Little Crow
Solar Park

Little Crow Solar Park, Scunthorpe

APPENDIX 4.9

NOISE IMPACT ASSESSMENT

DEADLINE 2

Revision: Deadline 2 - Rev A
Regulation No: APFP Reg: 5(2)(a)
PINS Reference: EN010101

Author: Clement Acoustics
Date: May 2021

On behalf of INRG Solar (Little Crow) Ltd

Document			
Document Properties			
Prepared By	Clements Acoustics		
Title	NOISE IMPACT ASSESSMENT		
Document Reference	7.16A LC TA4.9		
Version History			
Date	**Version**	**Status**	**Description/Changes**
Nov-20			
May-21	A		

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LITTLE CROW SOLAR PARK, SCUNTHORPE

NOISE IMPACT ASSESSMENT

Report **14027-NIA-01 RevJ**

Prepared on 24 May 2021

Issued For:

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1.0 INTRODUCTION

Clement Acoustics has been commissioned by INRG Solar (Little Crow) Ltd to measure existing background noise levels at the proposed Little Crow Solar Park to the west of Appleby Lane, Scunthorpe DN20 0BG. The measured noise levels have been used to determine noise emission criteria for plant and activities associated with a proposed solar park in agreement with the planning requirements of North Lincolnshire Council.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

It is noted that the following comments have been made regarding the issue of noise by representatives of the Local Authority:

- Environmental Health Response (ref PLU 009333) associated with Pre-Planning Application (ref PRE/2018/137) included the following comments on noise:
  "*However, given the location and nature of the proposed development, it is likely that operational noise will not give rise to significant adverse impact provided that any necessary mitigation measures are included. This department would expect a planning application to include details of operational noise sources and predicted noise levels at relevant locations*."
- The Statement of Common Ground (Document Ref 9.4 LC OTH, PINS Ref APP-112) includes the following statement:
  "*Noise is not expected to constitute a significant impact on surrounding receivers (with mitigation measures recommended accordingly), and a supplementary report to the Environmental Impact Assessment is therefore considered appropriate*."

On the basis of the above comments, earlier revisions of this report have sought to identify areas where mitigation is likely to be required, with recommendations and summaries presented accordingly. Further to an increased focus on noise associated with the proposed access track, full summaries of the assessments of this noise source are now included herein.

2.0 SITE DESCRIPTION

The main element of the proposal is the construction, operation, maintenance and decommissioning of a ground mounted solar park and associated battery storage with an intended design capacity of over 50MWp (megawatts peak). As associated development, battery storage will allow the development to fully utilise the network connection capacity when the solar park is not exporting at peak capacity. The batteries would be available to store energy from and release electrical energy to the local electricity network.

Proposals will include the installation and operation of associated equipment and plant units, and use of an access track during the construction, operational and decommissioning phases.

The attached site plan in Appendix A shows an aerial view of the existing site, with a red line indicative of the Order Limits marked on it.

Surrounding properties identified as residential are shown on the attached site plan in Appendix A and have been identified as the nearest affected receivers. These nearest noise sensitive receivers were identified through observations on-site. If there are any receivers closer to those identified within this report when construction is due to commence then a further assessment will need to be carried out. Therefore, the closest noise sensitive receptor should be confirmed by the client before the plant is installed or any noise mitigation measures are implemented.

The residential receivers are identified as follows:

- Receiver 1 [Springwood Lodge, Ermine Street]:
    - Farm with associated dwellings to the north east,
- Receiver 2 [Heron Lodge (also known as Fennswood)]:
    - Residential house to the north east of the main site, and to the south of the Access Track,
- Receiver 3 [Gokewell Priory Farm]:
    - Chicken farm with associated dwelling to the east of the main site, and to the south of the Access Track,
- Receiver 4 [Appleby Gardens]:
    - Representative of residential houses on Appleby Gardens, South View, Westwood, Westminster Road and surrounding residential roads.

The receiver locations are shown in the attached site plan in Appendix A. This site plan is based on the Order Limits Aerial Plan (Document ref 2.39 LC DRW, PINS Ref APP-043).

3.0 ENVIRONMENTAL NOISE SURVEY

Environmental noise surveys were undertaken at positions deemed representative of each receiver location, prior to the commencement of any development works. Surveys were conducted in accordance with BS 7445: 1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.[1] [BS 7445-2]

This standard describes requirements and preferences for obtaining representative noise data in relation to determining the compatibility of land use activity with respect to existing or predicted noise.

The standard states requirements and preferences, including but not limited to:

- Sensitivity of equipment used to measure noise levels
    - Instrumentation should preferably be Type 1, but at least Type 2
- Correct location of noise monitoring of equipment
    - 1.2 to 1.5 m above floor level
    - More than 3 m away from reflective surfaces

The environmental noise monitoring procedure also considers the timings and locations of the surveys, which were agreed with the Local Authority, as stated in the Statement of Common Ground (Document Ref 9.4 LC OTH, PINS Ref APP-112).

1 British Standard 7445: 1991 '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*', British Standards Institution, 1991

3.1 Unattended Noise Survey Procedure

Measurements were undertaken at three positions as shown on the existing site in attached site plan 14027-SP1. The choice of these positions was based both on accessibility and on collecting representative noise data in relation to the nearest affected receivers. The selected monitoring locations are considered to provide suitably representative noise data for assessing predicted levels of noise emissions to the identified sensitive receivers.

The surroundings and position used for each monitoring location are described in Table 3.1.

Position No.	Description
1	The microphone was mounted on a tripod at the northeast of the site, towards receivers to the northeast. The microphone was positioned 1.5 m from the ground and away from any reflective surfaces. [1]
2	The microphone was mounted on a tripod at the east of the site, close to the existing farm premises. The microphone was positioned 1.5 m from the ground and away from any reflective surfaces. [1]
3	The microphone was mounted on a tripod at the southeast of the site. The microphone was positioned 1.5 m from the ground and away from any reflective surfaces. [1]

Table 3.1: Description of unattended monitoring locations

Note [1]: The position was considered to be free-field according to guidance found in BS 7445-2, which states that corrections need not be applied to measured noise levels where they are more than 3.5 m from a building facade.

Continuous automated monitoring was undertaken for the duration of the survey between 13:45 on 27 September 2018 and 19:00 on 30 September 2018, in agreement with the Statement of Common Ground (Document Ref 9.4 LC OTH, PINS Ref APP-112).

The measurement procedure complied with BS 7445-2.

3.2 Weather Conditions

At the time of set-up and collection of the monitoring equipment, the weather conditions were generally dry with light winds.

Weather conditions during the survey period have been obtained from the internet resource www.wunderground.com, which identified Humberside Airport as the nearest weather station. Wunderground.com indicates that there was no precipitation during the surveys, with windspeeds generally less than 12 mph, with only short periods with gusts above that.

It is considered that the weather conditions did not significantly adversely affect the measurements and are therefore considered suitable for the measurement of environmental noise.

3.3 Equipment

The equipment calibration was verified, by means of a field verification check, before and after use and no abnormalities were observed.

The equipment used was all Class 1, which is the equivalent of Type 1, stated as the preference for instrumentation in BS 7445-2.

The equipment used is as shown in Table 3.2.

Position No.	Make / Model	Type	Serial Number
1	Svantek 957	Class 1 Sound Level Meter	15385
2	Svantek 957	Class 1 Sound Level Meter	28003
3	Svantek 977	Class 1 Sound Level Meter	45354
All	Norsonic Type 1251	Class 1 Calibrator	31716

Table 3.2: Equipment Used

Calibration certificates are shown in Appendix F.

4.0 RELEVANT NOISE CRITERIA

4.1 Local Authority Statement of Common Ground

Further to liaison with the Local Authority, a Statement of Common Ground (Document Ref 9.4 LC OTH, PINS Ref APP-112), has been established, wherein it has been agreed that British Standard 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'[2] [BS 4142] is the appropriate standard to assess the effects of operational noise of the solar park.

4.2 Operational Noise: BS 4142 Criteria

In a BS 4142 assessment, corrections are applied to noise levels in order to calculate a noise rating level for the effects of proposed activities on nearby noise sensitive receivers. Levels are calculated at the nearest residential window.

Section 9.2 of BS 4142 establishes penalties that may be applied to noise sources depending on specific features of the noise to obtain the noise rating level. The penalties as defined and described in BS 4142 are summarised in Table 4.1.

Characteristic	Comments	Maximum Penalty
Tonality	Can be converted to 2 dB for a tone which is just perceptible, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible	6 dB
Impulsivity	Can be converted to 3 dB for impulsivity which is just perceptible, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible	9 dB
Distinctiveness	Intended for sources that are neither tonal nor impulsive, but distinctive against background noise sources	3 dB
Intermittency	When the sound has identifiable on/off conditions	3 dB

Table 4.1: Available penalties according to BS4142

BS 4142 states that a noise rating 5 dB above the background noise level is likely to be an indication of an adverse impact. If the difference is 10 dB or more, then this is stated as likely to be an indication

2 Britisg Standard 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*', British Standards Institution, 2014

of a significant adverse impact. Where the rating level does not exceed the background noise level, this is stated as an indication of the sound source having a low impact.

4.3 Construction Noise Criteria

The method for assessing the severity of construction noise on residential properties is presented as Example Method 1 (the ABC Method) of British Standard 5228-1: 2009 '*Code of practice for noise and vibration control on construction and open sites. Part 1: Noise*'[3] [BS 5228-1], within section E.3.2.

Table E.1 from the standard is reproduced below in Table 4.2.

Assessment Category and threshold value period (L_{Aeq})	Category A[A]	Category B[B]	Category C[C]
Daytime (07:00 - 19:00) and Saturdays (07:00 - 13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold value for the category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity. Note 3: Applied to residential receptors only[1].			
[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values [B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. [C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Table 4.2: Guidance on setting noise emission thresholds for construction sites

[1] As any non-residential sensitive receptors are further from the site and would have less onerous criteria, they will be inherently protected through the assessment undertaken for the identified receivers.

The measured ambient noise levels on site will be used to determine suitable criteria for construction noise, according to the above method.

3 British Standard *5228-1:2009 'Code of practice for noise and vibration control on construction and open sites. Noise'*, British Standards Institution, 2009.

4.4 Proposed Use of Access Track

Changes to traffic flows along a stretch of road (in this case the access track) can typically be assessed according to the guidance of the Design Manual for Roads and Bridges[4] [DMRB]. This standard describes the expected effects on residential receptors, according to the calculated change to road traffic noise in decibels for short term and long term increases to traffic flow.

However, it is understood that the access track is currently used to provide access to agricultural land for tillage operations. Therefore, although it can be demonstrated that the access track already provides access to heavy good vehicles, the nature of the traffic means usage could be highly sporadic. Comparison of projected flows against the existing baseline would therefore be unlikely to provide a reliable and representative assessment.

Section 3.43 of DMRB states:

> "*For the prediction of road traffic noise the methodology given in the CRTN should be used. Annex 4 provides additional guidance on the use of CRTN*."

Calculation of Road Traffic Noise[5] [CRTN] gives methodologies for predicting noise levels from flows of traffic along roads. Section 30 of CRTN states that the methodologies are suitable where traffic flows exceed 50 vehicles per hour, and that for lower flow rates of traffic they may be unreliable.

Traffic along the access track during operational and construction phases will therefore be assessed according to the Standards referenced in Sections 4.2 and 4.3 respectively, each of which includes provisions for such an assessment.

4 Design Manual for Roads and Bridges (DMRB), Volume 11 '*Environmental Assessment',* The Highways Agency, Transport Scotland, Welsh Government, The Department For Regional Development Northern Irelane, November 2011

5 Calculation of Road Traffic Noise, Department of Transport Welsh Office, 1988

5.0 RESULTS

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured at the locations shown in the site plan in Appendix A.

The measured noise levels are shown as time histories in Appendix C.

5.1 Background Noise Levels for BS 4142 Assessment

BS 4142 comprises a comparison of predicted noise emissions from the operational phase of the development with representative background noise levels measured during the initial surveys.

Analysis of the measured background noise levels has been undertaken in accordance with the statistical analysis method example as shown in Figure 4 of BS 4142. It should be noted that the guidance of the standard is as follows:

"The objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

The frequency distribution of background noise levels measured during the worst-case proposed hours of operation (07:00 to 17:00) are shown in Figures 5.1 to 5.3 for Positions 1 to 3 respectively.

