0	114.0	0.0	-0.7	0.7	0.1	Passed
LZeq	114.0	114.0	0.0	-0.7	0.7	0.1	Passed

6. Level linearity on the reference level range

The level linearity on the reference level range is determined by applying steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A and fast time-weighting. All levels in [dB].

Exp abs level	Meas. level	Abs dev	Abs Limit -	Abs Limit +	Exp rel level	Rel dev	Rel Limit -	Rel Limit +	Uncert.	Status
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
119.0	119.0	0.0	-0.8	0.8	119.0	0.0	-0.3	0.3	0.1	Passed
124.0	124.0	0.0	-0.8	0.8	124.0	0.0	-0.3	0.3	0.1	Passed
125.0	125.0	0.0	-0.8	0.8	125.0	0.0	-0.3	0.3	0.1	Passed
114.0	114.0	0.0	-0.8	0.8	0.0	0.0	-0.3	0.3	0.1	Passed
109.0	109.0	0.0	-0.8	0.8	109.0	0.0	-0.3	0.3	0.1	Passed
104.0	104.0	0.0	-0.8	0.8	104.0	0.0	-0.3	0.3	0.1	Passed
99.0	99.0	0.0	-0.8	0.8	99.0	0.0	-0.3	0.3	0.1	Passed
94.0	94.0	0.0	-0.8	0.8	94.0	0.0	-0.3	0.3	0.1	Passed
89.0	89.0	0.0	-0.8	0.8	89.0	0.0	-0.3	0.3	0.1	Passed
84.0	84.0	0.0	-0.8	0.8	84.0	0.0	-0.3	0.3	0.1	Passed
79.0	79.0	0.0	-0.8	0.8	79.0	0.0	-0.3	0.3	0.1	Passed
74.0	74.0	0.0	-0.8	0.8	74.0	0.0	-0.3	0.3	0.1	Passed
69.0	69.0	0.0	-0.8	0.8	69.0	0.0	-0.3	0.3	0.1	Passed
64.0	64.0	0.0	-0.8	0.8	64.0	0.0	-0.3	0.3	0.1	Passed
59.0	59.0	0.0	-0.8	0.8	59.0	0.0	-0.3	0.3	0.1	Passed
54.0	54.0	0.0	-0.8	0.8	54.0	0.0	-0.3	0.3	0.1	Passed
49.0	49.0	0.0	-0.8	0.8	49.0	0.0	-0.3	0.3	0.1	Passed
44.0	44.0	0.0	-0.8	0.8	44.0	0.0	-0.3	0.3	0.1	Passed
39.0	39.0	0.0	-0.8	0.8	39.0	0.0	-0.3	0.3	0.1	Passed
34.0	34.1	0.1	-0.8	0.8	34.0	0.1	-0.3	0.3	0.1	Passed
33.0	33.1	0.1	-0.8	0.8	33.1	0.0	-0.3	0.3	0.1	Passed
32.0	32.1	0.1	-0.8	0.8	32.1	0.0	-0.3	0.3	0.1	Passed
31.0	31.2	0.2	-0.8	0.8	31.1	0.1	-0.3	0.3	0.1	Passed
30.0	30.2	0.2	-0.8	0.8	30.2	0.0	-0.3	0.3	0.1	Passed

7. Level linearity including the level range control

The test is performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter set for frequency weighting A and fast time weighting. With the input signal level kept constant, the indicated signal level is recorded for all level ranges where the applied signal level is displayed. All levels in [dB].

		Low Range		Mid Range		High Range			
Starting Range	Source level	Dev	Limit +/-	Dev	Limit +/-	Dev	Limit +/-	Uncert.	Status
Low	94	0.0	0.40	0.0	0.15	0.0	0.15	0.1	Passed
Mid	114			0.0	0.30	0.0	0.55	0.1	Passed
High	134					0.0	0.30	0.1	Passed
Low	29	0.1	0.30					0.1	Passed
Mid	36			0.1	0.30			0.1	Passed
High	58					0.1	0.30	0.1	Passed

8. Toneburst response

The response of the sound level meter to short-duration signals is tested on the reference level range with 4 kHz tonebursts that start and stop at zero crossings and are extracted from steady 4 kHz sinusoidal electrical input signals. The sound level meter is set for frequency weighting A. All levels in [dB].

