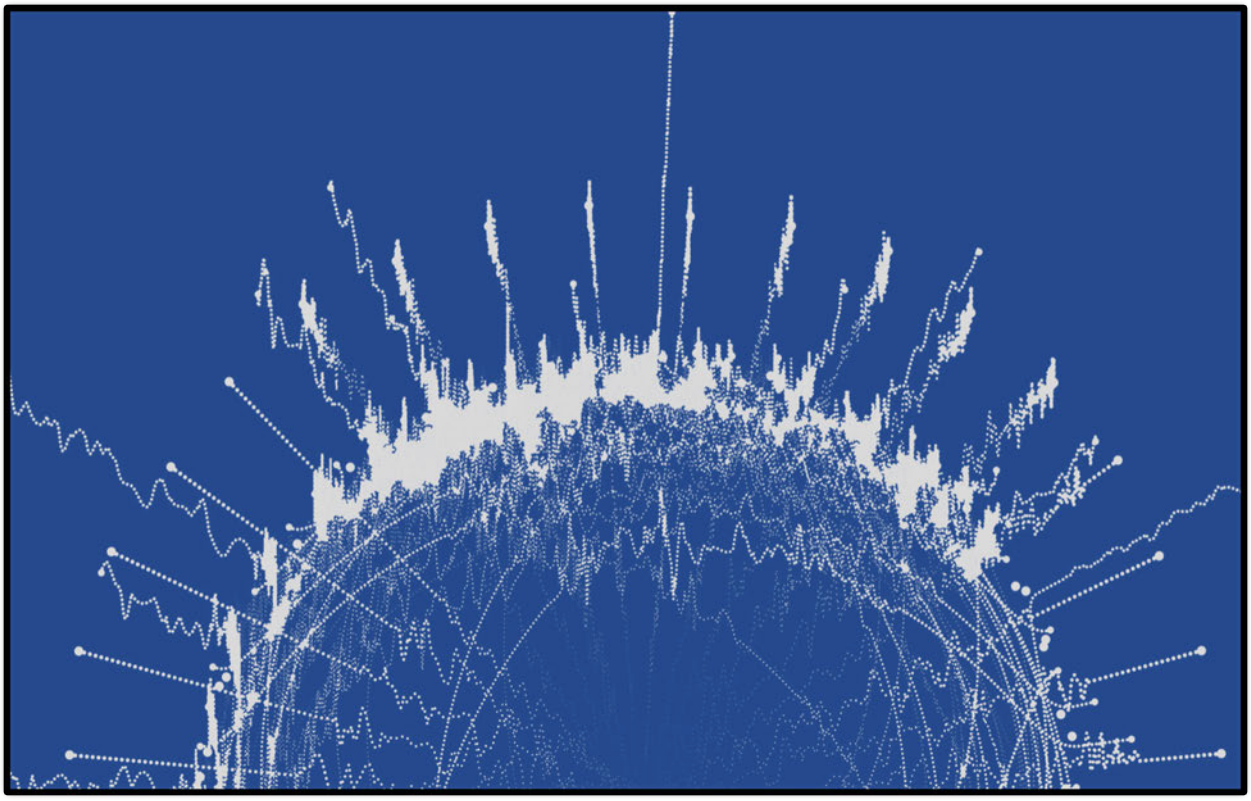
TGSacoustics

Environmental Sound Survey

and

Noise Impact Assessment

Land To The South Of Chear Fen Boat Club,
Twenty Pence Road, Cottenham, Cambridgeshire, CB6 8PX



TGSacoustics

Environmental Sound Survey
and
Noise Impact Assessment

to
NPPF - PPG Technical Note rev:2014
and
BS5228-1:2009+A1:2014

For
Mr Drew Price and Mr James Ball

Land to the south of Chear Fen Boat Club
Twenty Pence Road
Cottenham
Cambridgeshire
CB6 8PX

Report No. 02489
Version 1.1

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Signed

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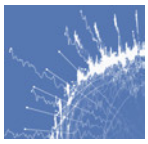

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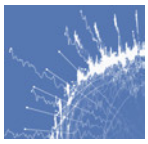


Executive Summary

Following a request from Mr Drew Price and Mr James Ball, a Sound Survey was undertaken on 3rd of March 2023, at Land to the South of Chear Fen Boat Club, Twenty Pence Road, Cottenham, Cambridgeshire, CB6 8PX, to support an appeal against refusal of planning permission.

Planning permission was refused on the 5th of September 2022 for the stationing of caravans for residential purposes, nine dayrooms and hardstanding ancillary to that use. The LPA noted that a statement demonstrating the safeguarding of the Sand and Gravel Mineral Safeguarding Area, due to noise impacts at the application site, was not provided with the application.

Measurements undertaken provide baseline levels to inform the noise impact assessment, allowing assessment of impacts to the limits contained within the Technical Note to the NPPF. Reference has been made to the Noise Report and Technical Notes undertaken by Sharps Redmore that supported the original application for the mineral workings. This ensures that the prediction processes undertaken within the TGSacoustics report, including those of BS5228-1:2009+A1:2014, are consistent with those supporting the gaining of planning permission for the mineral workings themselves.

The Sand and Gravel Mineral Safeguarding Area, known as Mitchell Hill, lies to the south of the appeal site, with Phases 6 and 7, known separately as Chear Fen, immediately adjacent. Workings are currently on Phase 4 in 2023, having successfully gained planning permission in 2018.

The appeal site is predicted to fall below the limits provided in the Technical Note to the NPPF, when operations are active at the Phase 6 workings. In addition, there are strong contextual arguments which further reduce the predicted impacts. Specifically, onerous, or worst-case scenarios have been used for the levels predicted by Sharps Redmore for the mineral working planning application and are considered to overstate the impacts. This is also the case for the TGSacoustics report as the same plant level data is used and the same assessment procedures undertaken. This potential for overstating the predicted levels is also supported by the Periodic Noise Monitoring of 2020 and observations whilst Phase 4 was being worked in 2023.

With the assumptions laid out in this Report, the appeal site can achieve an acceptable acoustic environment when assessed by the procedures within BS 5228:2009-1+A1:2014 and the limits provided in the Technical Note to the NPPF. This will provide the required safeguarding of the mineral workings.

The Author - Qualifications and Status

Tim Green has over forty years of experience in monitoring and analysing sound, including 21 years employment with the BBC. He has worked in Environmental Acoustics since 2009, including seven years as an Associate Lecturer in Acoustics at the University of Derby.

His work with TGSacoustics Ltd includes advising and assessment in areas of Environmental Acoustics. He is highly experienced in the measurement of sound and the evaluation of data. His presentation skills have strength in both the written presentation of reports and in presenting evidence as a Professional Witness.

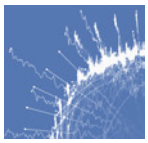
His observational skills have provided contextual data, of increasing importance within the NPPF, BS 4142:2014 and ProPG, that has guided numerical data to successfully form robust argument.

His Associate Lecturer role included medical leave cover between 2020 and 2022 as Programme Lead on the MSc in Applied Acoustics at Derby and Module Leads on the IOA Diploma. He also provided support on the IOA Certificate of Competence in Environmental Noise Measurement and the Work-Place Noise Assessment courses. Work at Derby continues in 2023 delivering the Environmental Competency Course. Independently, he has run a bespoke course on the application of ProPG guidance.

His presentations to the IOA in the last 8 years have included topics in environmental, building, and musical acoustics.

He has a Masters Degree in Applied Acoustics, awarded with Distinction by the University of Derby. He holds the Institute of Acoustics Diploma in Acoustics and Noise Control, awarded with Special Commendation and holds the Certificate of Competence in Environmental Noise Measurement.

He is a Corporate member of the Institute of Professional Sound.