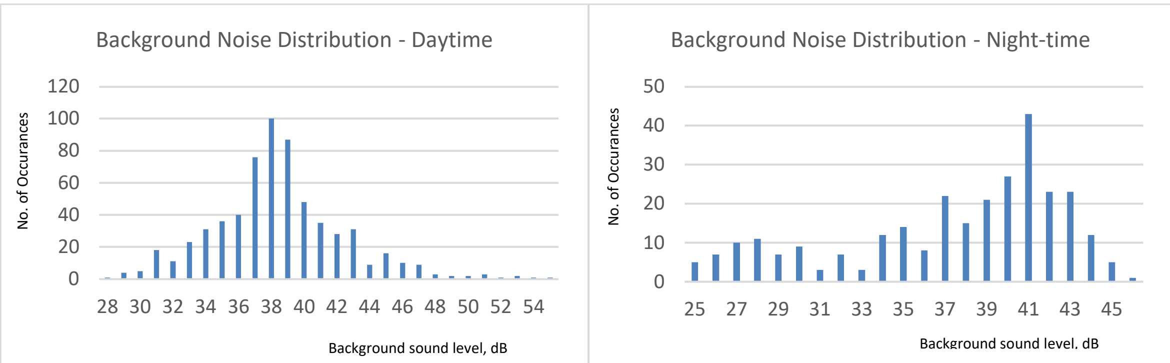


Figure 5.1: Statistical analysis of the background noise level at Position 1

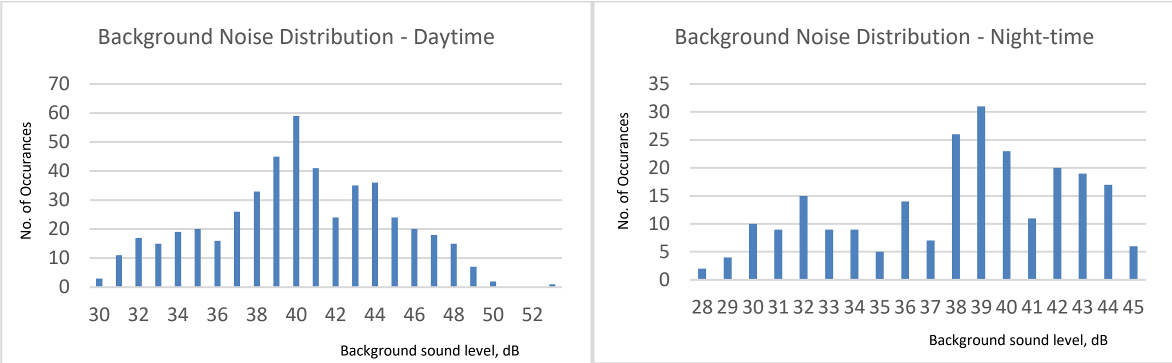


Figure 5.2: Statistical analysis of the background noise level at Position 2

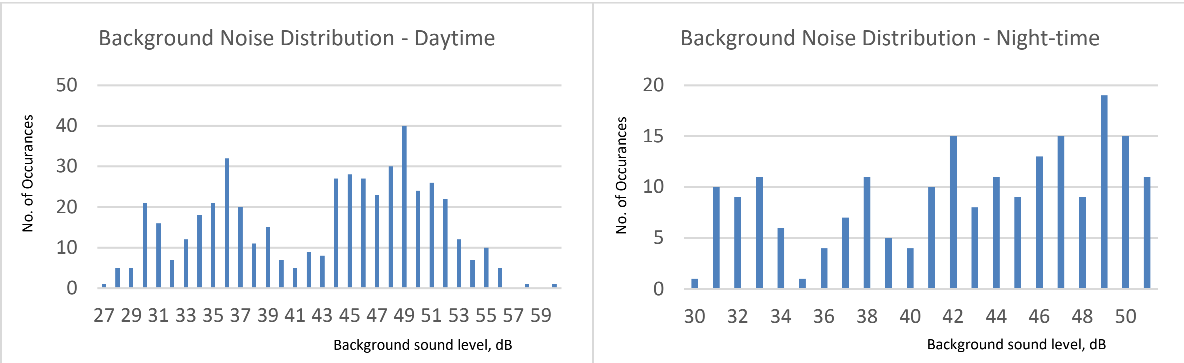


Figure 5.3: Statistical analysis of the background noise level at Position 3

Based on the analysis shown in Figures 5.1 to 5.3, the typical background noise level has been determined to be **36 dB(A) during daytime hours** and **32 dB(A) during night-time hours**. This is considered to be in accordance with the conclusions drawn from the same methodology when used in the BS 4142 example.

5.2 Ambient Noise Levels for BS 5228 Assessment

As shown in Section 4.3, BS 5228-1 requires analysis of the measured ambient noise levels such that suitable criteria for construction noise can be established accordingly.

The data from the surveys has been analysed, with calculated ambient noise levels as shown in Table 5.1.

Period	Average Ambient Noise Level $L_{eq,\ T}$
Position 1 – Northeast of Site	
Daytime [07:00 - 23:00]	47 dB(A)
Night-time [23:00 - 07:00]	43 dB(A)
Position 2 – East of Site	
Daytime [07:00 - 23:00]	47 dB(A)
Night-time [23:00 - 07:00]	42 dB(A)
Position 3 – Southeast of Site	
Daytime [07:00 - 23:00]	53 dB(A)
Night-time [23:00 - 07:00]	48 dB(A)

Table 5.1: Site noise levels for daytime and night time

By comparing the levels shown in Table 5.1 with the guidance shown in Table 4.2, it is shown that this site falls into Category A.

The guidance of BS 5228-1 subsequently states that where the cumulative level due to construction noise and the existing ambient noise exceeds **65 dB(A)**, a significant effect has been deemed to occur.

As the existing ambient noise levels shown in Table 2.1 are more than 10 dB below this threshold value, this in effect becomes the threshold level for construction noise in isolation.

Calculations have been undertaken according to the guidance given in BS 5228 in order to predict worst-case levels of noise emissions.

6.0 PRELIMINARY NOISE IMPACT ASSESSMENT – OPERATIONAL NOISE

6.1 Onsite Plant

Exact details of the proposed plant installation are not currently known. However, a preliminary assessment has been undertaken in order to establish the likelihood of mitigation being required to avoid an unacceptable noise impact on the identified receptors.

Based on typical data for similar projects, and the known requirements for this project, and assessment has been undertaken considering the following indicative plant units:

- Battery Compound (16 Battery Containers)
  - 32 No. HVAC Units: Sound Power Level of Each 79 dB(A)
  - 36 No. Transformers: Sound Power Level of Each 70 dB(A)
  - 36 No. Inverters: Sound Power Level of Each 79 dB(A)
  - **Cumulative Sound Power Level 97.8 dB(A)**
- Substation Compound
  - 132 kV Transformer: Sound Power Level 90 dB(A)
- Inverter / Transformers (29 No. Distributed Around the Site)
  - Sound Pressure Level of Each (at 1 m) 85 dB(A)

The spectral content of noise emissions for transformers and inverters has been predicted using measured noise levels obtained from similar operational sites. Noise measurements were taken at Hardingham Solar Park of an operational solar park inverter, at a distance of 5 m. The measured noise levels are shown in Table 6.1.

	Sound Pressure Level (dB) in each Frequency Band at 5m								
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Solar Park Inverter	61	60	59	52	53	47	40	33	57

Table 6.1: Measured Sound Pressure Levels at 5 m of Existing Plant at Similar Site

The spectral content of this measurement has been used as a reference to define the spectral shape of transformer or inverter units. The spectral shape has been kept the same, with matching increases applied to each frequency level, such that the overall level matches the stated levels for the various transformers and inverters as detailed above.

For HVAC units, manufacturer data for a typical HVAC unit (Mitsubishi PU(H)-10) has been used, shifted to match the overall stated level.

In line with the guidance of BS 4142: 2014, a +3 dB penalty has been applied to the stated noise emissions, in order to account for potentially identifiable 'on/off' periods.

It is understood the Battery and Substation Compounds could be operational at any time, whereas the Inverter / Transformers around the site will be operational during daylight hours only.

It should be noted that there are currently two proposals for the layout of the site (Work No. 2A and Work No. 2B), with the location of the battery compound yet to be finalised. Figure 6.1 shows the two proposed layouts for the northern tip of the site.

In Work No. 2A (the preferred location), the battery compound will be located in a protrusion from the north surrounded by trees, while in Work No. 2B, the battery compound is located just to the north of the Substation Compound.

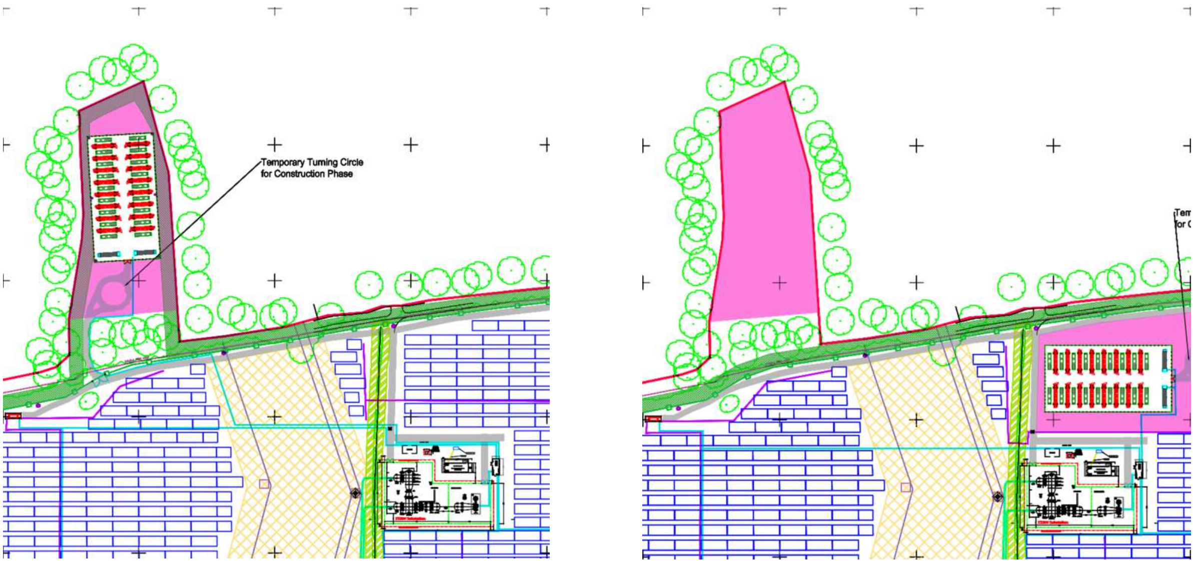


Figure 6.1: Indication of Battery Compound location in Work No. 2A and Work No. 2B

Based on the noise sources shown above and the topography, noise modelling has been undertaken to investigate complex propagation through the area.

The noise model was constructed using the proprietary noise modelling software package CadnaA. CadnaA is a computer aided noise model where noise sources are applied to a simulated environment to assess the impact at the nearest sensitive receptors. Noise emissions to the identified receptors have been predicted using the calculation methodology outlined in ISO 9613-2[6].

The noise model was constructed utilising the following assumptions and parameters:

- Locations of obstacles such as screens or barriers in the propagation path
- Presence of reflecting surfaces
- Hardness of the ground between the sources and receivers
- Attenuation due to atmospheric absorption

The proposed layout of the site including locations of noise generating equipment has been established using the Works Details – Whole Site Plan (Document Ref 2.10 LC DRW , PINS Ref APP-015).

Modelling has been undertaken for the two proposed layout options.

The model constructed for the Work No. 2A layout is shown in Appendix B, overlaid on the Works Details – Whole Site Plan (Document Ref 2.10 LC DRW , PINS Ref APP-015).

The resulting calculated noise levels at each receiver are summarised in Tables 6.2 and 6.3 for daytime and night-time operation of plant respectively, where they are compared with the established background noise levels.