The continuous signal level is 123 dB.

Burst signal	Burst duration [ms]	Exp level	Meas level	Dev	Limit -	Limit +	Uncert.	Status
LAF	200	122.0	122.0	0.0	-0.5	0.5	0.2	Passed
LAF	2	105.0	104.9	-0.1	-1.5	1.0	0.2	Passed
LAF	0.25	96.0	95.8	-0.2	-3.0	1.0	0.2	Passed
LAS	200	115.6	115.6	0.0	-0.5	0.5	0.2	Passed
LAS	2	96.0	96.0	0.0	-3.0	1.0	0.2	Passed
LAeq10s	200	106.0	106.0	0.0	-0.5	0.5	0.2	Passed
LAeq10s	2	86.0	85.9	-0.1	-0.5	0.5	0.2	Passed
LAeq10s	0.25	77.0	76.8	-0.2	-0.5	0.5	0.2	Passed

NTi AUDIO

9. C-weighted peak sound level

The sound level meter is tested on the least-sensitive level range with fast time weighting and C frequency weighting. The test signals are a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings. All levels in [dB].

Burst signal	Source level	Exp LCp-LCF	Meas LCp-LCF	Dev	Limit -	Limit +	Uncert.	Status
8kHz	129.0	3.4	3.1	-0.3	-2.0	2.0	0.2	Passed
500Hz +	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed
500Hz -	132.0	2.4	2.2	-0.2	-1.0	1.0	0.2	Passed

10. Overload Indication

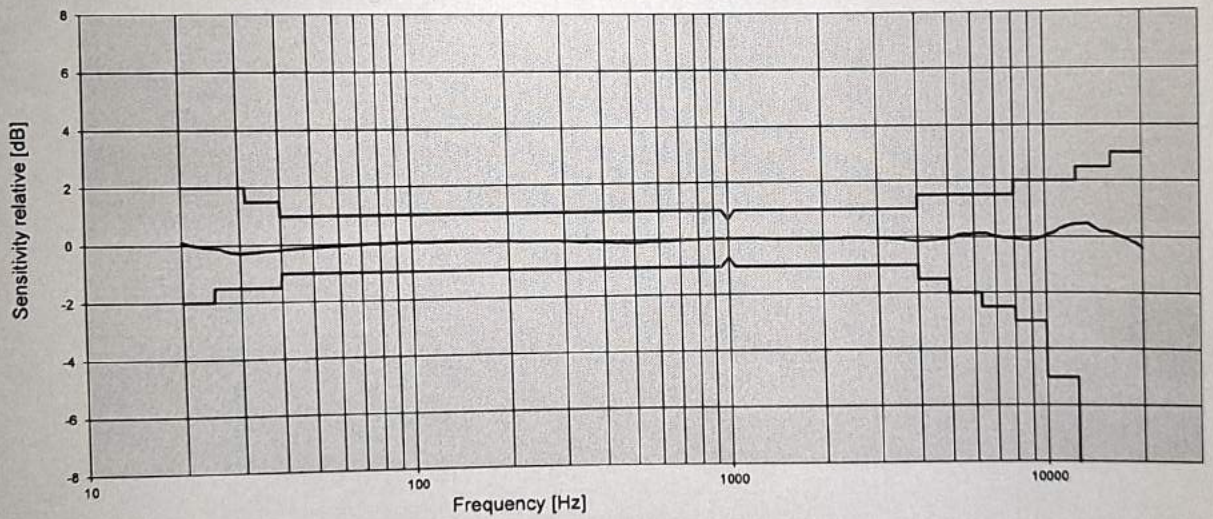
Overload indication is tested on the least-sensitive level range with the sound level meter set to A-weighted, time-averaged sound level. Positive and negative one-half-cycle sinusoidal electrical signals at a frequency of 4 kHz are used. All levels in [dB].