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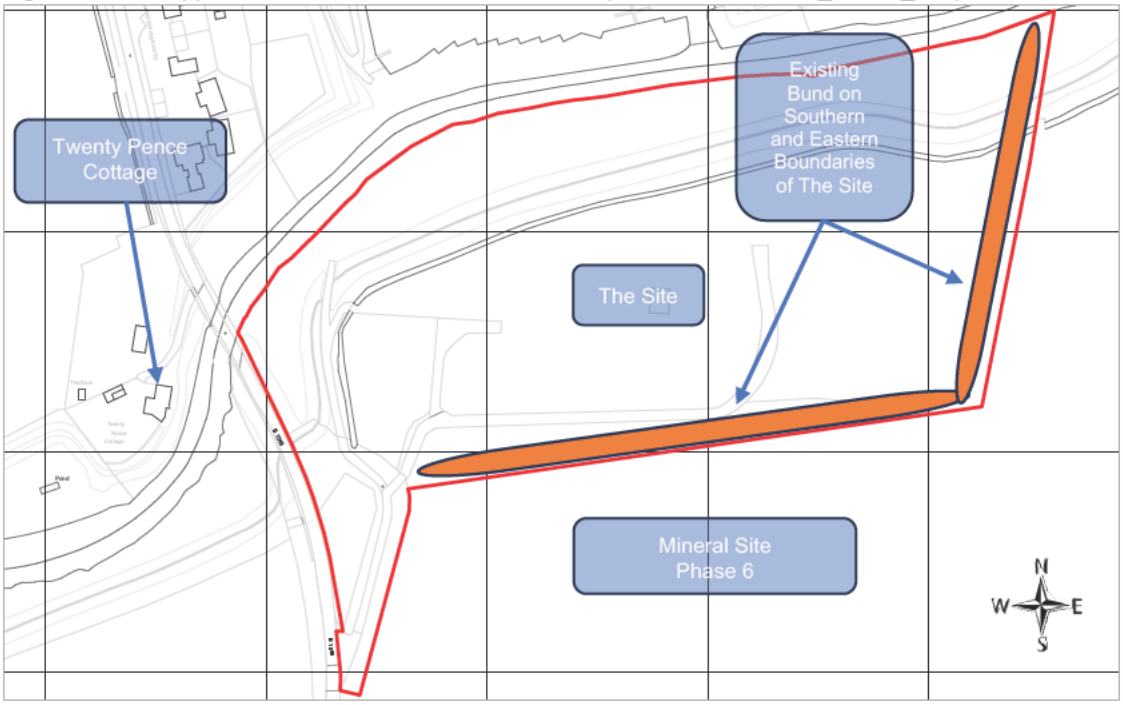
1. Introduction

1.1 Following a request from Mr Drew Price and Mr James Ball, a Sound Survey was undertaken on 3rd of March 2023, at Land to the South of Chear Fen Boat Club, Twenty Pence Road, Cottenham, Cambridgeshire, CB6 8PX (hereinafter called 'The Site'). Measurements undertaken provide baseline levels to inform the noise impact assessment.

1.2 The Sound Survey and Noise Impact assessment contained herein, is to inform the appeal by Mr Drew Price and Mr James Ball against the Planning Permission refusal of the 5th of September 2022 for the stationing of caravans for residential purposes, nine dayrooms and hardstanding ancillary to that use. In their refusal, the Council state: *In the absence of a statement demonstrating safeguarding of the Sand and Gravel Mineral Safeguarding Area, the proposal is contrary to Policy 5 of the Cambridgeshire and Peterborough Minerals and Waste Local Plan (June 2021)* (Decision Notice, 22/01703/FUL).

1.3 The Sand and Gravel Mineral Safeguarding Area, known as Mitchell Hill, is currently being worked, having successfully gained planning permission in 2018. The sand and gravel deposits are expected to last for 12 years, of which Chear Fen, Phases 6 & 7, will be active for 21 months (Calculations, Appendix E, page 34). A noise assessment was undertaken by Sharps Redmore for the complete extraction workings and included an assessment at Twenty Pence Cottage, which lies due west of The Site (Figure 1.1).

Figure 1.1 The Application Site and Immediate Environs (Base Plan: GPS 21_1161B_001)



1.4 The Sharps Redmore report (Environmental Statement – Noise, 2018) details the impacts to the closest residential properties to the minerals site respective to the operating phases. The Sharps Redmore Report led to conditions, identifying maximum permissible levels, which reflect the relationship between the predicted impacts from extraction activities and the baseline background levels.

1.5 A further Technical Note was produced by Sharps Redmore (Noise - Technical Note, 2018) to meet the clarification requested by Cambridge County Council. This Technical Note provides further data and revised mitigations to demonstrate acceptability of noise from the mineral workings.

1.6 Periodic monitoring, to demonstrate compliance with condition 12, was undertaken by LF Acoustics in December 2020 (Periodic Noise Monitoring, 2020) and reports levels from Phase 1 (Figure 1.2). All levels measured are lower than the site noise limits, predicted by Sharps Redmore, and set by condition, by between 5 dB and 7 dB. The mineral workings were active on Phase 4 on the 3rd of March 2023 (Figure 1.3).

Figure 1.2 LF Acoustics Phase 1 Noise Monitoring Positions (Base Plan: LF Acoustics)

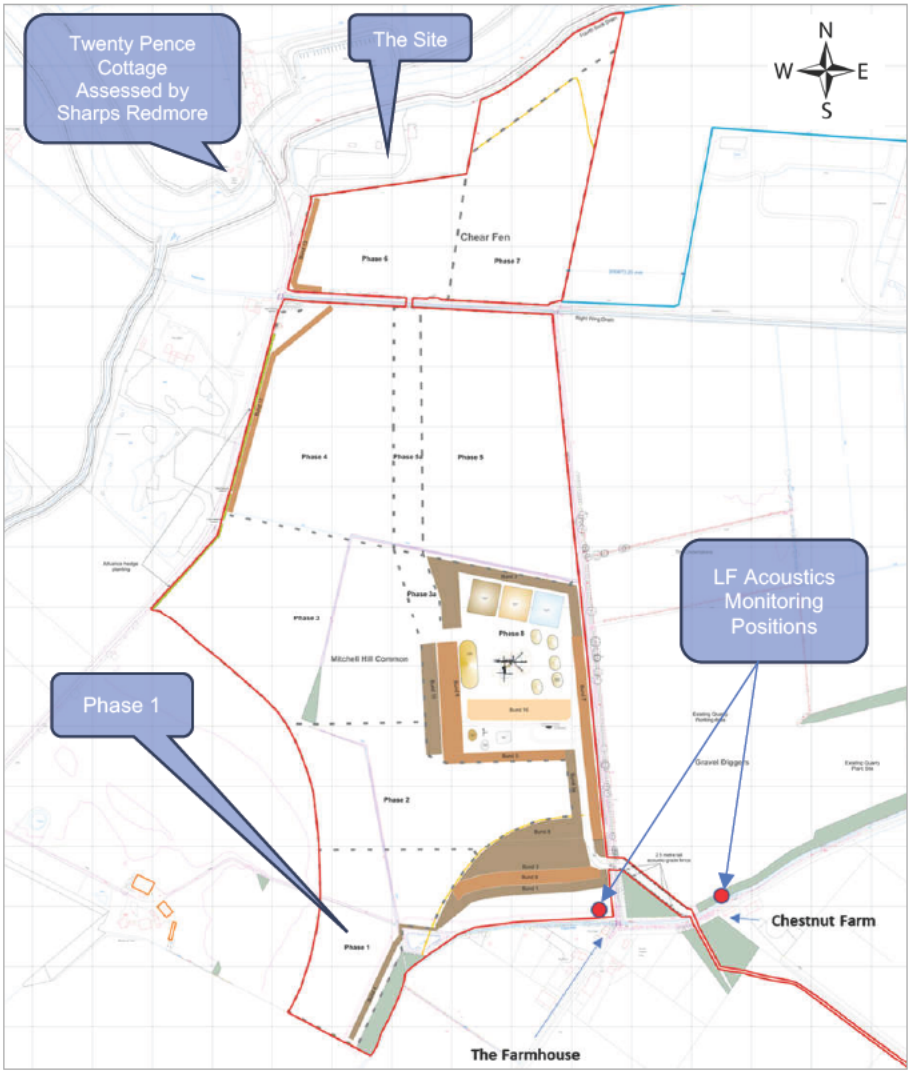


Figure 1.3 Working Phase Drawing – (Base plan: Clover Planning - CP/FRIM/MH/03g)

1.7 The Sharps Redmore calculations provide detailed data for Twenty Pence Cottage, which is a similar distance and direction to the activities as that of The Site. The Site is closer to the activities on the extraction site than Twenty Pence Cottage; however, with adaptation for distance, and correction for the existing bund, and considered with the Sharps Redmore data for operations, the impact levels can be assessed at The Site.

1.8 The TGSacoustics assessment of The Site will be undertaken using the same process as performed by Sharps Redmore for the original planning submission to meet the NPPF Technical Note (Planning Policy Guidance, Minerals, 2014).

2. Assessment Criteria

2.1 The National Planning Policy Framework (NPPF, 2012) replaced the previous Minerals Policy Statement (MPS2), with the Planning Policy Guidance Technical Guidance. This takes the form of web-based guidance revised on 6th March 2014.

2.2 The NPPF was revised in 2019 and Chapter 17 considers facilitating the sustainable use of minerals. Within this chapter, paragraphs 203 to 208 address the safeguarding of mineral extraction and states that planning policies should:

> *'set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality'*
>
> *'when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction.'*
>
> *'ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source[76], and establish appropriate noise limits for extraction in proximity to noise sensitive properties.'*

2.3 The reference 76 in the above paragraph directs to the National Planning Guidance on minerals. The Technical Guidance considers the control of noise emissions:

> *'Those making mineral development proposals, including those for related similar processes such as aggregates recycling and disposal of construction waste, should carry out a noise impact assessment, which should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.'*

2.4 It provides proposals for the control and mitigation of noise emissions:

- *consider the main characteristics of the production process and its environs, including the location of noise-sensitive properties and sensitive environmental sites;*
- *assess the existing acoustic environment around the site of the proposed operations, including background noise levels at nearby noise-sensitive properties;*
- *estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations;*
- *identify proposals to minimise, mitigate or remove noise emissions at source;*
- *monitor the resulting noise to check compliance with any proposed or imposed conditions.*

2.5 It considers whether the acoustic environment of the proposed site gives rise to significant adverse effect, adverse effect or that a good standard of amenity is achieved. This should be in line with the Explanatory Note of the Noise Policy for England (NPSE, 2010).