Receptor	Background Noise Level	Work No. 2A Noise Rating Level	Difference	Work No. 2B Noise Rating Level	Difference
Receiver 1	L_{A90} 36 dB	L_{Aeq} 34.7 dB	-1.3 dB	L_{Aeq} 35.0 dB	-1.0 dB
Receiver 2		L_{Aeq} 40.5 dB	+ 4.5 dB	L_{Aeq} 40.6 dB	+ 4.6 dB
Receiver 3		L_{Aeq} 41.9 dB	+ 5.9 dB	L_{Aeq} 41.9 dB	+ 5.9 dB
Receiver 4		L_{Aeq} 31.3 dB	-4.7 dB	L_{Aeq} 31.4 dB	-4.6 dB

Table 6.2: BS 4142 Assessment for Receivers – Daytime

6 ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoor, Part 2: General method of calculation', International Organization for Standardization, 1996

Receptor	Background Noise Level	Work No. 2A Noise Rating Level	Difference	Work No. 2B Noise Rating Level	Difference
Receiver 1	L_{A90} 32 dB	L_{Aeq} 26.4 dB	-5.6 dB	L_{Aeq} 28.3 dB	-3.7 dB
Receiver 2		L_{Aeq} 27.0 dB	-5.0 dB	L_{Aeq} 29.2 dB	-2.8 dB
Receiver 3		L_{Aeq} 23.9 dB	-8.1 dB	L_{Aeq} 27.2 dB	-4.8 dB
Receiver 4		L_{Aeq} 14.4 dB	-17.6 dB	L_{Aeq} 16.2 dB	-15.8 dB

Table 6.3: BS 4142 Assessment for Receivers – Night-time

As shown in Tables 6.2 and 6.3, there are some exceedances during daytime hours, while night-time levels are expected to comply.

Mitigation has therefore been investigated in Section 6.2.

6.2 Discussion of Mitigation

As shown in Table 6.1, Receivers 2 and 3 could be subject to levels that exceed desirable levels during daytime hours. A study of partial levels has identified the closest noise sources, which are causing the exceedance.

The identified Inverter / Transformers that could require mitigation are indicated in Figure 6.3, circled in yellow. These have been marked on the extract from the Works Details – Whole Site Plan (Document Ref 2.10 LC DRW, PINS Ref APP-015).

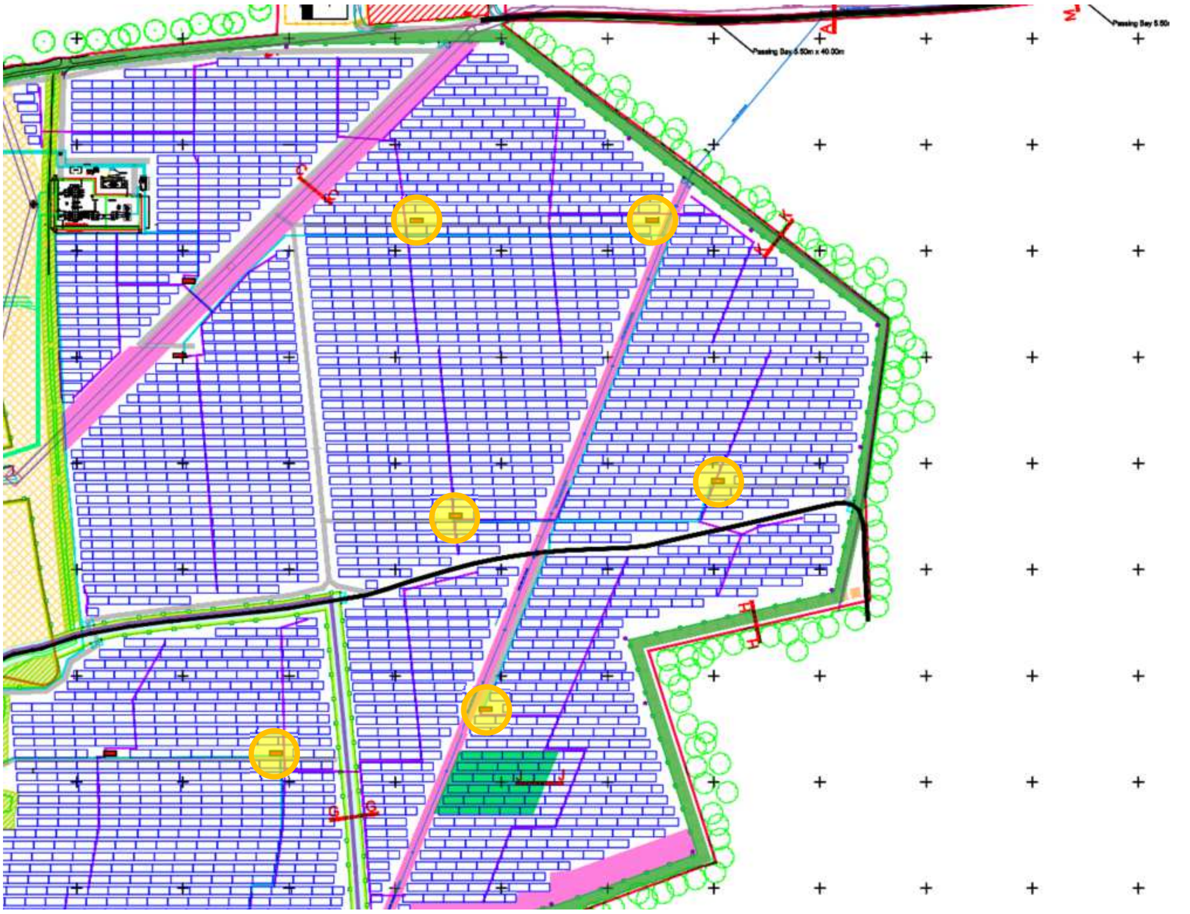


Figure 6.3: View of East of Site, With Mitigation Requirements Indicated

With these 6 Inverter Transformers each reduced by 8 dB, calculations indicate that acceptable conditions could be achieved for all receptors.

For these Transformer Inverters, with source noise levels as currently assumed, an uplift of approximately 8 dB in the acoustic reduction of each container is therefore anticipated as being required.

Note: The above advice is preliminary only, based on the anticipated levels of noise. It is understood that the predicted noise emissions are worst case. Calculations should be undertaken using noise data for the final plant selection before any mitigation is applied.

Through the above measures, it will be demonstrated that any installed plant will not be expected to have a negative impact on the amenity of nearby noise sensitive receivers.

6.3 Assessment of Access Track

In Paragraph 9.8.18 of the Environmental Statement Chapter 9 Transport and Access (Document Ref 6.9 LC ES CH9, PINS Ref APP-066), the following is stated:

> *"There are anticipated to be around four visits to the site a year (one per quarter) for additional equipment maintenance. These would typically be made by light van or 4x4 type vehicles."*

Where a noise source is expected to happen so infrequently, a negative impact on residential amenity would not be anticipated. However, in order to present a particularly robust assessment, calculations have been undertaken for a worst-case daytime period when a quarterly visit occurs.

It is understood visits to site would be during daytime only. During the worst-case 1-hour period, the service vehicle will arrive or depart the site, utilising the access track.

A worst-case 1-hour period has been constructed, comprising the noise source as detailed in Table 6.4.

Noise Source	Measured Sound Pressure Level (at stated distance)	Measured Maximum Noise Level (at stated distance)	Comments	Penalties
HGV Accessing Yard[1]	L_{Aeq} 73 dB, at 3 m	L_{Amax} 83 dB, at 3 m	Articulated lorry pass by (23 sec duration)	+3 dB Distinctiveness

Table 6.4: Measurement data used in Access Track assessment

[1] The noise levels presented are taken from Library Data measured on previous, similar sites. This specific noise level was measured on an access road at a project referred to as Pylon Farm, Newyears Green Lane, Harefield. Full spectral levels can be seen in Appendix B. The levels presented are for a Heavy Goods Vehicle and will therefore present a particularly robust assessment, when considering noise from a light van or 4x4 type vehicle.

It is anticipated that a single trip along the access road would last 30 seconds. In calculations, it is assumed that the noise source will be apparent at the closest point to the noise sensitive receiver for the entire duration.

The closest identified receiver to the Access Track is Receiver 2 [Heron Lodge], with curtilage at a minimum distance of 30 m. All other identified receivers are significantly further from the Access Track.

Penalties have been applied as stated in Table 6.5, in accordance with the requirements of BS 4142.

With all corrections as specified in British Standard 4142 applied, the noise rating levels would be as shown in Table 6.5. Detailed calculations are shown in Appendix E1.

Calculated Noise Rating Level at Receiver $L_{Aeq,1hr}$	Typical Measured Background Noise [Daytime Hours] $L_{A90,5mins}$	Difference	Indication
Receiver 2 Assessment			
32 dB(A)	L_{A90} 36 dB	-4 dB	Indication of the sound source having a low impact

Table 6.5: Noise rating level and assessment for Access Track

As shown in Table 6.5, noise emissions from the proposed operational use of the Access Track are expected to be in the region specified as an indication of the sound source having a low impact at the worst affected receiver.

7.0 NOISE IMPACT ASSESSMENT – CONSTRUCTION NOISE

7.1 Description of Sources

Anticipated worst case noise emissions associated with the proposed construction works are summarised in Table 7.1, where typical noise emission levels for the loudest processes are shown. Guidance on typical noise levels has been taken from available manufacturer data and Annexe C of BS 5228-1.

The loudest anticipated phase of works comprises the installation of fence posts around the perimeter of the site and around the various compounds, and the installation of supports for the solar panels across the site. Heavy Goods Vehicles [HGVs] will also access the site using the Access Track.

These items of works and processes have therefore formed the basis of this assessment.

In Table 9.5 of the Environmental Statement Chapter 9 Transport and Access (Document Ref 6.9 LC ES CH9, PINS Ref APP-066), it is shown that there would be an anticipated 8 HGVs visiting the site per day, creating 16 trips (arrivals and departures).

Paragraph 9.8.13 of the same document states that HGV deliveries will be coordinated to avoid peak hours.

BS 5228 does not define an assessment period. In order to present a robust assessment, the assessment period has been set at one hour, during which time it will be assumed that all 8 daily HGVs could arrive the site, while onsite works are continuously ongoing.

The anticipated works during this period will be assessed cumulatively. Descriptions of the source data used in calculations and comments on assumptions made are summarised in Table 7.1.

Noise Source	Measured Sound Pressure Level (at stated distance)	Comments	Assumptions
Pushing Support for Solar Panels and Fence Posts	L_{Aeq} 75 dB, at 10 m[1]	Manufacturer supplied 'maximum noise'. Assumed to be indicative of pushing operations	Assumed to be in use for 50% of the assessment period
Wheeled/Tracked Excavator (idling)	L_{Aeq} 67 dB, at 10 m	Noise source taken from BS 5228-1 of similar machinery idling	Assumed to be idling whenever not in use, i.e. 50% of the time
Articulated dump truck[2]	L_{Amax} 81 dB, at 10 m	Stated L_{max} (maximum level) taken from BS 5228-1 will be used to present a robust assessment	8 trips during assessment period

Table 7.1: Noise sources used in assessment

[1] This is a representative level, taken from manufacturer data for an example of self-propelled post-pushing machinery, attached to this document as Appendix G. The stated 'maximum noise' is assumed to be the ambient noise level during loudest operations, in order to present a robust assessment. The measurement distance is not stated, which is assumed to be 10 m as a worst case.

[2] The 'articulated dump truck' noise source has been adopted as the indicative level for HGVs, as it is the loudest noise source presented in the 'distribution of materials' section of Table C.4 of BS 5228-1. A particularly robust assessment will therefore be presented.

The Outline Construction Traffic Management Plan [OCTMP] (Document Ref 7.36 LC TA9.2 , PINS Ref APP-105) details typical working hours as 07:00 to 18:00 on weekdays, with reduced hours of 08:00 to 13:30 on Saturdays. No works are proposed on Sundays / Bank Holidays.

It is understood a minimum of six machines for post-pushing will be on site at any one time, although they are not expected to all be in use simultaneously. The assessed scenario is detailed in Section 7.3 and has been designed to provide a worst-case assessment.