Start level	OV +	OV -	Dev	Limit -	Limit +	Uncert.	Status
136.6	138.8	138.9	0.1	-1.5	1.5	0.3	Passed

NTi AUDIO

Frequency Response

Measurement Microphone **M2230** consisting of **MA220 PreAmplifier** S.No. **10699**
MC230A Capsule S.No. **A22991**



Sensitivity @ 1 kHz = 44.1 mV/Pa

CERTIFICATE OF CALIBRATION

ISSUED BY	Gracey & Associates	BSI CERTIFICATE	FS 25913
DATE OF ISSUE	30 January 2023	CERTIFICATE NUMBER	2023-0195
DATE OF CALIBRATION	27 January 2023		
CALIBRATION INTERVAL	12 months		PAGE 1 OF 1

Gracey & Associates
Barn Court Shelton Road
Upper Dean PE28 0NQ
Tel: 01234 708835
www.gracey.co.uk

TEST ENGINEER
Jamie Bishop

APPROVING SIGNATORY
Greg Rice

Equipment **NTi XL2 S, s/n: a2a-08072-e0**
Description Acoustic Analyser - STIPA, NTi Audio

Customer Gracey & Associates

Standards
BS EN 60651

Conditions

Atmospheric Pressure	102.4 kPa
Temperature	21.5 °C
Relative Humidity	30.1 %

Calibration Reference Sources

Equipment	S/N	Last Cal	Equipment	S/N	Last Cal
Druck DPI 141	479	06-Aug-20	HP 34401	3146A16728	08-Apr-22
Vaisala HMP23	S2430007	03-Aug-20			

Notes

We certify that the above product was duly tested and found to be within the specification at the points measured (except where indicated). Measurements are traceable to reference sources calibrated to National Standards. Where no national or international standards exist, traceability is to standards maintained by the manufacturer. Our Quality Management System has been assessed to comply with BS EN ISO 9001:2015 - BSI Certificate number FS 25913. Tests were carried out in environmental conditions controlled to the extent appropriate to the instrument's specification. All relevant test certificates are available for inspection.
The uncertainties are for a confidence probability of not less than 95%.

CERTIFICATE OF CONFORMANCE

ISSUED BY	Gracey & Associates	BSI CERTIFICATE	FS 25913
DATE OF ISSUE	30 January 2023	CERTIFICATE NUMBER	2023-0196
DATE OF CALIBRATION	27 January 2023		
CALIBRATION INTERVAL	12 months		PAGE 1 OF 1

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TEST ENGINEER
Jamie Bishop

APPROVING SIGNATORY
Greg Rice

Equipment **NTi MA220, s/n: 3341**
Description Preamplifier - XL2, NTi Audio

Customer Gracey & Associates

Standards
Manufacturer Specifications

Conditions

Atmospheric Pressure	102.4 kPa
Temperature	21.1 °C
Relative Humidity	30.1 %

Calibration Reference Sources

Equipment	S/N	Last Cal	Equipment	S/N	Last Cal
Druck DPI 141	479	06-Aug-20	HP 34401	3146A16728	08-Apr-22
Vaisala HMP23	S2430007	03-Aug-20			

Notes

We certify that the above product was duly tested and found to be within the specification at the points measured (except where indicated). Measurements are traceable to reference sources calibrated to National Standards. Where no national or international standards exist, traceability is to standards maintained by the manufacturer. Our Quality Management System has been assessed to comply with BS EN ISO 9001:2015 - BSI Certificate number FS 25913. Tests were carried out in environmental conditions controlled to the extent appropriate to the instrument's specification. All relevant test certificates are available for inspection.
The uncertainties are for a confidence probability of not less than 95%.