2.6 Appropriate noise limits are provided within the Technical Note for normal daytime operations:

> *'Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field).'*

2.7 Appropriate noise limits are provided within the Technical Note for normal evening operations:

> *'For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.'*

2.8 However, the Technical Guidance notes:

> *Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed.*

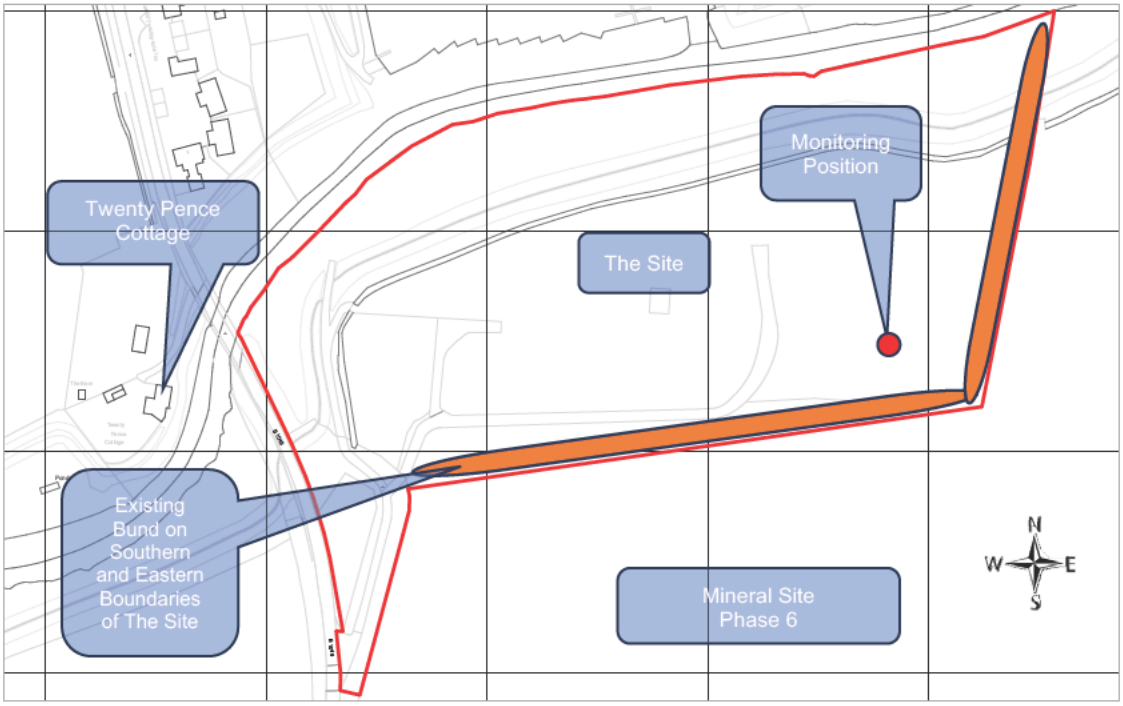
2.9 The noise limits above are intended for routine excavations and the temporary works comprising soil-stripping, bund construction, bund removal and final restoration, a limit of 70 dB $L_{Aeq,1h,free\text{-}field)}$ for a period of 8 weeks in the year, is considered a normal maximum.

3. Sound Survey – Measurement Method

3.1 Baseline level measurements were undertaken on the 3rd of March 2023. These were undertaken at times of day similar to the Sharps Redmore measurements (Environmental Statement – Noise, 2018) to allow for a direct comparison. It is noted that the measurement position at The Site is shielded from sounds to the south and east (Figure 3.1)(Photographs, Appendix F, pages 35-37). Whilst this will affect the measurement levels, it provides a representative background level at the mobile homes for assessment against the mineral workings' activity sounds.

3.2 Although workings were in progress at Phase 4, the sounds from those activities were barely audible from the top of the bund and inaudible at the monitoring position allowing background levels to be achieved without any potential contribution from the mineral activities. Audio tracks recorded continuously throughout the monitoring period support this (Audio tracks – available on request).

Figure 3.1 Monitoring Position



3.3 The Background Levels were undertaken in 15-minute intervals. The microphone, with wind shielding, was placed at a height of 1.5 metres and free field, (Photographs, Appendix F, pages 37-38). The meter was calibrated in the field before commencement of the measurement periods and directly afterwards (Appendix B, page 17). The meteorological conditions were recorded during the monitoring periods in 5-minute intervals (Appendix C, page 19).

3.4 Measurements are made to BS 7445-2:1991 and reference to BS 4142:2014+A1:2019 for Background Levels.

3.5 A real-time integrating sound analyser was used providing Class 1 performance of accuracy of approximately ±0.7 dB. Broadband and third octave band figures were recorded in the following measurements: $L_{Aeq\ (T)}$, $L_{A90\ (T)}$ (Glossary, Appendix A, page 16).

3.6 Time-coded 24 bit, 48kHz audio was recorded during the measurement periods to support the assessment. The audio files are available on request. All monitoring equipment used during the survey is listed in Appendix B (page 17).

4. Sound Survey – Measurement Results

4.1 Both Background $L_{A90(15min)}$ and Ambient $L_{Aeq\ (15min)}$ baseline measurements undertaken are reported from the measurement day of the 3rd of March 2023 (Table 4.1).

Table 4.1 Baseline Measurements

Measurement Results 03/03/23			
Start Time	Background Levels $L_{A90(15m)}$ dB	Residual Levels $L_{Aeq(15m)}$ dB	Notes
14:20	37	42	Dry conditions throughout with 8 oktas of cloud cover. The wind was from the north with an average speed of 2.4 m/s. Occasional military aircraft, dogs barking, and a bird scarer did not influence the Background Levels. The existing earth bund at The Site will have reduced the overall level of the $L_{A90(T)}$ than that reported by Sharps Redmore, in the open, at Long Drove (Environmental Statement – Noise, 2018).
14:35	36	40	
14:50	38	43	
15:05	36	44	
15:20	36	40	
15:35	38	44	
15:50	39	42	
16:05	39	44	
16:20	40	45	
16:35	39	44	
16:50	39	43	
17:05	40	43	

4.2 The Background Level modal value is 39 dB $L_{A90(15m)}$, with figures varying by ±1 dB from the modal accounting for 67% of the time.

4.3 The variation between the individual $L_{Aeq(15m)}$ figures is small, with the overall figure for the measurement period of 43 dB $L_{Aeq(3h)}$. The variation between the $L_{Aeq(15m)}$ and dB $L_{A90(15m)}$ is also small demonstrating a stable and consistent sound environment.

5. Noise Impact Assessment

5.1 Overview

5.1.1 The process of assessment of mineral working activity sound is taken from the Sharps Redmore report for Twenty Pence Cottage. This is Calculation Sheet 14 in the appendices of their report (Environmental Statement – Noise, 2018). The Sharps Redmore assessment identifies the plant levels, types, distances, and on-time factors of the activity sounds, which are also adjusted for other factors influencing the sound path. Their report demonstrates acceptable acoustic conditions at the residential property so providing for safe guarding the mineral workings.

5.1.2 The mitigations are further refined to cope with the lower Background Levels measured by Sharps Redmore on a Saturday, and the change to the processing plant activities (Noise Technical Notes, 2018). The Technical Note reports satisfactory outcomes for both weekday and Saturday working, noting that the revised bunding is adapted to reflect the changed processing plant noise levels for properties on Twenty Pence Road. The changes to Saturday operations noted in the Sharps Redmore Technical Notes of no soil screening, the removal of concrete crushing from all mineral site operations, and no backfilling on Phase 1, in conjunction with the improved bunds, reduces the Saturday activity sound levels in line with the reduced Background Levels observed.

5.1.3 The Periodic Noise Monitoring, undertaken by LF Acoustics in December 2020, supports the assessment procedure of Sharps Redmore. The Sharps Redmore report sought a cautious approach and therefore more onerous outcomes. This combined with the additional mitigation procedures described in their Technical Note (Noise Technical Notes, 2018), support the reduced overall levels measured in the Periodic Noise Monitoring of between 5 – 7 dB lower than the predictions (Periodic Noise Monitoring, 2020).

5.1.4 The process of monitoring and assessing the sound emanating from the mineral working activities undertaken in 2018, thus provides a robust base on which to assess the impacts at The Site under investigation in this TGSacoustics Report. The difference in distance to that of Twenty Pence Cottage are applied and its effect on barrier calculations. It is also noted that whereas temporary operations typically start with no earth bund, as this is part of the process of removing top soil and over burden, The Site has a significant earth bund already in place.

5.1.5 The impacts, assessed at The Site, are of a temporary nature. The mineral extraction has a life of 12 years in which 1.7 million tonnes of sand and gravel will be removed (Environmental Statement – Non-Technical Summary, 2018). It has been estimated that the Chear Fen site will contribute 0.25 million tonnes of this total. Assuming an equal speed of extraction, the Chear Fen site, Phases 6 & 7, will be active for approximately 21 months, with Phase 6 active for approximately 9 months (Calculations, Appendix E, page 34).