7.2 Primary Mitigation

Primary mitigation comprises the adoption of the Outline Construction Environment Management Plan [OCEMP] (Document Ref 7.8 LC TA4.1 , PINS Ref App-077) and CTMP, which detail ways in which construction and associated traffic noise will be minimised and controlled.

In order to present a robust assessment, the calculations in this report assume worst-case scenarios, i.e. no mitigation or restrictions being applied to the typical levels.

7.3 Assessed Scenario

It is understood the construction works include installation of approximately 80,000 supports for solar panels, as well as fence posts around the perimeter of the site and the compounds.

To provide a particularly robust assessment, it is assumed that 6 machines could be operational at one time, although this is unlikely to be the case.

The assessed scenario is for the cumulative effect of the following proposed sources of noise.:

- Pushing of fence posts using machinery:
  - 3 Machines operational at the closest point of the boundary to assessed receivers
  - East post is understood to take up to 4mins
  - Moving between posts (i.e. machinery idling) assumed to be as little as 4mins, to present a robust assessment.
- Pushing of solar panel supports using machinery:
  - 3 Machines operational at a representative nearby point of the site to assessed receivers
  - East support is understood to take up to 4mins
  - Moving between supports (i.e. machinery idling) assumed to be as little as 4mins, to present a robust assessment.
- Arrival of all anticipated daily HGVs in the assessment period
  - Each trip along the Access Track anticipated to last 30 sec
  - It is assumed the noise will be apparent at the closest point of the Access Track to the assessed receivers for the duration of the trip

7.4 Noise Impact Assessment

The receivers assessed for the construction works are summarised as follows:

- Receiver 2 [Heron Lodge]:
  - Receiver 2 is the closest receiver to the Access Track, at a minimum distance of 30 m
  - The closest point of the Order Limits where post pushing could occur is a minimum of 155 m from Receiver 2
- Receiver 3 [Gokewell Priory Farm]:
  - Receiver 3 is the closest identified receiver to the closest proposed construction works on the boundary of the Order Limits , at a distance of 130 m
  - Receiver 3 is a minimum of 680 m from the closest point of the Access Track

Other identified receivers are significantly further from both onsite construction works and the Access Track.

In order to present a particularly robust assessment, it will be assumed that post pushing works could be occurring on the closest site boundary to each receiver for an entire one-hour reference period, in addition to support pushing works on a representative nearby point of the site and all HGVs using the Access Track.

In order to calculate the correction due to the distance separation to the receivers, the following formula has been used, as defined in Formula F.2 in Annexe F of BS 5228-1. This is the appropriate formula to use when the distance separation exceeds 25 m, as is applicable here:

$$K_s = \left(25\log_{10}\frac{R}{10}\right) - 2$$

Where K_s is the distance adjustment and R is the distance separation.

With all corrections as specified in BS 5228 applied, the noise rating levels would be as shown in Table 7.2. Detailed calculations are shown in Appendices E2 and E3.

Receiver	Threshold for Significant Effects	Calculated Construction Noise at Receiver
Receiver 2	65 dB(A)	59 dB(A)
Receiver 3		53 dB(A)

Table 7.2: Calculated construction noise levels for receivers

As shown in Table 7.2, noise emissions from the worst-case anticipated construction operations at the closest receiver are expected to be below the established threshold for significant effects.

8.0 COMMENTS ON VIBRATION

8.1 Vibration due to Proposed Operations

Vibration is only typically a concern when works are proposed below ground level, involve significant drops, involve movement with mechanical fixings to hard ground or are undertaken in close proximity to receptors.

Proposals are to site all equipment according to manufacturer guidance. The proposed operational phase works do not include any below ground works or significant drops.

Based on the nature of the ground observed in the surroundings (soft ground) and the significant distance to identified receptors, vibration caused by onsite works is expected to be negligible and significantly below the lowest thresholds defined in BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting*'[7].

8.2 Vibration due to Construction

In the OCEMP, it is clarified that piling will not be undertaken for any foundations or similar. With this sort of piling constituting the main cause of construction vibration, this drastically reduces the likelihood of construction vibration causing a significant effect.

7 British Standard 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting*' British Standards Institution, 2008

The main source of construction activity will be the pushing of supports for fence posts and solar panel supports. Although a large number of posts and panels require pushing, the amount of vibration anticipated for each element is small.

The proposed operations do not include any significant below ground works or significant drops. The only proposed below ground works comprise excavating cable trenches for Direct Current or Medium Voltage cables, to a maximum depth of approximately 1.5 m and excavations for foundations. Excavation works will be into soft ground, without the need for any concrete breaking or piling.

Further, BS5228-2:2009 '*Code of practice for noise and vibration control on construction and open sites. Vibration*'[8] [BS 5228-2] gives a methodology to predict the transmission of vibration due to piling at receivers. All available formulae have a distance parameter that does not exceed 110 m, indicating that vibration cannot be accurately predicted beyond this distance even for piling operations.

Based on the minimum distance to the closest identified receiver (Receiver 3, at 130 m) and the lack of piling on this site, vibration is therefore expected to be at a level that cannot be predicted or detected and would therefore be considered insignificant.

Further, the ground in the surroundings is observed to be soft, which further reduces the potential for vibration transmission.

Similarly, movement of Heavy Goods Vehicle [HGV] is expected to generate vibration levels below the lowest thresholds defined in BS 5228-2, due to the interaction between the wheels and the ground, and the distance of separation to receptors.

We would recommend that Best Practical Means are adopted to avoid this effect, as detailed in the OCTMP.

It should be noted that the comments regarding vibration due to use of the Access Track assume an even road surface, with no notable bumps, undulations, or potholes.

8 British Standard 5228-2:2009 '*Code of practice for noise and vibration control on construction and open sites. Vibration*' British Standards Institution, 2009

9.0 CONCLUSION

An environmental noise survey has been undertaken at the proposed Little Crow Solar Park to the west of Appleby Lane, Scunthorpe DN20 0BG. The results of the survey have enabled criteria to be set for noise emissions from proposed plant units in accordance with the requirements of the Local Authority and relevant British Standards.

A preliminary noise impact assessment has been undertaken using typical worst-case noise data to predict the noise levels, due to the proposed plant, at the nearby noise sensitive receivers.

Preliminary noise modelling indicates that mitigation may be required for a small number of plant units closest to the receptors, but this should be confirmed once more specific details are known.

Further calculations have demonstrated that construction noise is not expected to constitute a significant effect, even during worst-case assumed activity.

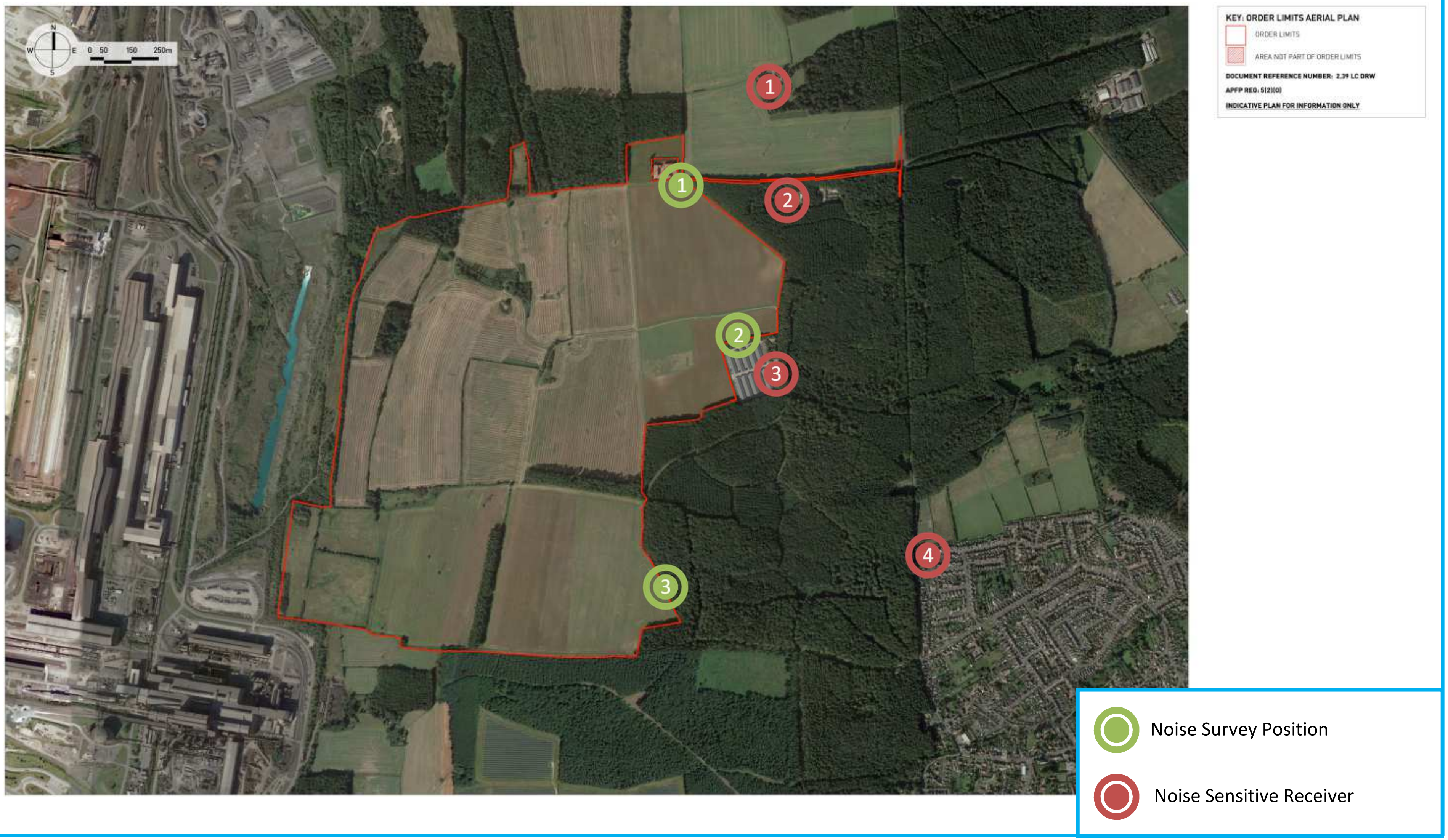
Vibration is not expected to present a significant effect for this development.