CERTIFICATE OF CALIBRATION

ISSUED BY	Gracey & Associates	BSI CERTIFICATE	FS 25913
DATE OF ISSUE	30 January 2023	CERTIFICATE NUMBER	2023-0197
DATE OF CALIBRATION	27 January 2023		
CALIBRATION INTERVAL	12 months		PAGE 1 OF 2

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TEST ENGINEER
Jamie Bishop

APPROVING SIGNATORY
Greg Rice

Equipment **NTi MC230, s/n: A21516**
Description Microphone - 1/2" FF 48V, NTi Audio

Customer Gracey & Associates

Standards
BS EN 61094

Conditions

Atmospheric Pressure	102.5 kPa
Temperature	21.5 °C
Relative Humidity	30.1 %

Calibration Data

Sensitivity	-26.5 dB
	47.2 mV/Pa

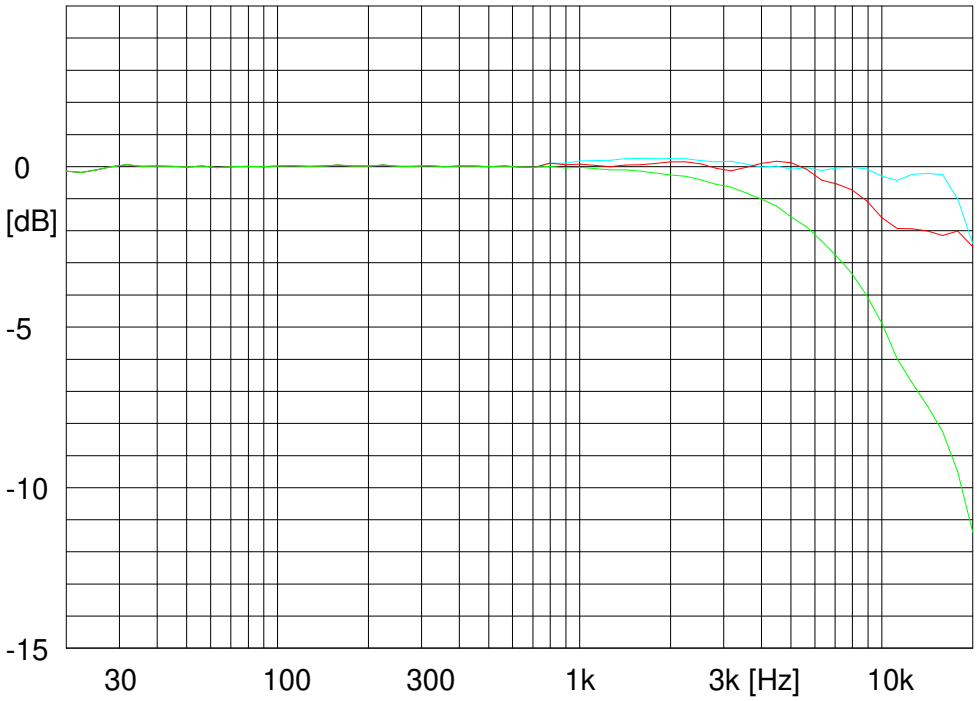
Calibration Reference Sources

Equipment	S/N	Last Cal	Equipment	S/N	Last Cal
B&K 4134 L	1935995	08-Oct-21	Druck DPI 141	479	06-Aug-20
HP 34401	3146A16728	08-Apr-22	Nor 1253	22456	08-Oct-21
Stanford DS36	33213	17-Aug-20	Vaisala HMP23	S2430007	03-Aug-20

Notes

We certify that the above product was duly tested and found to be within the specification at the points measured (except where indicated). Measurements are traceable to reference sources calibrated to National Standards. Where no national or international standards exist, traceability is to standards maintained by the manufacturer. Our Quality Management System has been assessed to comply with BS EN ISO 9001:2015 - BSI Certificate number FS 25913. Tests were carried out in environmental conditions controlled to the extent appropriate to the instrument's specification. All relevant test certificates are available for inspection.
The uncertainties are for a confidence probability of not less than 95%.