5.2 Sound Level Prediction Methodology

5.2.1 The prediction process used is that undertaken within the Sharps Redmore Report, which is based on BS 5228-1:2009+A1:2014. As this has been accepted as a valid and effective method in satisfying the planning application process for the mineral site, and therefore providing parameters for the safe guarding of the mineral reserves, the assessment of impacts at The Site uses the same process with the necessary corrections for distance and for the bund acting as a barrier on The Site.

5.2.2 The assumptions made by Sharps Redmore informing additional attenuation or enhancement of the sound, over and above the guidance in BS 5228:2009-1+A1:2014, are retained, as the variation to activity sounds at Twenty Pence Cottage will be similar to those at The Site (Environmental Statement – Noise, 2018, page 10, 5.1 – 5.2).

5.2.3 In addition, the modelling of the modes for each of the activities will be retained as these too are part of the tested and valid process (Environmental Statement – Noise, 2018, page 10, 5.3 - 5.4).

5.3 Temporary Workings

5.3.1 These include the removal of top soil and the expected over-burden. The top soil and sub-soil are removed to a depth of 300mm and 380mmm respectively. The over burden will be returned to a depth of 500mm at the point of restoration (Environmental Statement – Non-Technical Summary, 2018, 3.21, 3.22). As such, when calculating the attenuation due to the existing bund the temporary workings are assessed at ground level and the routine excavations at 1-metre below ground level.

5.3.2 The distance is taken as the minimum distance to Phase 6 and corrected as a point source by the BS 5228:2009-1+A1:2014 formula F.3, K'_h (Page 133, F.2.3.2).

5.3.3 These workings have a limit of 70 dB $L_{Aeq(1h)}$ for no more than 8 weeks a year (NPPF Technical Note, Guidance, Minerals, 2014).

5.1.6 It was observed during the removal of top soil on Phase 4 that two excavators were being used for this temporary activity, not a bulldozer (Photographs, Appendix F, page 39). This is also noted in the LF Acoustics report where one excavator was attending to soil handling activity (Periodic Noise Monitoring, 2020, page 3). Even with two excavators, operating at identical distances from The Site, these will provide a combined level of 105 dB $L_{WA'}$. This is 3 dB lower than that of the Bulldozer at 108 dB $L_{WA'}$ used by Sharps Redmore and in the calculations below (Table 5.1).

Table 5.1 Impacts from Temporary Works at The Site

Temporary Works – Bulldozer	
L_{WA}' 100% on-time	108 dB
Distance correction to receiver 50m	-42 dB
Barrier attenuation	-12 dB
Soft Ground	0 dB
Air Absorption	0 dB
Downwind Correction	+1 dB
Total Impact at Receiver $L_{Aeq(1h, free field)}$	**55 dB**

(Calculations, Appendix D, pages 20-21)

5.3.4 The impact level of 55 dB $L_{Aeq(1h, free field)}$ is well below the limit for temporary workings of 70 dB.

5.4 Routine Activities at The Site

5.4.1 Routine activities include excavation of minerals, the passage of dump trucks between Phase 6 and the processing plant, the aggregates processing plant itself, and tipper lorries on the access road. The processing plant had a log-washer included following the initial report from Sharps Redmore, but this is identified in their Technical Notes (Noise Technical Notes, 2018). The cumulative assessment below (Table 5.2), includes the effect of both the additional sound power level and the increase in bund mitigation within the revised plans.

5.4.2 The revised assessment in the Sharps Redmore Technical Note also includes the additional soil screening activity not previously part of the assessment. All revisions are included in the TGSacoustics cumulative assessment of impacts at The Site (Table 5.2).

Table 5.2 Cumulative Impacts from Routine Activities at The Site

	Edge of Excavations
Excavator	45 dB
Dump Trucks segment 6	39 dB
Dump Trucks segment 2	33 dB
Aggregates Processing Plant	35 dB
Soil Screening	22 dB
Tipper Lorries	27 dB
Cumulative Impact at Receiver $L_{Aeq(1h, free field)}$	**47 dB**
Threshold L_{Aeq} (Background $L_{A90(t)}$ +10 dB)	**49 dB**
Conclusion	**Satisfactory**

(Calculations, Appendix D, pages 22-33)

5.4.3 The operations are 2 dB below the limit at the edge of excavations making it satisfactory ('Minimum' assessment point - BS 5228-1:2009+A1:2014, page 128). Should the bund height with respect to the Phase 6 existing ground level be 4m, not 5m as assessed, then the cumulative impact of 48 dB $L_{Aeq(1h, free field)}$ remains satisfactory (Calculations, Appendix D, pages 22-33).

6. Discussion

6.1 Without any further physical mitigation or contextual factors mitigating the impacts, the Phase 6 operations will provide a satisfactory level at The Site against the Background Level.

6.2 Measurement on the 3rd of March 2023 demonstrates the most commonly occurring level of between 39 dB $L_{A90(15min)}$ and 40 dB $L_{A90(15min)}$. As such, the lower level of 39 dB $L_{A90(15min)}$ has been used for assessment. This slightly lower level than that recorded by Sharps Redmore is expected, as the bund on the southern and eastern boundary of The Site provides some attenuation to the sources contributing to the Background Level. This does, however, provide a realistic Background Level as it is the level experienced at the residential homes and so relative to any activity sounds at that location.

6.3 It has been assumed that the process of setting the limit to 10 dB above the Background Level, expressed in the Technical Note to the NPPF, is valid for the planning application for The Site as it was used in the Sharps Redmore report that informed the successful planning application for the mineral workings.

6.4 Whilst the Site is closer to the edge of the excavations than Twenty Pence Cottage assessed by Sharps Redmore, known as the 'minimum distance', and expressed in BS 5228:2009-1+A1:2014, it has a significant bund in place prior to any workings on Phase 6, which is relatively close to the mobile homes. This has a positive effect on the levels predicted at The Site.

6.5 Workings in this area are estimated to occur over a 9-month period for Phase 6 (Calculations, Appendix E, page 34). This is in the context of mineral extraction over a period of 12 years, during which the sounds associated with the excavating of minerals and transporting by articulated dump trucks will be reduced at other phase workings.

6.6 The satisfactory result is also considered as based on an onerous, or worst-case scenario, which is supported by the periodic testing results that highlight the magnitude of the margins included in the Sharps Redmore report and the BS 5228-1:2009-1+A1:2014 process. Both of these indicate that the actual impacts from Phase 6 at The Site may well be of a lower level than that assessed by Sharps Redmore and in this TGSacoustics Report.

6.7 If the numerical findings of the periodic testing translate throughout all the phases across the mineral workings, then the 5-7 dB reduction would further reduce levels at The Site, extending the margin of the already satisfactory result.

6.8 The difference in level between the measurements during the periodic monitoring to those levels predicted by Sharps Redmore, and of those within this TGSacoustics Report, may be due to:

- The Sharps Redmore enhancement factor of 3 dB on the articulated dumper truck $L_{WA'}$ level process (Environmental Statement – Noise, 2018, page 11, 5.3).
- The assessment by only the minimum distance, that of the closest point to the receiver, by means of BS5228-1:2009+A1:2014 (page 128).
- The 100% on-time assumed for the excavator for routine excavations (Environmental Statement – Noise, 2018, page 11, 5.3).
- The assumption of downwind for 100% of the time for all receivers despite them being located on a 180-degree spread from SSE to NNW (Environmental Statement – Noise, 2018, page 11, 5.1).
- The top soil movement was undertaken by the excavator at the point of Periodic Noise Monitoring (Periodic Noise Monitoring, 2020, 3.1, page 3) and during observation of the Phase 4 operations (Photographs, Appendix F, page 40). This is of a lower sound power level than the bulldozer used in the Sharps Redmore predictions.
- Assessment by cumulative impact whilst the mineral workings are undertaken on a campaign basis.

It is also noted that the periodic monitoring measurement is the total ambient sound, which includes all other sounds in addition to those of the mineral workings whilst predictions only include the plant and equipment of the mineral workings. This may further extend the difference between the predicted sound levels of the mineral workings and that of the measurements from the Periodic Noise Monitoring.

6.9 Whilst some of the points in 6.8 intentionally provide a more onerous assessment to ensure that any variability in sound levels due to the mineral activities or the Background Level is more likely to maintain a safe margin, when they are combined, they will produce a significant reduction from the levels predicted. The periodic testing undertaken by LF Acoustics in 2020 provides a strong indicator that this is the case.

7. Conclusions

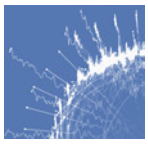
7.1 A sound survey was undertaken at The Site to inform the assessment of impacts due to mineral working activities predicted from the Phase 6 location. This survey informs the acceptability of the acoustic environment at residential properties on The Site. The assessments are made to the relevant standards and with reference to previous reports which provided the data informing the successful planning application for the mineral workings. These are detailed within this report.