Report by

Duncan Martin MIOA

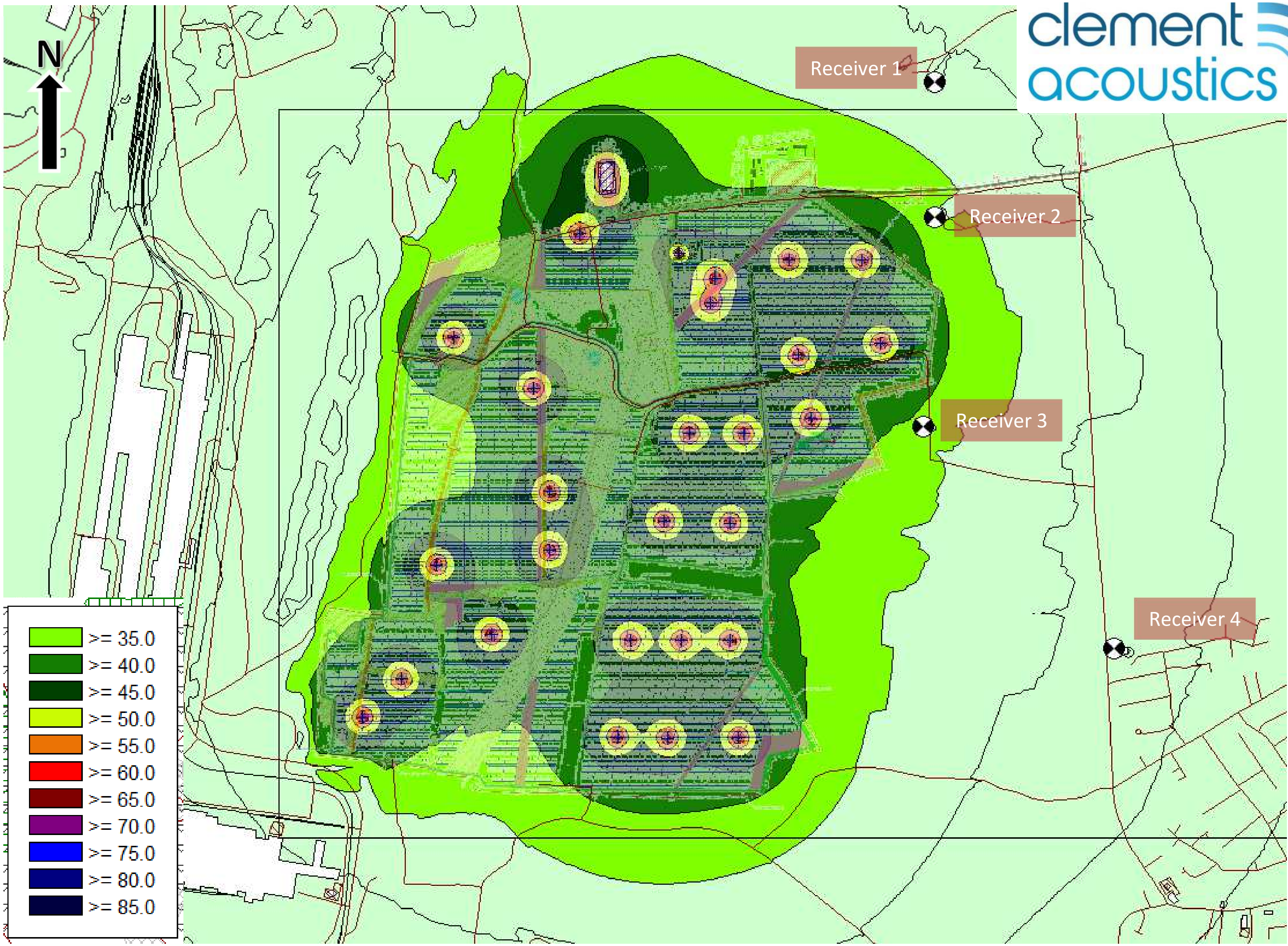
Checked by

John Smethurst MIOA



Appendix A Indicative site plan indicating noise monitoring positions and identified noise sensitive receivers

Date: 24 May 2021

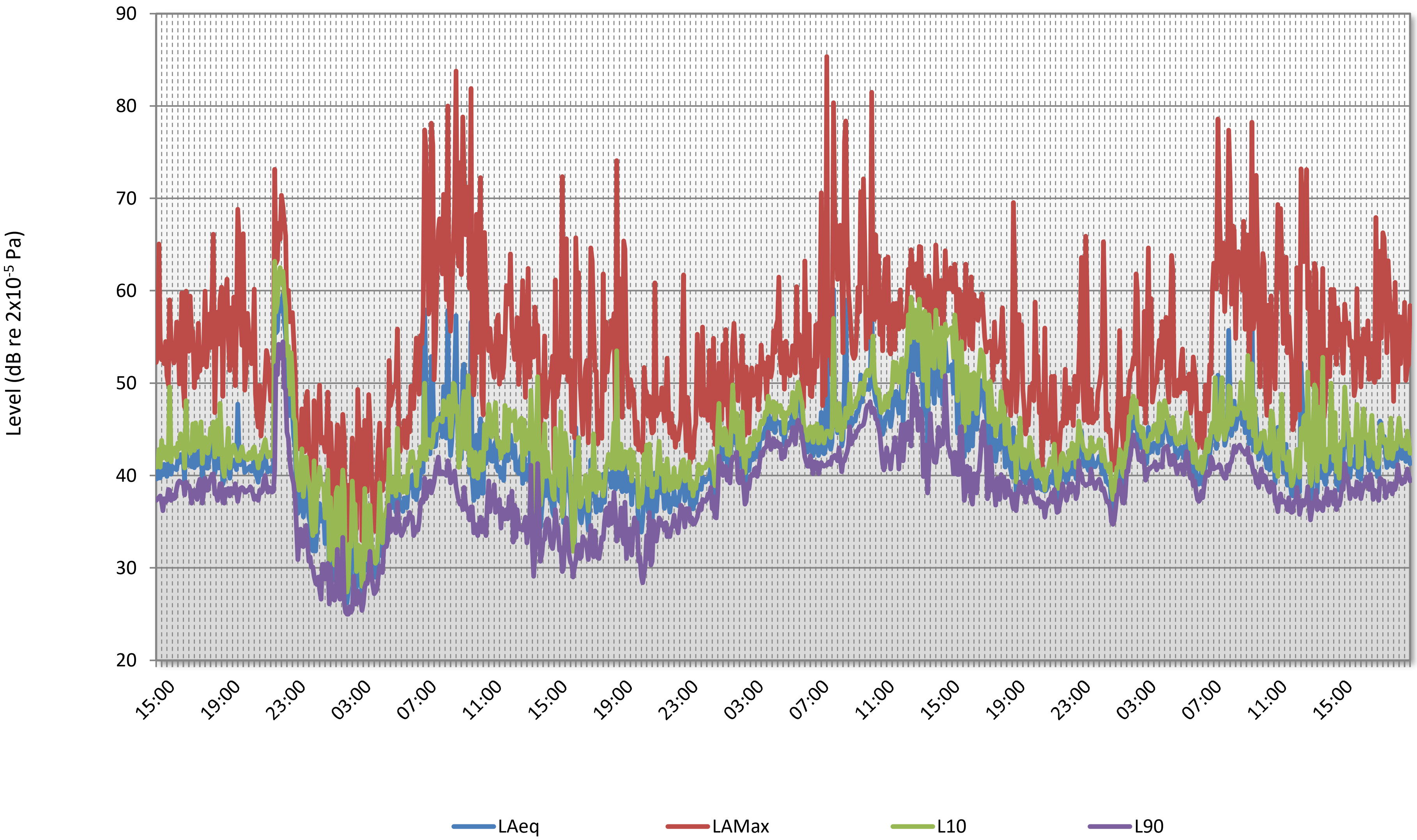


Appendix B 2D Plan View of Noise Propagation for Work No. 2A Layout (Without Mitigation)

Date: 24 May 2021

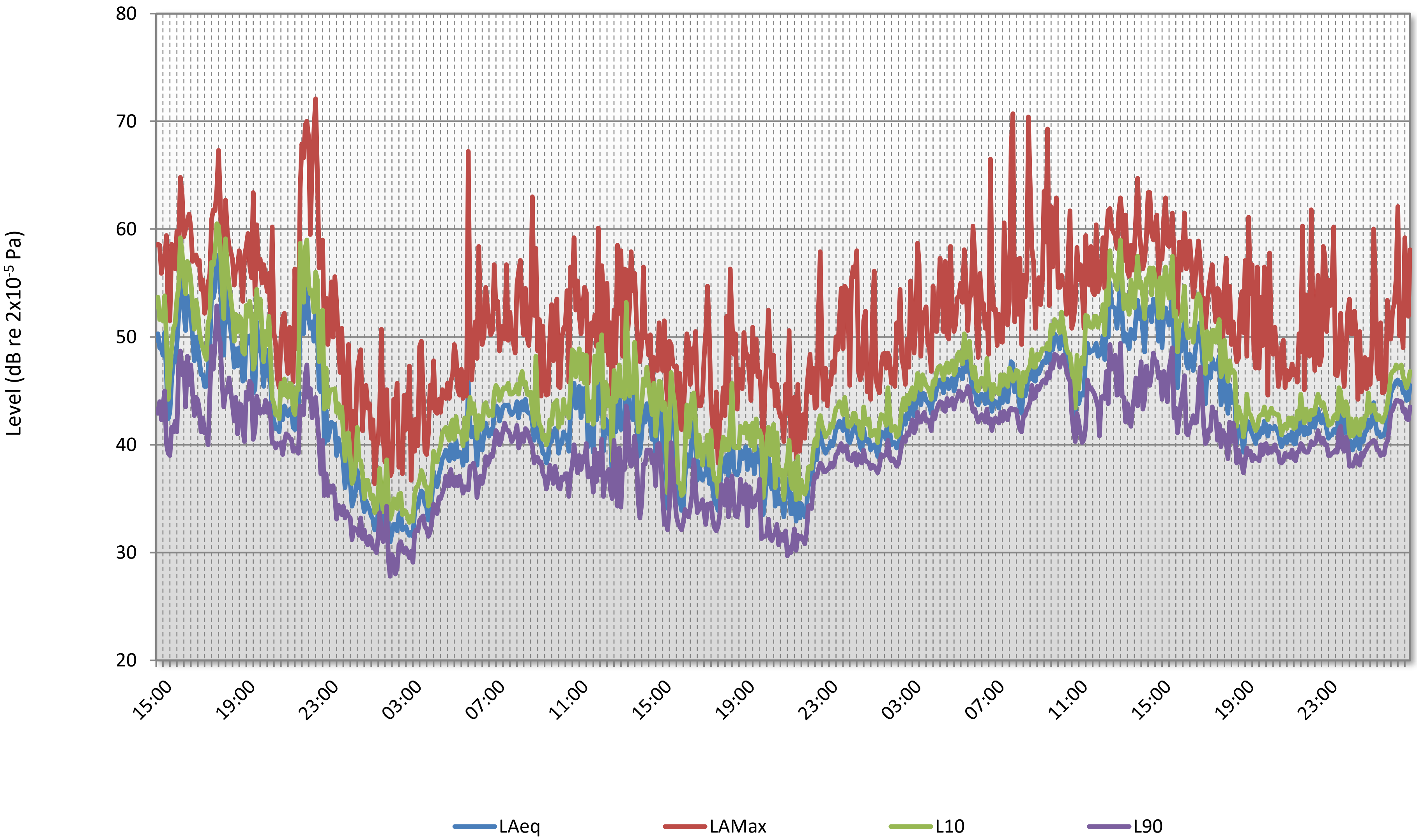
Little Crow Solar Park, Scunthorpe - *Position 1*

Environmental Noise Time History
27 September 2018 to 30 Septemer 2018



Little Crow Solar Park, Scunthorpe - *Position 2*

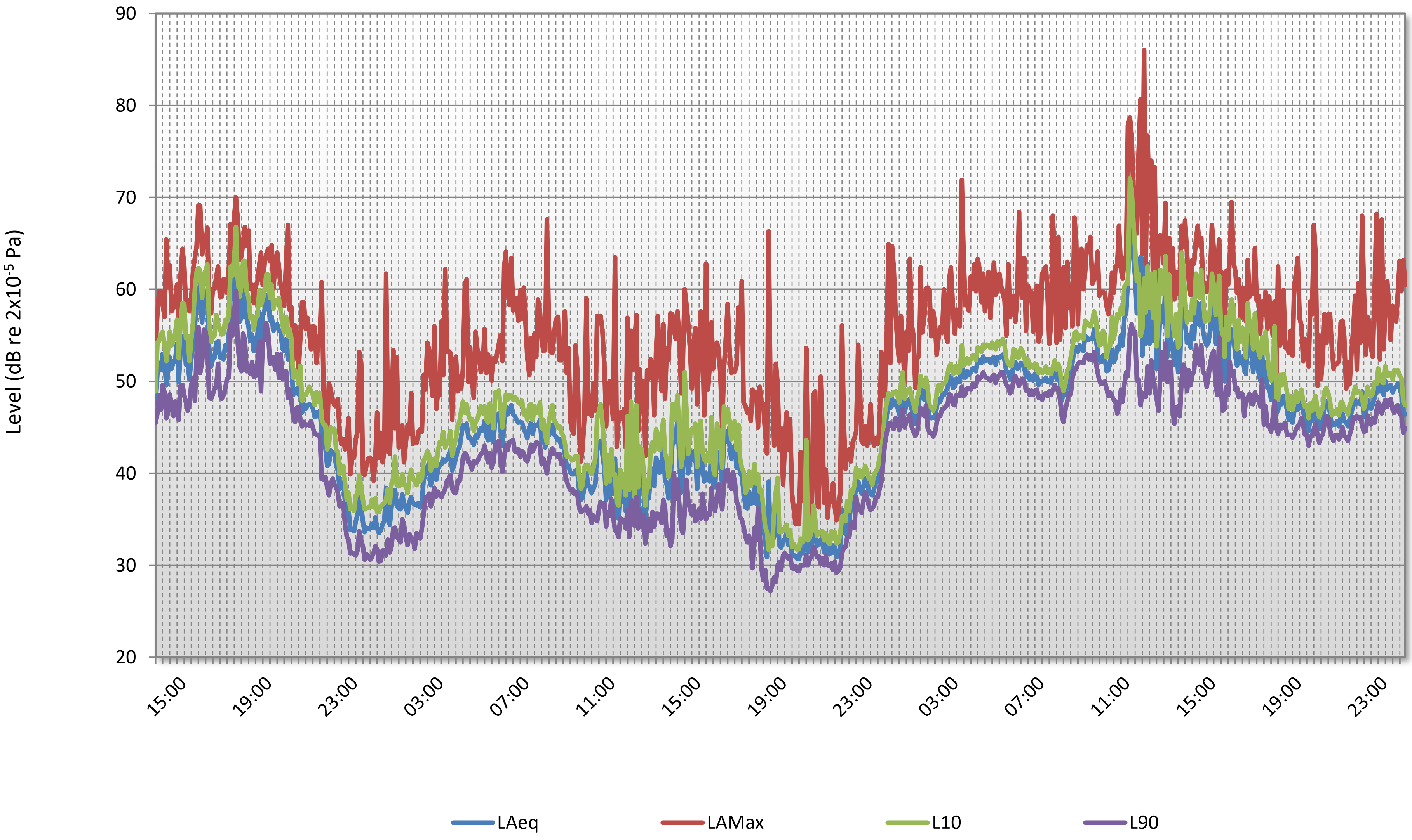
Environmental Noise Time History
27 September 2018 to 30 September 2018