Microphone Calibration Certificate



NTi
Type: MC230

Serial no: A21516

Sensitivity: 47.2 mV/Pa
-26.5 dB re. 1 V/Pa

Date: 27/01/2023

Signature:

Measurement conditions:

Polarisation voltage:	0.0 V
Pressure:	102.51 kPa
Temperature:	21.5 °C
Relative humidity:	30.1 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

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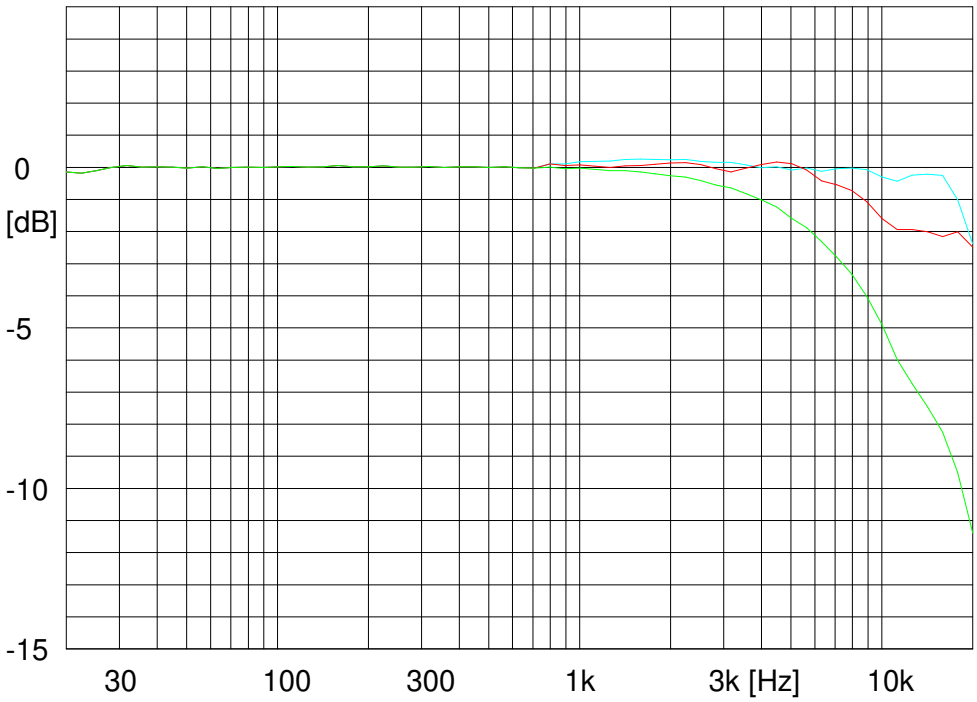
Microphone Calibration Certificate



NTi
Type: MC230

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-26.5 dB re. 1 V/Pa

Date: 27/01/2023

Signature:

Measurement conditions:

Polarisation voltage:	0.0 V
Pressure:	102.51 kPa
Temperature:	21.5 °C
Relative humidity:	30.1 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