7.2 Measurements were undertaken in March of 2023 to provide baseline Background Levels for the assessment at The Site. The sound levels for stationary and mobile plant have been taken from those used within the original report by Sharps Redmore which informed the successful planning application for the mineral workings. Their prediction process provides the number, and intensity of operations, as well as the source sound levels. This allows for consistency and referencing between the reports.

7.3 The Site does not exceed the limits provided in the Technical Note to the NPPF due to routine activities, nor for temporary workings, at Phase 6.

7.4 The satisfactory result is considered to be based on onerous, or worst-case scenarios. The Periodic Noise Monitoring undertaken by a second acoustics company in December of 2020, and observations of Phase 4 operations for this TGSacoustics Report in 2023, support the onerous nature of assumptions made in the initial prediction process. This will further reduce the levels predicted in this TGSacoustics Report, providing a greater margin of acceptability.

7.5 With the assumptions laid out in this Report, The Site achieves an acceptable acoustic environment when assessed by the procedures within BS 5228:2009-1+A1:2014 and the limits provided in the Technical Note to the NPPF, thus providing the required safeguarding of the mineral workings.



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For access to:

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Appendices

Appendix A Glossary

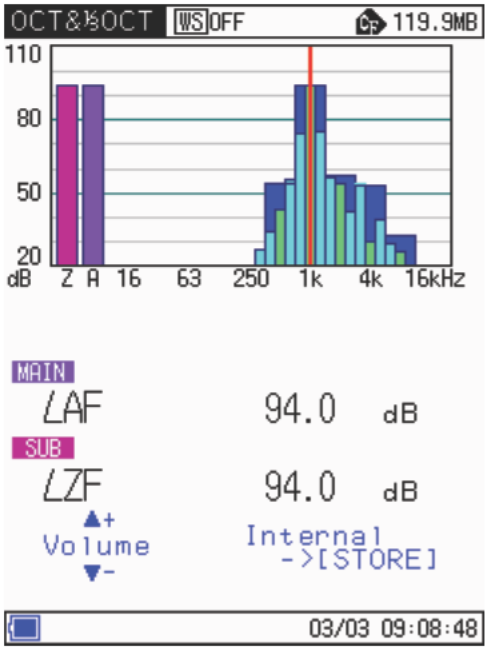
Ambient Sound Level	La = $L_{Aeq,T}$. Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
'A' weighting dB(A):	Filtering of the sound frequencies designed to reflect the response of the human ear to noise.
Attenuation:	Noise reduction, measured in decibels.
Background Sound Level	$L_{A90,T}$. A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels
Calibration:	A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level. This is performed in the field before and after measurement and by a laboratory every year for calibrators and bi-yearly for SLMs
Decibel (dB):	The unit used for sound level measurements.
Frequency (Hz):	The pitch of the sound, measured in Hertz.
Hz:	Hertz, the unit of frequency.
Integrating SLM:	Integrating Sound Level Meter. Instrument for measuring sound levels with the capacity to perform calculations to derive other parameters.
$L_{Aeq\ (T)}$	is the equivalent continuous A weighted sound level – the sound level of a notionally steady sound having the same energy as the fluctuating sound over a specified measurement period (T). All measurements are expressed in decibels (dB)
$L_{A90\ (T)}$	is the A weighted sound level, which is exceeded for 90% of the reference time T. All measurements are expressed in decibels (dB)
Noise Sensitive Receiver	NSR. Premises that are used for purposes sensitive to noise and require protection.
Mitigation:	The process of reducing the sound levels (and their impact) by means of physical barrier or distance
Okta	An okta is a unit of measurement used to describe the amount of cloud cover at any given location such as a weather station. Sky conditions are estimated in terms of how many eighths of the sky are covered in cloud, ranging from 0 oktas through to 8 oktas.
Third Octave-bands:	A division of the frequency range into bands.
Sound Pressure Level	L_P. Sound Pressure measured on a decibel scale. Sound Pressure is fluctuations in air pressure from the steady atmospheric pressure, created by sound due to the source of sound and its environment.

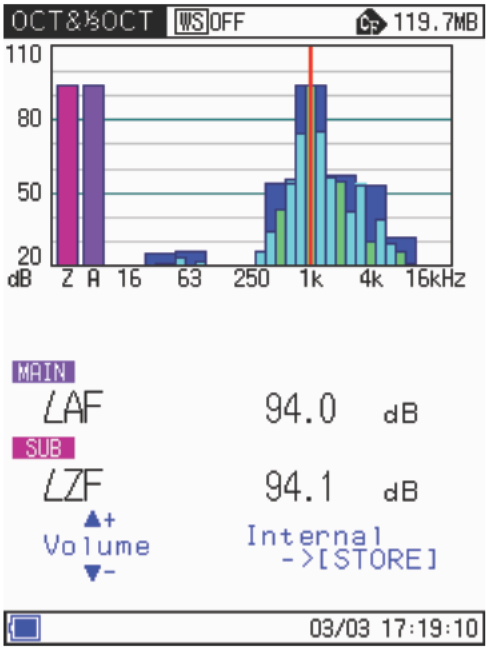
Appendix B Equipment and Calibration

Equipment

Equipment	Type	Serial number
Real time sound analyser	Rion NA-28	00881066
Microphone	Rion UC-59	01416
Preamplifier	Rion NH-23	81103
NA-28 UKAS Certificate of Calibration	11/01/2023 - 10/01/2025	UCRT23/1044
Calibrator	NC-74	34794318
NC-74 UKAS Certificate of Calibration	10/01/2023 - 09/01/2024	UCRT23/1039
Meteorological Monitoring	Kestrel 5000	2382668
Sound Recorder 48KHz / 24 bit	Sound Devices 744T	460505278002

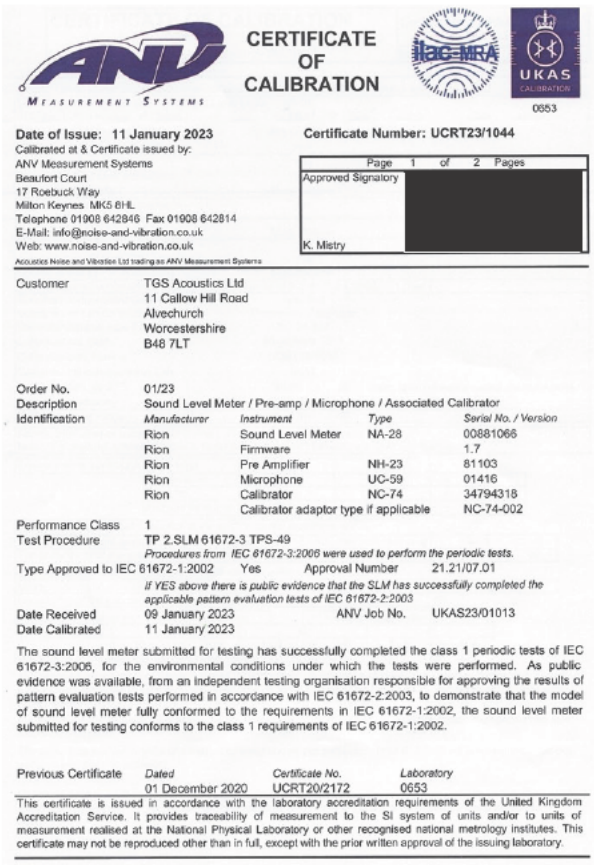
Field Calibration





Appendix B (Cont'd)

Calibration Certificates



CERTIFICATE OF CALIBRATION

0653

Date of Issue: 11 January 2023

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

Certificate Number: UCRT23/1044

Page 1 of 2 Pages
Approved Signatory
K. Mistry

Customer: TGS Acoustics Ltd, 11 Callow Hill Road, Alvechurch, Worcestershire, B48 7LT

Order No. 01/23
Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

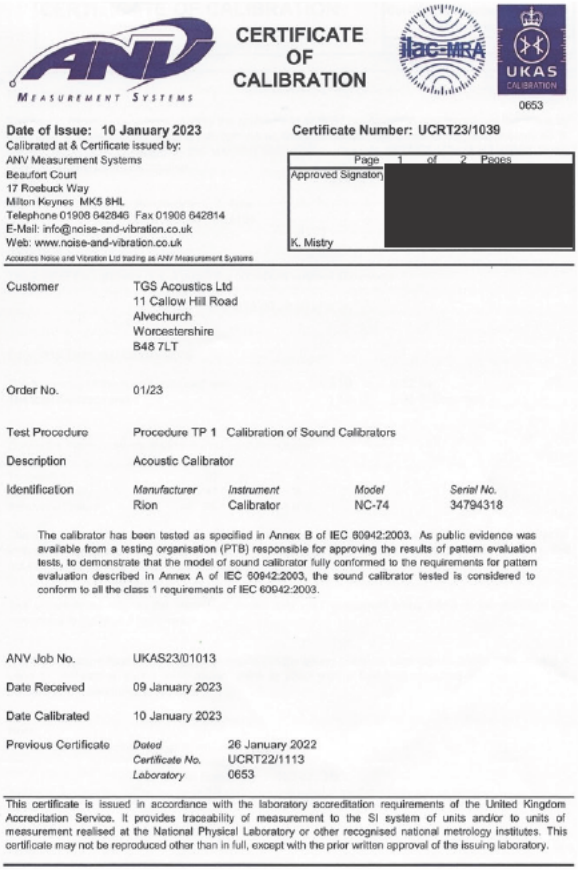
Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NA-28	00881066
	Rion	Firmware		1.7
	Rion	Pre Amplifier	NH-23	81103
	Rion	Microphone	UC-59	01416
	Rion	Calibrator	NC-74	34794318
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1
Test Procedure TP 2.SLM 61672-3 TPS-49
Procedures from IEC 61672-3:2006 were used to perform the periodic tests.
Type Approved to IEC 61672-1:2002 Yes Approval Number 21.21/07.01
If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003
Date Received 09 January 2023 ANV Job No. UKAS23/01013
Date Calibrated 11 January 2023