Appendix C2

Little Crow Solar Park, Scunthorpe - *Position 3*

Environmental Noise Time History
27 September 2018 to 30 September 2018



APPENDIX D

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10 dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX E1

14027

Little Crow Solar Park, Scunthorpe

APPENDIX E1: Assessment of Access Track - Operational Phase

Location: Access Track
Receiver: Reveiver 2

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
HGV Movements									
Measured HGV on Access Road at 3 m	73	67	67	66	69	67	59	50	73
Correction for usage in a one hour period (single pass - 30 secs)	-21	-21	-21	-21	-21	-21	-21	-21	
Correction for distance (30 m)[1]	-20	-20	-20	-20	-20	-20	-20	-20	
Calculated Noise Level at Receiver	**32**	**26**	**26**	**25**	**28**	**26**	**18**	**9**	**32**

[1] Distance correction applied for a moving point source, as only one trip

APPENDIX E2 & E3

Little Crow Solar Park, Scunthorpe

APPENDIX E2: Assessment for Construction Works at Receiver 2

Location: Post Pushing at Closest Section of Site Boundary

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Pushing of Fence Posts									
Stated noise emission level at 10 m [1]	71	63	63	62	68	69	70	66	75
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 155 m)	-28	-28	-28	-28	-28	-28	-28	-28	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**45**	**37**	**37**	**36**	**42**	**43**	**44**	**40**	**49**
Idling Between Posts									
Stated noise emission level at 10 m	67	66	59	58	56	53	44	35	61
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 155 m)	-28	-28	-28	-28	-28	-28	-28	-28	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**41**	**40**	**33**	**32**	**30**	**27**	**18**	**9**	**35**
Calculated Noise Level at Receiver due to Boundary Works	**47**	**42**	**39**	**38**	**42**	**43**	**44**	**40**	**49**

[1] Spectral levels assumed based on BS 5228 levels for a similar noise source (hydraulic hammer rig)

Location: Support Pushing at Representative Nearby Area of Site

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Pushing of Solar Panel Supports									
Stated noise emission level at 10 m [1]	71	63	63	62	68	69	70	66	75
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 200 m)	-31	-31	-31	-31	-31	-31	-31	-31	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**43**	**35**	**35**	**34**	**40**	**41**	**42**	**38**	**47**
Idling Between Supports									
Stated noise emission level at 10 m	67	66	59	58	56	53	44	35	61
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 200 m)	-31	-31	-31	-31	-31	-31	-31	-31	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**39**	**38**	**31**	**30**	**28**	**25**	**16**	**7**	**32**
Calculated Noise Level at Receiver due to Onsite Works	**44**	**39**	**36**	**35**	**40**	**41**	**42**	**38**	**47**

[1] Spectral levels assumed based on BS 5228 levels for a similar noise source (hydraulic hammer rig)

Location: Access Road

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
HGV Accessing Site									
Stated noise emission level at 10 m	85	87	77	75	76	73	69	62	81
Calculated Distance Adjustment Ks (R = 30 m)	-10	-10	-10	-10	-10	-10	-10	-10	
Correction for percentage on-time (8 No. 30sec trips)	-12	-12	-12	-12	-12	-12	-12	-12	
Noise Rating Level at Receiver due to Access Road	**63**	**65**	**55**	**53**	**54**	**51**	**47**	**40**	**59**

Cumulative Level at Receiver due to Construction Works	**63**	**65**	**55**	**53**	**54**	**52**	**50**	**44**	**59**

APPENDIX E3: Assessment for Construction Works at Receiver 3

Location: Post Pushing at Closest Section of Site Boundary

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Pushing of Fence Posts									
Stated noise emission level at 10 m [1]	71	63	63	62	68	69	70	66	75
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 130 m)	-26	-26	-26	-26	-26	-26	-26	-26	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**47**	**39**	**39**	**38**	**44**	**45**	**46**	**42**	**51**
Idling Between Posts									
Stated noise emission level at 10 m	67	66	59	58	56	53	44	35	61
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 130 m)	-26	-26	-26	-26	-26	-26	-26	-26	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**43**	**42**	**35**	**34**	**32**	**29**	**20**	**11**	**37**
Calculated Noise Level at Receiver due to Boundary Works	**49**	**44**	**41**	**40**	**44**	**45**	**46**	**42**	**51**

[1] Spectral levels assumed based on BS 5228 levels for a similar noise source (hydraulic hammer rig)

Location: Support Pushing at Representative Nearby Area of Site

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Pushing of Solar Panel Supports									
Stated noise emission level at 10 m [1]	71	63	63	62	68	69	70	66	75
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 200 m)	-31	-31	-31	-31	-31	-31	-31	-31	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**43**	**35**	**35**	**34**	**40**	**41**	**42**	**38**	**47**
Idling Between Supports									
Stated noise emission level at 10 m	67	66	59	58	56	53	44	35	61
Correction for no. of machines (3 no.)	5	5	5	5	5	5	5	5	
Calculated Distance Adjustment Ks (R = 200 m)	-31	-31	-31	-31	-31	-31	-31	-31	
Correction for percentage on-time (50%)	-3	-3	-3	-3	-3	-3	-3	-3	
Noise Rating Level at Receiver	**39**	**38**	**31**	**30**	**28**	**25**	**16**	**7**	**32**
Calculated Noise Level at Receiver due to Onsite Works	**44**	**39**	**36**	**35**	**40**	**41**	**42**	**38**	**47**

[1] Spectral levels assumed based on BS 5228 levels for a similar noise source (hydraulic hammer rig)

Location: Access Road

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
HGV Accessing Site									
Stated noise emission level at 10 m	85	87	77	75	76	73	69	62	81
Calculated Distance Adjustment Ks (R = 680 m)	-44	-44	-44	-44	-44	-44	-44	-44	
Correction for percentage on-time (8 No. 30sec trips)	-12	-12	-12	-12	-12	-12	-12	-12	
Noise Rating Level at Receiver due to Access Road	**29**	**31**	**21**	**19**	**20**	**17**	**13**	**6**	**25**

Cumulative Level at Receiver due to Construction Works	**50**	**45**	**42**	**41**	**46**	**46**	**47**	**43**	**53**

APPENDIX F

CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 08 November 2016 Certificate N° 1611582

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk
Acoustics Noise and Vibration Ltd trading as AV Calibration

Signed [redacted]

G. Parry [✓]
B. Baker [ ] J. Harriman [ ]

CLIENT	Clement Acoustics 202 Uxbridge Road London W12 7JP
F.A.O.	Andrew Thomas
ORDER No	- Job No TRAC16/11347/02
DATE OF RECEIPT	04 November 2016
PROCEDURE	AV Calibration Engineer's Handbook, section 25
IDENTIFICATION	Sound level meter Svantek type SVAN 957 serial No 15385 connected via a SC26/5 extension lead and preamplifier type SV 12L serial No 30282 to a half-inch microphone type ACO 7052E serial No 52152.
CALIBRATED ON	08 November 2016
PREVIOUS CALIBRATION	Calibrated on 13 March 2012, Certificate No. 1203130 issued by this laboratory.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

The sound level meter was set up using a type 4231 sound calibrator supplied by the laboratory; it was set to frequency weighting A, and initially read 115.8 dB. It was then adjusted to read 114.0 dB (corresponding to 114.0 dB at standard atmospheric pressure). This reading was derived from the certified output level of the calibrator and manufacturers' information on the free-field response of the sound level meter (see note 1). The calibration check frequency was 1kHz, and the resulting calibration factor calculated and stored by the meter was 3.88 dB.

Procedures based on IEC 61672-3:2006 (BS EN 61672-3:2006) were used to perform the periodic tests.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests carried out, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) and because the periodic tests carried out cover only a limited subset of the specifications in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

12.0 dB (A)   12.0 dB (C)   12.0 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 22 to 23 °C, 39 to 49 %RH and 100.2 to 100.3 kPa
End: 22 to 23 °C, 40 to 50 %RH and 100.1 to 100.2 kPa

Technical information including adjustment data specified in the manufacturers' User's Manual Appendix C dated 28 February 2015, with further clarification from Svantek, has been used to carry out this verification. No information on the uncertainty of measurement, required by 11.7 of IEC 61672-3:2006 (BS EN 61672-3:2006), of the adjustment data given in the instruction manual or obtained from the manufacturer or supplier of the sound level meter was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of the adjustment data has therefore been assumed to be numerically zero for the purpose of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the sound level meter may not conform to the requirements of IEC 61672-1:2002 (BS EN 61672-1:2003).

No publicly-available evidence has been found that the Svantek SVAN 957 sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by an independent testing organisation responsible for pattern approvals. It has therefore been tested as a Class 1 instrument in accordance with the manufacturer's claims.

All measurement data are held at AV Calibration for a period of at least six years.

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 *Guide to the Expression of Uncertainty in Measurement* published by the International Organisation for Standards (ISO).

[redacted]

NOTES

1 The stated level refers to the indicated A-weighted sound pressure level with the compensation filter set to EXTENSION CABLE, not to the reading in calibration mode.

2 As specified by the manufacturers all acoustic tests were carried out with the microphone filter set to EXTENSION CABLE, as was the test of self-generated noise; the remaining electrical tests were performed with the filter switched OFF. An additional electrical test was carried out, in which the effect of the filter was measured at octave intervals from 63Hz to 16kHz; the resulting frequency response was incorporated into the electrical signal tests of frequency weightings.
All sound measurements made using the sound level meter in the configuration specified on page 1 of this certificate should have the microphone filter set to EXTENSION CABLE.

3 The instrument was running firmware version 6.15.6

4 The microphone frequency response was measured by this laboratory using the electrostatic actuator method.

5 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method.

6 The case reflection factors have been taken as zero, since an extension lead has been used for this verification.

7 There is no legal requirement in the UK for pattern evaluation, which covers every aspect of the specification including environmental and electromagnetic compatibility testing. Since it is a time-consuming and expensive process, many manufacturers submit only one model from a "family" of instruments for pattern evaluation.

In this instance, the SVAN 959 successfully underwent pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB for short) in Germany. The fact that the SVAN 957 was not submitted does not imply that there are any known shortcomings in its design.

[redacted]

Acoustical signal test of frequency weighting C (electrostatic actuator method)

Frequency, Hz	Extended error, dB	Tolerance, dB	Uncertainty ± dB
125	0.30	± 1.5	0.23
8000	1.14	+2.1, -3.1	0.23

The case reflection factors have been taken as zero, since an extension lead has been used for this verification.