Gracey & Associates
www.gracey.com

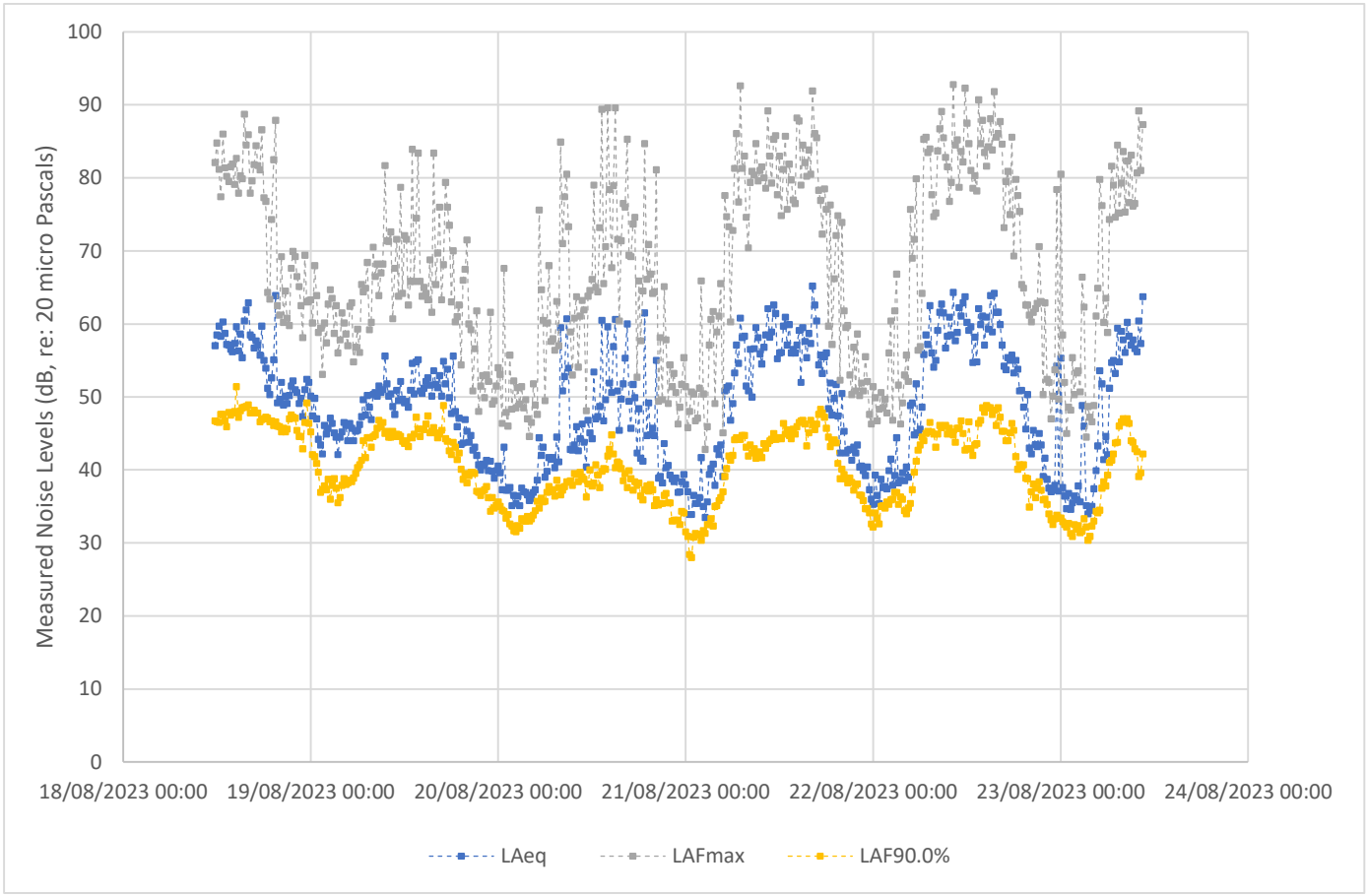
Comment:

APPENDIX 3 AUTOMATED NOISE MONITORING RESULTS

Project Information	
Project Number	WG-2417
Date	22/05/2023
Measurement Position	Position 1
Sheet Reference	CE-WG-2417-CALC-001

External Broadband Noise Levels	Measured Noise Levels (dB, re: 20 micro Pascals)		
	$L_{Aeq,T}$	Typical $L_{A90,\ 15mins}$	Typical L_{AFMax}
Daytime (07:00 to 19:00)	56	45	
Evening (19:00 to 23:00)	50	33	
Night-time (23:00 to 07:00)	46	28	72