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	01 December 2020	UCRT20/2172	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION

0653

Date of Issue: 10 January 2023

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

Certificate Number: UCRT23/1039

Page 1 of 2 Pages
Approved Signatory
K. Mistry

Customer: TGS Acoustics Ltd, 11 Callow Hill Road, Alvechurch, Worcestershire, B48 7LT

Order No. 01/23

Test Procedure Procedure TP 1 Calibration of Sound Calibrators
Description Acoustic Calibrator

Identification	Manufacturer	Instrument	Model	Serial No.
	Rion	Calibrator	NC-74	34794318

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) 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 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No. UKAS23/01013
Date Received 09 January 2023
Date Calibrated 10 January 2023

Previous Certificate		
	Dated	26 January 2022
	Certificate No.	UCRT22/1113
	Laboratory	0653

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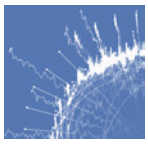
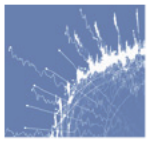


Appendix C Meteorological Results

Conditions were stable and dry with 8 oktas of cloud cover. The wind was from the north. Average wind speed was 2.4 m/s.

TGS_2023-03-03 17_10_00

Device Information:				
Name:	TGS			
Model:	5000L			
Serial:	2382668			
Firmware:	1.24			
Profile Version:	0.06			
Hardware Version:	Rev 11B			
LiNK Version:	1.04.04			
Time	Temp	Rel. Hum.	Baro.	Wind Speed
yyyy-MM-dd hh:mm:ss	Celsius	%	mb	m/s
2023-03-03 14:20:00	7.1	77.3	1034.1	1.2
2023-03-03 14:25:00	7.2	72.7	1034.1	2.0
2023-03-03 14:30:00	7.3	71.2	1034.0	1.2
2023-03-03 14:35:00	7.2	72.0	1034.0	1.7
2023-03-03 14:40:00	7.1	72.1	1034.0	2.3
2023-03-03 14:45:00	7.4	71.7	1034.0	2.1
2023-03-03 14:50:00	7.6	70.0	1034.1	1.5
2023-03-03 14:55:00	7.4	70.2	1034.1	1.1
2023-03-03 15:00:00	7.3	69.7	1034.0	1.7
2023-03-03 15:05:00	7.2	70.0	1034.0	4.2
2023-03-03 15:10:00	7.3	69.6	1034.0	2.5
2023-03-03 15:15:00	7.2	68.3	1034.0	4.5
2023-03-03 15:20:00	7.2	66.7	1034.0	2.0
2023-03-03 15:25:00	7.6	67.5	1034.0	2.4
2023-03-03 15:30:00	7.5	66.4	1034.0	2.0
2023-03-03 15:35:00	7.4	64.8	1033.9	3.3
2023-03-03 15:40:00	7.3	65.0	1034.0	2.3
2023-03-03 15:45:00	7.2	63.5	1033.9	1.8
2023-03-03 15:50:00	7.0	63.8	1033.9	2.8
2023-03-03 15:55:00	6.9	63.8	1033.9	2.4
2023-03-03 16:00:00	7.2	65.4	1033.9	1.4
2023-03-03 16:05:00	7.0	65.8	1033.9	3.4
2023-03-03 16:10:00	7.0	66.5	1033.9	1.8
2023-03-03 16:15:00	7.1	66.2	1033.8	3.0
2023-03-03 16:20:00	7.5	68.9	1033.8	3.0
2023-03-03 16:25:00	7.1	68.2	1033.9	2.6
2023-03-03 16:30:00	6.9	67.8	1033.9	4.5
2023-03-03 16:35:00	6.9	68.2	1033.9	1.5
2023-03-03 16:40:00	6.7	68.9	1033.8	3.9
2023-03-03 16:45:00	6.7	68.7	1033.9	1.7
2023-03-03 16:50:00	6.7	69.7	1033.9	4.7
2023-03-03 16:55:00	6.6	70.0	1033.9	2.1
2023-03-03 17:00:00	6.6	70.3	1033.9	3.2
2023-03-03 17:05:00	6.6	70.1	1034.0	0.5
2023-03-03 17:10:00	6.6	70.3	1035.1	0.7



Appendix D Plant Sound Level Calculations

D.1 Temporary works - Bulldozer

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11). This provides:

- Acoustic height of the bulldozer = 1.5m
- Sound Power Level = 108 dB $L_{WA'}$ dB
- Distance Correction for hard ground = point source by the BS 5228:2009-1+A1:2014 Formula F.3, K'_h (Page 133, F.2.3.2).
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = 0 dB
- Downwind (less than 150m) = +1 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = 0m

The distance from the edge of the phase area and the start of excavations is taken from Google Earth for Phase 4 workings and is typically 17m. The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, is 33m. The location of the activity is taken as operating at the edge of the Phase 6 working area. This is the 'minimum distance', as expressed in BS 5228:2009-1+A1:2014 (Page 128).

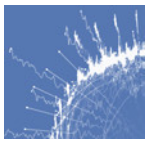
The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from BS 5228-1:2009+A1:2014, page 46, Table C.2, line 10 - corrected to A-weighted levels

The calculation gives:

Temporary Works – Bulldozer	
$L_{WA'}$ 100% on-time	108 dB
Distance correction to receiver 50m	-42 dB
Barrier attenuation	-12 dB
Soft Ground	0 dB
Air Absorption	0 dB
Downwind Correction	+1 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**55 dB**

Should the barrier be closer to 4m than 5m high, the reduction in the barrier attenuation of 1 dB has no significance in the outcome.



Bulldozer. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation - Source Data

Source to barrier	17.00
Barrier to receiver	33.00
Barrier height difference to source	3.50
Barrier height difference to receiver	1.50
Height difference source to receiver	2.00
Source to receiver direct (c)	50.04
Source to barrier top (a)	17.36
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.35

Broadband L_{WA}, dB	
Without Barrier	**80**
Mitigated Figure	**68**
Barrier Reduction	**12**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.35	7.46	63.00	55.54
125	0.35	9.08	74.00	64.92
250	0.35	11.20	72.00	60.80
500	0.35	13.69	70.00	56.31
1000	0.35	16.41	74.00	57.59
2000	0.35	19.27	71.00	51.73
4000	0.35	22.20	69.00	46.80
8000	0.35	25.17	63.00	37.83
Total L_{WA}, dB			**80.0**	**67.7**

Bulldozer. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation - Source Data

Source to barrier	17.00
Barrier to receiver	33.00
Barrier height difference to source	2.50
Barrier height difference to receiver	1.50
Height difference source to receiver	1.00
Source to receiver direct (c)	50.01
Source to barrier top (a)	17.18
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.21

Broadband L_{WA}, dB	
Without Barrier	**80**
Mitigated Figure	**69**
Barrier Reduction	**11**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.21	6.55	63.00	56.45
125	0.21	7.79	74.00	66.21
250	0.21	9.55	72.00	62.45
500	0.21	11.77	70.00	58.23
1000	0.21	14.32	74.00	59.68
2000	0.21	17.09	71.00	53.91
4000	0.21	19.97	69.00	49.03
8000	0.21	22.91	63.00	40.09
Total L_{WA}, dB			**80.0**	**69.2**

D.2 Routine Excavations - Excavator

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11). This provides:

- Acoustic height of the excavator = 2m
- Sound Power Level = 102 dB $L_{WA'}$ dB
- Distance Correction for hard ground = point source by the BS 5228:2009-1+A1:2014 Formula F.3, K'_h (Page 133, F.2.3.2)
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = 0 dB
- Downwind (less than 150m) = +1 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = -1 m

The distance from the edge of the phase area and the start of excavations is taken from Google Earth for Phase 4 workings and is typically 17m. The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, is 33m. The location of the activity is taken as operating at the edge of the Phase 6 working area. This is the 'minimum distance', as expressed in BS 5228:2009-1+A1:2014 (Page 128).