Electrical signal tests of frequency weightings

Frequency, Hz	Extended error in A-weighting, dB		Extended error in C-weighting, dB		Extended error in Z-weighting, dB		Tolerance, dB	Uncertainty ± dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve		
63	0.23	-0.23	0.23	-0.23	0.23	-0.23	± 1.5	0.23
125	0.13	-0.33	0.23	-0.23	0.23	-0.23	± 1.5	0.23
250	0.23	-0.23	0.23	-0.23	0.23	-0.23	± 1.4	0.23
500	0.13	-0.33	0.23	-0.23	0.23	-0.23	± 1.4	0.23
1000	REF	REF	REF	REF	REF	REF	REF	0.23
2000	0.33	-0.13	0.33	-0.13	0.33	-0.13	± 1.6	0.23
4000	0.63	0.17	0.73	0.27	0.63	0.17	± 1.6	0.23
8000	1.03	0.57	1.03	0.57	0.93	0.47	+2.1, -3.1	0.23
16000	0.53	0.07	0.53	0.07	0.83	0.37	+3.5, -17.0	0.23

The above data include manufacturer-specified corrections for the microphone response. The effect of the EXTENSION CABLE compensation filter is also incorporated.

Frequency and time weightings at 1 kHz

Parameter measured	Extended error, dB	Tolerance, dB
LAF	REF	REF
LCF	± 0.13	± 0.4
LZF	± 0.13	± 0.4
LAS	± 0.13	± 0.3
LAeq	± 0.13	± 0.3

Uncertainty ± 0.13 dB

[redacted]

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate No 1611582

Level Linearity on the reference range (at 8 kHz, ref 94.0 dB);
and also including the level range control (at 1 kHz, ref 114.0 dB on the reference range)

Reference range (HIGH)		
Nominal reading, dB	Extended error, dB	Warning flags
33.0	U/R	U/R
34.0	U/R	U/R
35.0	U/R	U/R
36.0	0.30	¤
37.0	0.30	¤
38.0	0.30	¤
39.0	0.30	¤
40.0	0.30	¤
41.0	0.30	¤
44.0	0.30	¤
49.0	0.30	¤
54.0	± 0.20	¤
59.0	± 0.20	¤
64.0	± 0.20	¤
69.0	± 0.20	¤
74.0	± 0.20	¤
79.0	± 0.20	¤
84.0	± 0.20	¤
89.0	± 0.20	¤
94.0	Ref	¤
99.0	± 0.20	¤
104.0	± 0.20	¤
109.0	± 0.20	¤
114.0	± 0.20	¤
119.0	± 0.20	¤
124.0	± 0.20	¤
129.0	± 0.20	¤

Reference range (HIGH)		
Nominal reading, dB	Extended error, dB	Warning flags
134.0	± 0.20	¤
135.0	± 0.20	¤
136.0	± 0.20	¤
137.0	± 0.20	¤
138.0	± 0.20	¤
139.0	± 0.20	¤
140.0	O/L	O/L
141.0	O/L	O/L
142.0	O/L	O/L
143.0	O/L	O/L

Linearity including range control		
Nominal reading, dB	Range	Extended error, dB
118.0	LOW	± 0.20
114.0	LOW	± 0.20
41.0	LOW	± 0.20

¤ denotes no warning flag

Linearity tolerances ± 1.1 dB

Uncertainty ± 0.20 dB

[redacted]

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate No 1611582

Toneburst response

Parameter	Burst length ms	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
LAFmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	-0.30	-0.30	-0.30	+1.3, -3.3
LASmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -3.3
LAE	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	± 0.20	± 0.20	± 0.20	+1.3, -3.3

Uncertainty ± 0.20 dB

Peak C sound level

Frequency, Hz	Burst length cycles	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
8000	1	-0.37	-0.87	± 0.27	± 2.4
500	+ ½	-0.37	-0.37	-0.37	± 1.4
	- ½	-0.37	-0.37	-0.37	± 1.4

Uncertainty ± 0.27 dB

Overload indication

Extended error in level of negative pulse required to trigger overload, relative to level of positive pulse required:

± 0.23	dB

Tolerance ± 1.8 dB

Uncertainty ± 0.23 dB

The measured errors obtained during testing have been extended by the laboratory's expanded measurement uncertainty before assessing conformance to the standard, and it is these extended errors which are quoted above. In accordance with convention, positive measured errors have been extended by the positive value of expanded uncertainty, and negative measured errors by the negative value. Where a bilateral extended error (± n.n dB) is given, this implies that the measured error was numerically zero.
The laboratory's expanded measurement uncertainties, including contributions from manufacturers-specified corrections where appropriate are stated above.

Uncertainty of the sound calibrator used to set up the sound level meter ± 0.22 dB

END

[redacted]

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CALIBRATION CERTIFICATE

OBJECT OF CALIBRATION	Sound level meter type SVAN 957, No 28003, manufacturer SVANTEK with preamplifier type SV12L, No 30282, manufacturer SVANTEK and microphone type 7052E, No 69528, manufacturer SVANTEK.
APPLICANT	Clement Acoustics 202 Uxbridge Road, London, W12 7JP
CALIBRATION METHOD	Method described in instruction IN-02 "Calibration of the sound level meter", issue number 11 date 27.01.2016, written on the basis of international standard EN IEC 61672-3:2013Electroacoustics. Part 3: Periodic tests.
ENVIRONMENTAL CONDITIONS	Temperature: (21.1-23.1) ^{o}C Ambient pressure: (100.7-100.8)hPa Relative humidity: (41-44) %
DATE OF CALIBRATION	22-05-2018
UNCERTAINTY OF MEASUREMENTS	Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor *k* = 2.
CONFORMITY WITH REQUIREMENTS	On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.
CALIBRATION RESULTS	**The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.** The results are presented on pages 2 to 7 of this certificate (including measurement uncertainty).
APPROVED BY	B HUNT

CALIBRATION RESULTS Calibration results are the following:

1. Indication at the calibration check frequency

The sound level meter was calibrated in compliance with the instruction manual. During this process, the indication of this SLM was adjusted to the sound pressure level of the sound level calibrator type SV 30A, No 44775, from SVANTEK. The sound pressure level was corrected by the free-field factor.

Deviation of the acoustic pressure measurement of the A-weighted sound level using the sound calibrator type SV 30A, No 44775, from SVANTEK, was made according to the standard reference conditions: for static pressure 1003 hPa, for temperature 24 ºC and for relative humidity 60 %, results:

(0.0±0.2) dB

The deviation was determined as a difference between the measured sound level and the sound level corrected by the free-field factor appropriate to mentioned sound calibrator.

2. Self-generated noise with microphone installed

Frequency weighting	A
The highest level of self-generated noise stated in the instruction manual [dB]	19.0
Indication [dB]	12.0

3. Self-generated noise with microphone replaced by the electrical input signal device

Frequency weighting	A	C	Z
The highest expected level of self-generated noise stated in the instruction manual [dB]	12.0	12.0	20.0
Level of self-generated noise [dB]	9.0	9.0	15.5

4. Acoustical signal tests of a frequency weighting C

Frequency	Relative frequency-weighted free-field response	Design-goal frequency weighting	The deviation of frequency weighting	Extended uncertainty	Acceptable limits
Hz	dB	dB	dB	dB	dB
125.0	93.98	-0,2	-0.3	0.3	±1.5
1000.0	94.46	0,0	0.0	0.3	±1.1
4000.0	94.53	-0,8	0.9	0.4	±1.6
8000.0	92.94	-3,0	1.5	0.4	-3.1; +2.5

5. Electrical signal tests of frequency weightings

Frequency	Design-goal frequency weighting			The deviation of frequency weighting			Extended uncertainty	Acceptable limits
	A	C	Z	A	C	Z		
Hz	dB	dB	dB	dB	dB	dB	dB	dB
63	-26,2	-0,8	0,0	0.1	0.1	0.1	0,3	±1,5
125	-16,1	-0,2	0,0	-0.1	-0.1	-0.1	0,3	±1,5
250	-8,6	0,0	0,0	0.0	0.0	0.0	0,3	±1,4
500	-3,2	0,0	0,0	0.0	0.1	0.1	0,3	±1,4
1000	0,0	0,0	0,0	0.2	0.2	0.2	0,3	±1,1
2000	1,2	-0,2	0,0	0.3	0.3	0.3	0,3	±1,6
4000	1,0	-0,8	0,0	0.0	0.0	0.0	0,3	±1,6
8000	-1,1	-3,0	0,0	0.3	0.3	0.2	0,4	-3,1; +2,1
16000	-6,6	-8,5	0,0	-0.2	-0.2	0.0	0,6	-17,0; +3,5

6. Frequency and time weightings at 1 kHz

	Sound level				Time-averaged sound level
Frequency weighting	A	A	C	Z	A
Time weighting	Fast	Slow	Fast	Fast	-
Indication [dB]	114.0	114.0	114.0	114.0	114.0
The deviation of indication from the indication of A-weighted sound level with Fast time weighting [dB]		0.0	0.0	0.0	0.0
Extended uncertainty [dB]		0.1			
Acceptable limits[dB]		±0.3	±0.4	±0.4	±0.3

7. Level linearity

Reference level range: HIGH

Expected sound level	Indication	Level linearity error	Extended uncertainty	Acceptable limits
dB	dB	dB	dB	dB
140.0	140.0	0.0	0.2	±1.1
139.0	139.0	0.0		
138.0	138.0	0.0		
137.0	137.0	0.0		
136.0	136.0	0.0		
135.0	135.0	0.0		
134.0	134.0	0.0		
129.0	129.0	0.0		
124.0	124.0	0.0		
119.0	119.0	0.0		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	89.0	0.0		
84.0	84.0	0.0		
79.0	79.0	0.0		
74.0	73.9	-0.1		
69.0	68.9	-0.1		
64.0	63.9	-0.1		
59.0	58.9	-0.1		
54.0	54.0	0.0		
49.0	49.0	0.0		
44.0	44.0	0.0		
43.0	43.0	0.0		
42.0	42.0	0.0		
41.0	41.0	0.0		
40.0	40.0	0.0		

Level range: LOW

Expected sound level	Indication	Level linearity error	Extended uncertainty	Acceptable limits
dB	dB	dB	dB	dB
123.0	123.0	0.0	0.2	±1.1
122.0	122.0	0.0		
138.0	138.0	0.0		
120.0	120.0	0.0		
119.0	119.0	0.0		
118.0	118.0	0.0		
117.0	117.0	0.0		
116.0	116.0	0.0		
115.0	115.0	0.0		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	89.0	0.0		
84.0	84.0	0.0		
79.0	79.0	0.0		
74.0	73.9	-0.1		
69.0	68.9	-0.1		
64.0	63.9	-0.1		
59.0	59.0	0.0		
54.0	54.0	0.0		
49.0	49.0	0.0	0.3	
44.0	44.0	0.0		
39.0	39.0	0.0		
34.0	34.1	0.1		
33.0	33.1	0.1		
32.0	32.1	0.1		

8. Level linearity including the level range control

Level range	LOW	HIGH
Indication for the reference sound pressure level [dB]	114.0	114.0
The deviation of indication [dB]		0.0
Anticipatedlevel that is 5 dB less than the upper limit specified in the instruction manual for levelrange at 1 kHz [dB]	136.0	122.0
Indication [dB]	136.0	121.9
The deviation of indication [dB]	0.0	0.1
Extended uncertainty [dB]	0.2	
Acceptable limits[dB]	±1.1	

9. Toneburst response

Measurement quantity	Time weighting	Toneburst duration	The indications in response to toneburst relative to the steady sound level	Reference toneburst response relative to the steady sound level	The deviations of the measured tonebursstin responses from the corresponding reference toneburst	Extended uncertainty	Acceptable limits
		ms	dB	dB	dB	dB	dB
Time-weighted sound level	Fast	200	-0.9	-1.0	0.1	0.2	±0.8
		2	-18.0	-18.0	0.0		-1.8; +1.3
		0.25	-27.1	-27.0	-0.1		-3.3; +1.3
Time-weighted sound level	Slow	200	-7.4	-7.4	0.0		±0.8
		2	-27.0	-27.0	0.0		-1.8; +1.3
Sound exposure level	-	200	-6.9	-7.0	0.1		±0.8
		2	-26.9	-27.0	0.1		-1.8; +1.3
		0.25	-36.1	-36.0	-0.1		-3.3; +1.3

10.Peak C sound level

Numbers of cycles in test signal	Frequency of test signal	The deviation of indication	Extended uncertainty	Acceptable limits
	Hz	dB	dB	dB
One	8000	-0.4	0.2	±2.4
Positive half-cycle	500	-0.1		±1.4
Negative half-cycle	500	-0.1		

11.Overload indication

Frequency weighting A

The difference between the levels of the positive and negative one-half-cycles input signals that first cause the displays of overload indication	Extended uncertainty	Maximum value of the difference
dB	dB	dB
0.1	0.3	1.8

NOTES

1. All acoustic tests were carried out with the compensation filter set to Free-field whereas the remaining electrical tests were performed with the filter switched off as specified by the manufacturers.