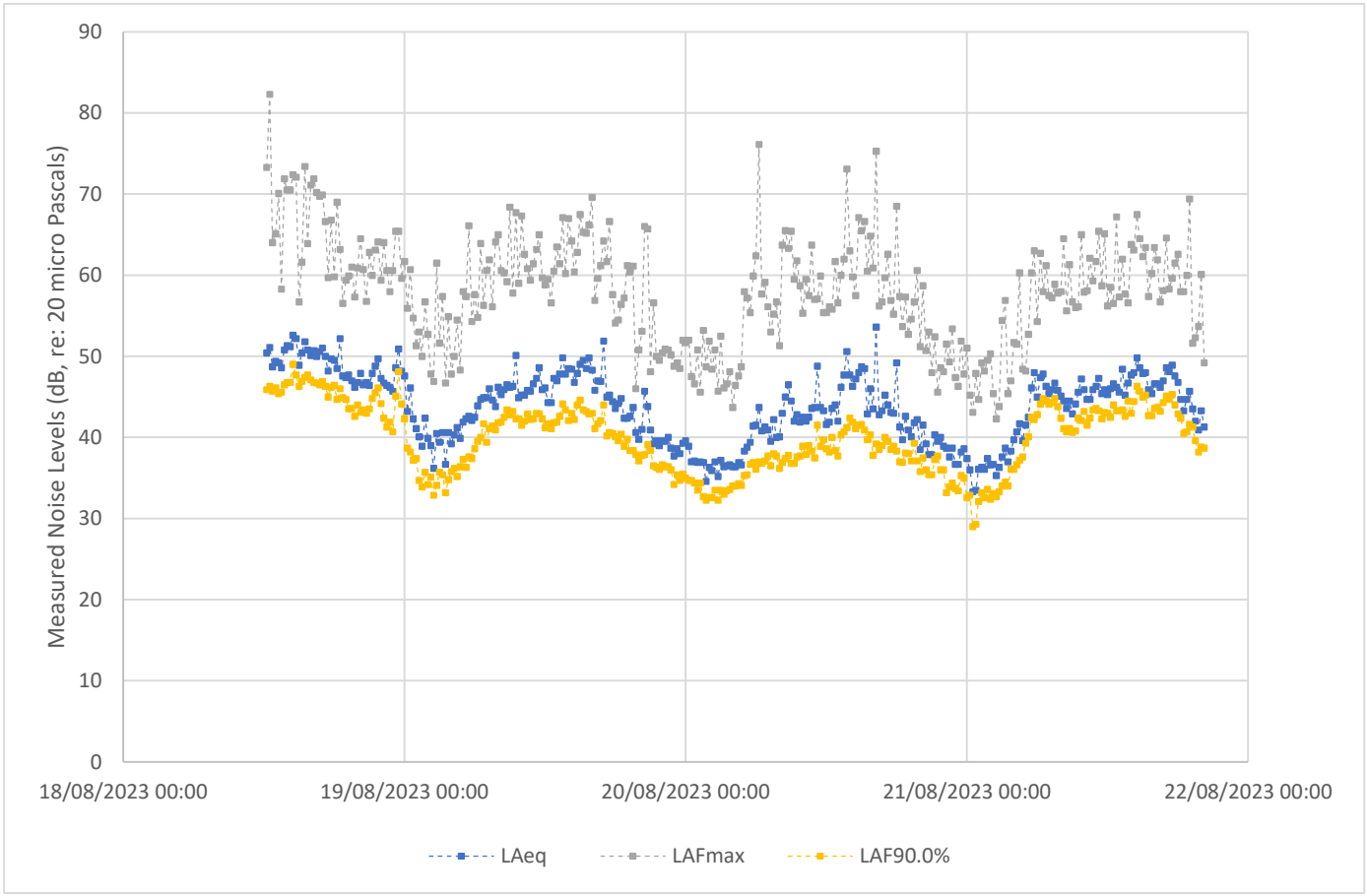
External Noise Levels (Free Field)	Measured Noise Levels (dB, re: 20 micro Pascals)								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Average Noise Level ($L_{Aeq,16hr}$)	37	41	45	49	51	49	46	44	55
Average Noise Level ($L_{Aeq,8hr}$)	29	32	36	39	42	40	37	36	46
Typical Maximum Noise Level (L_{AFMax})	55	58	59	63	66	65	63	66	72



Project Information	
Project Number	WG-2417
Date	22/05/2023
Measurement Position	Position 1
Sheet Reference	CE-WG-2417-CALC-002