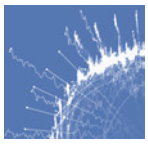
The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from BS 5228-1:2009+A1:2014, page 46, Table C.2, line 16 - corrected to A-weighted levels

The calculation gives:

Routine Excavations - Excavator	
$L_{WA'}$ 100% on-time	102 dB
Distance correction to receiver 50m	-42 dB
Barrier attenuation	-16 dB
Soft Ground	-0 dB
Air Absorption	0 dB
Downwind Correction	+1 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**45 dB**

Should the barrier be closer to 4m than 5m high, the reduction in the barrier attenuation of 2 dB has no significance in the outcome.



Excavator. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation - Source Data

Source to barrier	17.00
Barrier to receiver	33.00
Barrier height difference to source	4.00
Barrier height difference to receiver	1.50
Height difference source to receiver	2.50
Source to receiver direct (c)	50.06
Source to barrier top (a)	17.46
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.44

Broadband $L_{WA'}$ dB	
Without Barrier	**75**
Mitigated Figure	**59**
Barrier Reduction	**16**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.44	7.92	46.00	38.08
125	0.44	9.70	55.00	45.30
250	0.44	11.95	65.00	53.05
500	0.44	14.52	70.00	55.48
1000	0.44	17.30	69.00	51.70
2000	0.44	20.19	67.00	46.81
4000	0.44	23.13	64.00	40.87
8000	0.44	26.11	57.00	30.89
Total $L_{WA'}$ dB			**74.7**	**59.1**

Excavator. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation - Source Data

Source to barrier	17.00
Barrier to receiver	33.00
Barrier height difference to source	3.00
Barrier height difference to receiver	1.50
Height difference source to receiver	1.50
Source to receiver direct (c)	50.02
Source to barrier top (a)	17.26
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.27

Broadband $L_{WA'}$ dB	
Without Barrier	**75**
Mitigated Figure	**61**
Barrier Reduction	**14**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.27	7.00	46.00	39.00
125	0.27	8.44	55.00	46.56
250	0.27	10.40	65.00	54.60
500	0.27	12.77	70.00	57.23
1000	0.27	15.43	69.00	53.57
2000	0.27	18.25	67.00	48.75
4000	0.27	21.16	64.00	42.84
8000	0.27	24.12	57.00	32.88
Total $L_{WA'}$ dB			**74.7**	**60.8**

D.3 Routine Excavations – Articulated Dump Trucks (ADT) Phase 6, 700m Haul

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11). This provides:

- Acoustic height of the ADT = 2.5m
- Sound Power Level = 105 dB $L_{WA'}$ dB (this is 3 dB higher than Sharps Redmore Site Sound Level Tests)
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = -1 dB
- Downwind = +2 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = -1 m
- The calculation for moving plant on a haul road is taken from BS 5228:2009-1+A1:2014 Formula F.6, (Page 136, F.2.5.2):

$$L_{Aeq(1h)} = L_{WA} - 33 + 10logQ - 10logV - 10logd$$

Where:

Q = no. of vehicle passes per hour (24 for 2x ADT)

V = Average speed in kph (18 kph)

d = distance from receiver (Taken as the average acoustic centre of haulage route of 470m – Google Earth)

The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from BS 5228-1:2009+A1:2014, page 47, Table C.2, line 32 - corrected to A-weighted levels
- The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, of 33m

The calculation gives:

Routine Excavations – ADT Segment 6	
$L_{WA'}$ 100% on-time	105 dB
Correction by formula F.6 for distance and on-time	-58 dB
Barrier attenuation	-9 dB
Soft Ground	0 dB
Air Absorption	-1 dB
Downwind Correction	+2 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**39 dB**

Should the barrier be closer to 4m than 5m high, there is no reduction in the barrier attenuation.

ADT. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation - Source Data

Source to barrier	437.00
Barrier to receiver	33.00
Barrier height difference to source	3.50
Barrier height difference to receiver	1.50
Height difference source to receiver	2.00
Source to receiver direct (c)	470.00
Source to barrier top (a)	437.01
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.04

Broadband L_{WA}, dB	
Without Barrier	**79**
Mitigated Figure	**70**
Barrier Reduction	**9**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.04	5.21	59.00	53.79
125	0.04	5.61	58.00	52.39
250	0.04	6.31	69.00	62.69
500	0.04	7.44	70.00	62.56
1000	0.04	9.08	73.00	63.92
2000	0.04	11.20	75.00	63.80
4000	0.04	13.69	68.00	54.31
8000	0.04	16.41	62.00	45.59
Total L_{WA}, dB			**79.0**	**69.7**

ADT. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation - Source Data

Source to barrier	437.00
Barrier to receiver	33.00
Barrier height difference to source	2.50
Barrier height difference to receiver	1.50
Height difference source to receiver	2.00
Source to receiver direct (c)	470.00
Source to barrier top (a)	437.01
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.04

Broadband L_{WA}, dB	
Without Barrier	**79**
Mitigated Figure	**70**
Barrier Reduction	**9**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.04	5.15	59.00	53.85
125	0.04	5.49	58.00	52.51
250	0.04	6.10	69.00	62.90
500	0.04	7.12	70.00	62.88
1000	0.04	8.63	73.00	64.37
2000	0.04	10.64	75.00	64.36
4000	0.04	13.05	68.00	54.95
8000	0.04	15.73	62.00	46.27
Total L_{WA}, dB			**79.0**	**70.1**

D.4 Routine Excavations – Articulated Dump Trucks (ADT) Segment 2, surge pile

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11). This provides:

- Acoustic height of the ADT = 2.5m
- Sound Power Level = 105 dB $L_{WA'}$ dB (this is 3 dB higher than Sharps Redmore Site Sound Level Tests)
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = -1 dB
- Downwind = +2 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = -1 m
- The calculation for moving plant on a haul road is taken from BS 5228:2009-1+A1:2014 Formula F.6, (Page 136, F.2.5.2):

$$L_{Aeq(1h)} = L_{WA} - 33 + 10logQ - 10logV - 10logd$$

Where:

Q = no. of vehicle passes per hour (24 for 2x ADT)

V = Average speed in kph (18 kph)

d = distance from receiver (842m – Google Earth)

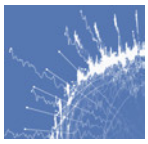
The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from BS 5228-1:2009+A1:2014, page 47, Table C.2, line 32 - corrected to A-weighted levels
- The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, of 33m

The calculation gives:

Routine Excavations – ADT Segment 2	
$L_{WA'}$ 100% on-time	105 dB
Correction by formula F.6 for distance and on-time	-61 dB
Barrier attenuation	-12 dB
Soft Ground	0 dB
Air Absorption	-1 dB
Downwind Correction	+2 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**33 dB**

Should the barrier be closer to 4m than 5m high, the reduction in the barrier attenuation of 3 dB has no significance in the outcome.



ADT. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation Day - Source Data (two barriers)

Source to barrier 1	150.00
Source to barrier 2	809.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	0.50
Barrier 1 height difference to receiver	1.50
Height difference source to receiver	2.00
Barrier top (or distance between barriers)	659.00
Height difference between barriers	2.00
Source to receiver direct (c)	842.00
Between barriers (e)	659.00
Source to barrier top (a)	150.00
Receiver to barrier top (b)	33.03
Path difference (c-(a+b+e))	0.04

Broadband $L_{WA'}$ dB	
Without Barrier	79
Mitigated Figure	67
Barrier Reduction	12

Reduction=10*LOG (3+(40*Path Difference*Frequency* H)/344)

Frequency band (Hz)	Path difference	e	H	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.04	659.00	2.9999999	5.80	59.00	53.20
125	0.04	659.00	3.0000000	6.62	58.00	51.38
250	0.04	659.00	3.0000000	7.91	69.00	61.09
500	0.04	659.00	3.0000000	9.71	70.00	60.29
1000	0.04	659.00	3.0000000	11.96	73.00	61.04
2000	0.04	659.00	3.0000000	14.53	75.00	60.47
4000	0.04	659.00	3.0000000	17.31	68.00	50.69
8000	0.04	659.00	3.0000000	20.20	68.00	47.80
Total $L_{WA'}$ dB					**79.2**	**67.2**

ADT. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation Day - Source Data (two barriers)

Source to barrier 1	150.00
Source to barrier 2	809.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	1.50
Barrier 1 height difference to receiver	0.50
Height difference source to receiver	2.00
Barrier top (or distance between barriers)	659.00
Height difference between barriers	1.00
Source to receiver direct (c)	842.00
Between barriers (e)	659.00
Source to barrier top (a)	150.01
Receiver to barrier top (b)	33.00
Path difference (c-(a+b+e))	0.01

Broadband $L_{WA'}$ dB	
Without Barrier	79
Mitigated Figure	71
Barrier Reduction	9

Reduction=10*LOG (3+(40*Path Difference*Frequency* H)/344)

Frequency band (Hz)	Path difference	e	H	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.01	659.00	2.9999999	5.08	59.00	53.92
125	0.01	659.00	3.0000000	5.36	58.00	52.64
250	0.01	659.00	3.0000000	5.87	69.00	63.13
500	0.01	659.00	3.0000000	6.75	70.00	63.25
1000	0.01	659.00	3.0000000	8.10	73.00	64.90
2000	0.01	659.00	3.0000000	9.96	75.00	65.04
4000	0.01	659.00	3.0000000	12.26	68.00	55.74
8000	0.01	659.00	3.0000000	14.86	68.00	53.14
Total $L_{WA'}$ dB					**79.2**	**70.6**