2. The instrument was running firmware version 6.15

3. The measurements in this document are traceable to GUM (Central Office of Measures), Poland

4. | | |
   |---|---|
   | Signal Generator | Svantek Type 401 #124 |
   | Sound Level Calibrator | Svantek Type SV30A #44775 |
   | Barometer | LAB-EL Type LB706B #912 |
   | Voltmeter | Svantek Type 912AE #15940 |

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CALIBRATION CERTIFICATE

OBJECT OF CALIBRATION	Sound level meter type SVAN 977, No 45354, manufacturer SVANTEK with preamplifier type SV12L, No 47603, manufacturer SVANTEK and microphone type 7052E, No 60645, manufacturer SVANTEK.
APPLICANT	Clement Acoustics.
CALIBRATION METHOD	Method described in instruction IN-02 "Calibration of the sound level meter", issue number 11 date 27.01.2016, written on the basis of international standard EN IEC 61672-3:2013 Electroacoustics. Part 3: Periodic tests.
ENVIRONMENTAL CONDITIONS	Temperature: (22.9 - 23.1) °C Ambient pressure: (101.0 - 102.0) kPa Relative humidity: (49 - 51) %
DATE OF CALIBRATION	25-07-2017
UNCERTAINTY OF MEASUREMENTS	Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor k = 2.
CONFORMITY WITH REQUIREMENTS	On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.
CALIBRATION RESULTS	**The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.** The results are presented on pages 2 to 6 of this certificate (including measurement uncertainty).
APPROVED BY	A.S.

CALIBRATION RESULTS Calibration results are the following:

1. Indication at the calibration check frequency

The sound level meter was calibrated in compliance with the instruction manual. During this process, the indication of this SLM was adjusted to the sound pressure level of the sound level calibrator type SV 30A, No 44775, from SVANTEK. The sound pressure level was corrected by the free-field factor.

Deviation of the acoustic pressure measurement of the A-weighted sound level using the sound calibrator type SV 30A, No 44775, from SVANTEK, was made according to the standard reference conditions.

(0.0 ± 0.2) dB

The deviation was determined as a difference between the measured sound level and the sound level corrected by the free-field factor appropriate to mentioned sound calibrator.

2. Self-generated noise with microphone installed

Frequency weighting	A
The highest level of self-generated noise stated in the instruction manual [dB]	19.0
Indication [dB]	12.8

3. Self-generated noise with microphone replaced by the electrical input signal device

Frequency weighting	A	C	Z
The highest expected level of self-generated noise stated in the instruction manual [dB]	14.0	13.0	21.0
Level of self-generated noise [dB]	5.6	4.3	9.6

4. Acoustical signal tests of a frequency weighting C

Frequency	Relative frequency-weighted free-field response	Design-goal frequency weighting	The deviation of frequency weighting	Extended uncertainty	Acceptable limits
Hz	dB	dB	dB	dB	dB
125.0	93.95	-0,2	-0.3	0.3	±1.5
1000.0	94.45	0,0	0.0	0.3	±1.1
4000.0	93.35	-0,8	-0.3	0.4	±1.6
8000.0	89.88	-3,0	-1.6	0.4	-3.1; +2.5

5. Electrical signal tests of frequency weightings

Frequency	Design-goal frequency weighting			The deviation of frequency weighting			Extended uncertainty	Acceptable limits
	A	C	Z	A	C	Z		
Hz	dB	dB	dB	dB	dB	dB	dB	dB
63	-26,2	-0,8	0,0	0.1	0.0	0.0	0,3	±1,5
125	-16,1	-0,2	0,0	0.0	0.0	0.0	0,3	±1,5
250	-8,6	0,0	0,0	0.1	0.1	0.1	0,3	±1,4
500	-3,2	0,0	0,0	0.2	0.3	0.3	0,3	±1,4
1000	0,0	0,0	0,0	0.0	0.0	0.0	0,3	±1,1
2000	1,2	-0,2	0,0	0.6	0.6	0.6	0,3	±1,6
4000	1,0	-0,8	0,0	0.5	0.5	0.4	0,3	±1,6
8000	-1,1	-3,0	0,0	0.1	0.1	0.0	0,4	-3,1; +2,1
16000	-6,6	-8,5	0,0	-3.2	-3.2	-3.0	0,6	-17,0; +3,5

6. Frequency and time weightings at 1 kHz

	Sound level				Time-averaged sound level
Frequency weighting	A	A	C	Z	A
Time weighting	Fast	Slow	Fast	Fast	-
Indication [dB]	114.0	114.0	114.0	114.0	114.0
The deviation of indication from the indication of A-weighted sound level with Fast time weighting [dB]		0.0	0.0	0.0	0.0
Extended uncertainty [dB]		0.1			
Acceptable limits [dB]		±0.3	±0.4	±0.4	±0.3

7. Level linearity

Reference level range: 130 dB

Expected sound level	Indication	Level linearity error	Extended uncertainty	Acceptable limits
dB	dB	dB	dB	dB
136.0	136.0	0.0	0.2	±1.1
135.0	135.0	0.0		
134.0	134.0	-0.1		
133.0	133.0	-0.1		
132.0	132.0	-0.1		
131.0	131.0	-0.1		
130.0	129.9	-0.1		
129.0	128.9	-0.1		
124.0	123.9	-0.1		
119.0	118.9	-0.1		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	88.9	-0.1		
84.0	83.9	-0.1		
79.0	78.9	-0.1		
74.0	73.9	-0.1		
69.0	68.9	-0.1		
64.0	63.9	-0.1		
59.0	58.9	-0.1		
54.0	53.9	-0.1		
49.0	49.0	0.0		
48.0	48.0	0.0		
47.0	47.0	0.0		
46.0	46.0	0.0		
45.0	45.0	0.0		
44.0	44.0	0.0		

Level range: 105 dB

Expected sound level	Indication	Level linearity error	Extended uncertainty	Acceptable limits
dB	dB	dB	dB	dB
119.0	118.9	-0.1	0.2	±1.1
118.0	117.9	-0.1		
134.0	134.0	-0.1		
116.0	115.9	-0.1		
115.0	114.9	-0.1		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	89.0	0.0		
84.0	84.0	0.0		
79.0	79.0	0.0		
74.0	73.9	-0.1		
69.0	68.9	-0.1		
64.0	63.9	-0.1		
59.0	58.9	-0.1		
54.0	53.9	-0.1		
49.0	49.0	0.0		
44.0	44.0	0.0		
39.0	39.0	0.0		
34.0	34.1	0.1		
33.0	33.2	0.2	0.3	
32.0	32.2	0.2		
31.0	31.2	0.2		
30.0	30.4	0.4		
29.0	29.4	0.4		
28.0	28.6	0.6		

8. Level linearity including the level range control

Level range	105 dB	130 dB
Indication for the reference sound pressure level [dB]	114.0	114.0
The deviation of indication [dB]		0.0
Anticipated level that is 5 dB less than the upper limit specified in the instruction manual for level range at 1 kHz [dB]	132.0	110.0
Indication [dB]	131.9	110.0
The deviation of indication [dB]	0.1	0.0
Extended uncertainty [dB]	0.2	
Acceptable limits [dB]	±1.1	

9. Toneburst response

Measurement quantity	Time weighting	Toneburst duration	The indications in response to toneburst relative to the steady sound level	Reference toneburst response relative to the steady sound level	The deviations of the measured toneburst in responses from the corresponding reference toneburst	Extended uncertainty	Acceptable limits
		ms	dB	dB	dB	dB	dB
Time-weighted sound level	Fast	200	-1.0	-1.0	0.0	0.2	±0.8
		2	-18.0	-18.0	0.0		-1.8; +1.3
		0.25	-27.1	-27.0	-0.1		-3.3; +1.3
Time-weighted sound level	Slow	200	-7.4	-7.4	0.0		±0.8
		2	-27.0	-27.0	0.0		-1.8; +1.3
Sound exposure level	-	200	-7.0	-7.0	0.0		±0.8
		2	-27.0	-27.0	0.0		-1.8; +1.3
		0.25	-36.1	-36.0	-0.1		-3.3; +1.3

10. Peak C sound level

Numbers of cycles in test signal	Frequency of test signal	The deviation of indication	Extended uncertainty	Acceptable limits
	Hz	dB	dB	dB
One	8000	-0.5	0.2	±2.4
Positive half-cycle	500	-0.1		±1.4
Negative half-cycle	500	-0.1		

11. Overload indication

Frequency weighting A

The difference between the levels of the positive and negative one-half-cycles input signals that first cause the displays of overload indication	Extended uncertainty	Maximum value of the difference
dB	dB	dB
0.0	0.3	1.8

NOTES

1. All acoustic tests were carried out with the compensation filter set to Free-field whereas the remaining electrical tests were performed with the filter switched off as specified by the manufacturers.

2. The instrument was running firmware version 1.22.1

CERTIFICATE OF CALIBRATION

MEASUREMENT SYSTEMS

UKAS CALIBRATION
0653

Date of Issue: 26 September 2017

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

Certificate Number: UCRT17/1820

Approved Signatory
[redacted]
K. Mistry

CUSTOMER	Clement Acoustics Ltd 202 Uxbridge Road London W12 7JP
ORDER No	Solo S/N 65785 Job No UKAS17/09502
DATE OF RECEIPT	25 September 2017
PROCEDURE	Procedure TP 1 Calibration of Sound Calibrators or Calibration Engineer's Handbook section 2
IDENTIFICATION	Sound Calibrator Norsonic type 1251 serial number 31716 with one-inch housing and adapter type 1443 for half-inch microphone
CALIBRATED ON	26 September 2017
PREVIOUS CALIBRATION	Calibrated on 15 April 2016, Certificate No. 02672/1 issued by a UKAS accredited calibration laboratory No. 0801

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output was

114.16 ± 0.1 dB rel 20 μPa

The fundamental frequency of the sound output was 1001 Hz ± 0.06 %,
and its total distortion was (0.09 ± 0.03) %.

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.

During the measurements the laboratory environmental conditions were:

Temperature: 22 to 24 °C
Atmospheric pressure: 101.2 to 101.3 kPa
Relative humidity: 34 to 48 %

The tests carried out were as specified in Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). The sound calibrator has been shown to conform to the class 1 requirements for periodic testing in Annex B of IEC 60942:2003 for the sound pressure level and frequency stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003. However it has successfully undergone pattern evaluation to the earlier Standard IEC 942:1988

END

Appendix G

Datasheet for Typical Machinery to be Used During Construction

PAUSELLI SELF PROPELLED PILE DRIVER MOD. 400

The pile driver Mod. 400 is a compact self propelled rig specifically designed for the installation of solar panels and road safety barriers.

The machine can also be used to install posts and wooden piles such as fence posts.

TECHNICAL DATA	UNIT	VALUE
DIESEL ENGINE DEUTZ D2011L02I AIR-OIL COOLED 2 CYLINDER	KW - (HP)	21.77 – (29.2)
HYDRAULIC HAMMER INDECO HP 500 – IMPACT ENERGY	JOULE	610
HAMMER WEIGHT	KG	320
STRIKING RATE PER MINUTE	N/MIN	660 – 1.370
POST DRIVING CAPACITY	MM	2900*x200x120
MAX NOISE	DBA	75
HYDRAULIC OIL TANK CAPACITY	LITRES	100
DIESEL TANK CAPACITY	LITRES	30
SPEED	KM/H	7
TRANSPORT DIMENSION	MM	2000lx2100w x2280h
TOTAL WEIGHT	KG	1800

*PILE SECTIONS LONGER THAN 2.9 METRES CAN STILL BE INSTALLED IF PRE DRIVEN