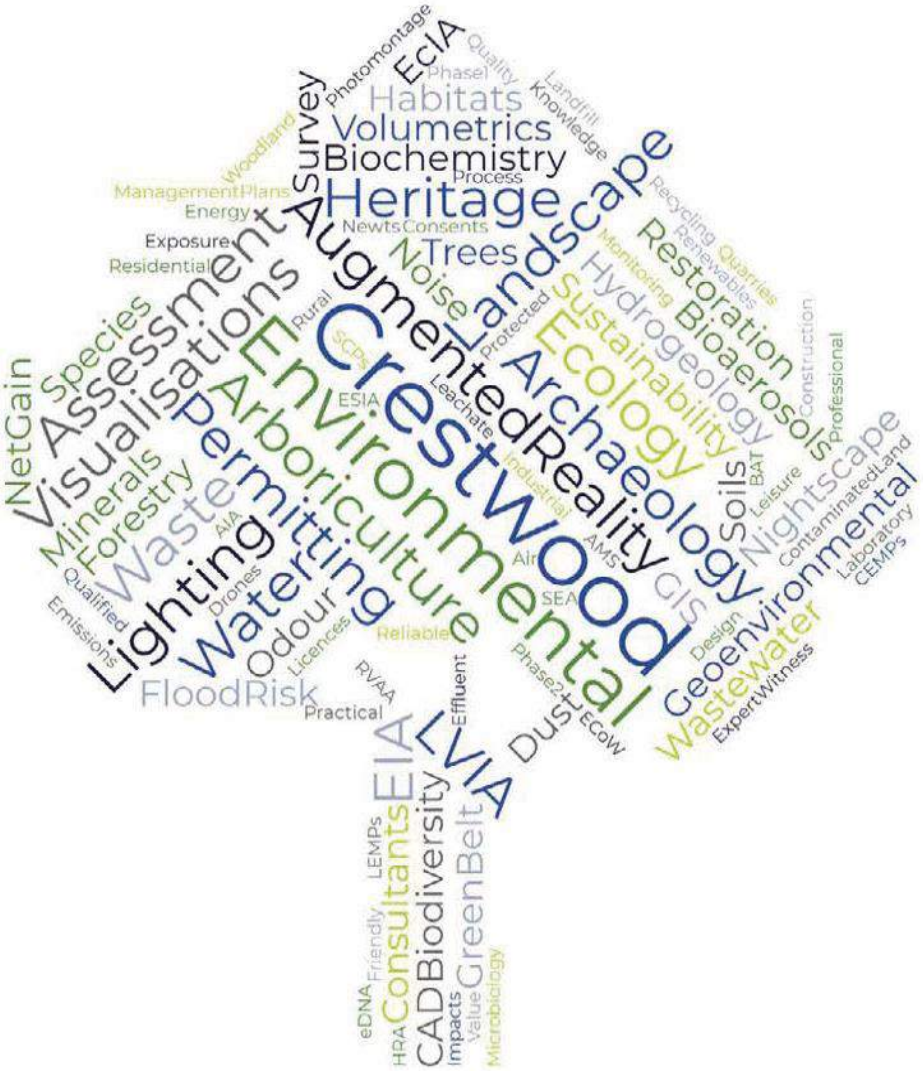
External Broadband Noise Levels	Measured Noise Levels (dB, re: 20 micro Pascals)		
	$L_{Aeq,T}$	Typical $L_{A90,\ 15mins}$	Typical L_{AFMax}
Daytime (07:00 to 19:00)	47	43	
Evening (19:00 to 23:00)	44	36	
Night-time (23:00 to 07:00)	42	29	61

External Noise Levels (Free Field)	Measured Noise Levels (dB, re: 20 micro Pascals)								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
Average Noise Level ($L_{Aeq,16hr}$)	58	50	44	42	41	37	35	30	46
Average Noise Level ($L_{Aeq,8hr}$)	52	43	38	38	38	34	30	28	42
Typical Maximum Noise Level (L_{AFMax})	72	62	54	56	57	54	50	49	61



APPENDIX 4 CRESTWOOD ENVIRONMENTAL PROJECT TEAM

Position	Name	Years of Experience	Qualifications
Project Lead Report Author	Chris Turner	More than 18 years post graduate experience in Acoustics	BSc(Hons) Physics and Computer Science MSc Applied Acoustics and Noise Control Incorporated Engineer Member of the Institute of Acoustics Member of the Institute of Directors Member of the Institute of Physics
Assistant working under supervision of the Project Lead	Daniel Jones	~ 1-year post-graduate experience	BSc (Hons) Biology and Environmental Science MSc Environmental Sustainability and Green Technology Graduate Member of the Institute of Environmental Management and Assessment
Report QA	Kate Brady	More than 10 years of Environmental Permitting	BSc (Hons) Environmental Science and Health MSc Environmental Diagnosis and Management Member of the Chartered Institution of Water and Environmental Management



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