D.5 Aggregates Processing Plant

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11) and the revisions identified in their Noise Technical Notes. This provides:

- Acoustic height of the Plant = 4.5m
- Sound Power Level = 112 dB $L_{WA'}$ dB (this is the higher, revised level in Sharps Redmore Technical Notes, 2018, Paragraph 16, page 5)
- Distance Correction for hard ground = point source by the BS 5228:2009-1+A1:2014 Formula F.3, K'_h (Page 133, F.2.3.2).
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = -2 dB
- Downwind = +2 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = -1 m

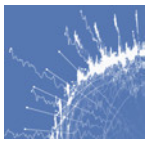
The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from Sharps Redmore Noise Technical Notes
- The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, of 33m
- Distance between plant and receiver = 842m (Google Earth)
- The Bund 2 Barrier of soil is too low to be of any effect on the sound path and as such just the bund on the southern boundary of the site is used for assessment

The calculation gives:

Aggregates Processing Plant	
$L_{WA'}$ 100% on-time	112 dB
Correction by formula F.3 for distance	-67 dB
Barrier attenuation	-10dB
Soft Ground	0 dB
Air Absorption	-2 dB
Downwind Correction	+2 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**35 dB**

Should the barrier be closer to 4m than 5m high, there is no reduction in the barrier attenuation.



Aggregates Plant. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation - Source Data

Source to barrier	809.00
Barrier to receiver	33.00
Barrier height difference to source	1.50
Barrier height difference to receiver	1.50
Height difference source to receiver	0.00
Source to receiver direct (c)	842.00
Source to barrier top (a)	809.00
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.04

Broadband L_{WA}, dB	
Measured level	**112**
Mitigated Figure	**102**
Reduction	**10**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.04	5.13	93.00	87.87
125	0.04	5.46	93.00	87.54
250	0.04	6.05	97.00	90.95
500	0.04	7.04	102.00	94.96
1000	0.04	8.53	104.00	95.47
2000	0.04	10.51	105.00	94.49
4000	0.04	12.90	107.00	94.10
8000	0.04	15.56	103.00	87.44
Total L_{WA}, dB			**111.8**	**101.8**

Aggregates Plant. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation - Source Data

Source to barrier	809.00
Barrier to receiver	33.00
Barrier height difference to source	0.50
Barrier height difference to receiver	1.50
Height difference source to receiver	0.00
Source to receiver direct (c)	842.00
Source to barrier top (a)	809.00
Receiver to barrier top (b)	33.03
Path difference (c-(a+b))	0.03

Broadband L_{WA}, dB	
Measured level	**112**
Mitigated Figure	**102**
Reduction	**10**

Reduction=10*LOG (3+(40*Path Difference*Frequency)/344)

Frequency band (Hz)	Path difference	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.03	5.12	93.00	87.88
125	0.03	5.44	93.00	87.56
250	0.03	6.02	97.00	90.98
500	0.03	6.98	102.00	95.02
1000	0.03	8.44	104.00	95.56
2000	0.03	10.40	105.00	94.60
4000	0.03	12.77	107.00	94.23
8000	0.03	15.42	103.00	87.58
Total L_{WA}, dB			**111.8**	**101.9**

D.6 Soil Screening Plant

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11) and the revisions identified in their Noise Technical Notes. This provides:

- Acoustic height of the Plant = 5m
- Sound Power Level = 110 dB $L_{WA'}$ dB (Sharps Redmore Technical Notes, 2018, Calc sheet 4b)
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = -2 dB
- Downwind = +2 dB
- Receiver height = 1.5m
- Height difference to existing ground level for this activity = 0 m

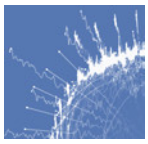
The barrier calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- Octave band sound power levels = Data from Sharps Redmore (Technical Notes, 2018, Calc sheet 4b)
- The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, of 33m
- Distance between plant and receiver = 910m (Google Earth)
- Distance between Plant and Bund 16 = 26m (Google Earth)
- The Bund 16 Barrier height = 8m (Proposed Amendments to the Planning Application, 2018)

The calculation gives:

Soil Screening Plant	
$L_{WA'}$ 100% on-time	110 dB
Correction by formula F.3 for distance	-67 dB
Barrier attenuation	-21 dB
Soft Ground	0 dB
Air Absorption	-2 dB
Downwind Correction	+2 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**22 dB**

Should the barrier be closer to 4m than 5m high, there is no reduction in the barrier attenuation.



Soil Screening. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation Day - Source Data (two barriers)

Source to barrier 1	26.00
Source to barrier 2	877.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	3.00
Barrier 1 height difference to receiver	4.50
Height difference source to receiver	1.50
Barrier top (or distance between barriers)	851.00
Height difference between barriers	3.00
Source to receiver direct (c)	910.00
Between barriers (e)	851.01
Source to barrier top (a)	26.17
Receiver to barrier top (b)	33.31
Path difference (c-(a+b+e))	0.48

Broadband $L_{WA'}$ dB	
Without Barrier	**110**
Mitigated Figure	**89**
Barrier Reduction	**21**

Reduction=10*LOG (3+(40*Path Difference*Frequency* H)/344)

Frequency band (Hz)	Path difference	e	H	Reduction (dB)	Octave Band L_{WA} dB	With Barrier L_{WA} dB
63	0.48	851.01	2.9999999	11.41	90.00	78.59
125	0.48	851.01	3.0000000	13.89	93.00	79.11
250	0.48	851.01	3.0000000	16.63	98.00	81.37
500	0.48	851.01	3.0000000	19.50	104.00	84.50
1000	0.48	851.01	3.0000000	22.43	105.00	82.57
2000	0.48	851.01	3.0000000	25.41	105.00	79.59
4000	0.48	851.01	3.0000000	28.40	100.00	71.60
8000	0.48	851.01	3.0000000	31.40	88.00	56.60
Total $L_{WA'}$ dB					**110.3**	**89.3**

Soil Screening. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

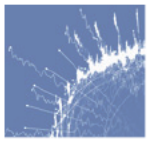
Barrier Calculation Day - Source Data (two barriers)

Source to barrier 1	26.00
Source to barrier 2	877.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	3.00
Barrier 1 height difference to receiver	4.50
Height difference source to receiver	1.50
Barrier top (or distance between barriers)	851.00
Height difference between barriers	4.00
Source to receiver direct (c)	910.00
Between barriers (e)	851.01
Source to barrier top (a)	26.17
Receiver to barrier top (b)	33.31
Path difference (c-(a+b+e))	0.49

Broadband LWA' dB	
Without Barrier	**110**
Mitigated Figure	**89**
Barrier Reduction	**21**

Reduction=10*LOG (3+(40*Path Difference*Frequency* H)/344)

Frequency band (Hz)	Path difference	e	H	Reduction (dB)	Octave Band LWA dB	With Barrier LWA dB
63	0.49	851.01	2.9999999	11.44	90.00	78.56
125	0.49	851.01	3.0000000	13.93	93.00	79.07
250	0.49	851.01	3.0000000	16.67	98.00	81.33
500	0.49	851.01	3.0000000	19.53	104.00	84.47
1000	0.49	851.01	3.0000000	22.47	105.00	82.53
2000	0.49	851.01	3.0000000	25.44	105.00	79.56
4000	0.49	851.01	3.0000000	28.43	100.00	71.57
8000	0.49	851.01	3.0000000	31.44	88.00	56.56
Total LWA' dB					**110.3**	**89.3**



D.7 Tipper Lorries on Access Road

Methodology follows that used in the Sharps Redmore report (5.3 pages 10-11). This provides:

- Acoustic height of the tipper lorry = 1.5m
- Sound Power Level = 105 dB $L_{WA'}$ dB
- Soft Ground = 0 dB (The -2 dB is removed as the barrier has a significant effect)
- Air Absorption = -3 dB
- Downwind = +2 dB
- Height difference to existing ground level for this activity = 0 m
- The calculation for moving plant of a haul road is taken from BS 5228:2009-1+A1:2014 formula F.6, (Page 136, F.2.5.2):

$$L_{Aeq(1h)} = L_{WA} - 33 + 10logQ - 10logV - 10logd$$

Where:

Q = no. of vehicle passes per hour (4)

V = Average speed in kph (18 kph)

d = average distance from receiver (1015m – Google Earth)

The barrier attenuation is given by Sharps Redmore Report as L_{WA} or L_{Aeq} level data not available in BS 5228-1:2009+A1:2014. The calculated path difference of 0.01 would concur with the -7 dB when considered on the path difference graph in figure F.3 in BS 5228-1:2009+A1:2014 (Page 131, Figure F.3 b)).

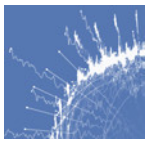
The Path Difference calculation is given by:

- Height of bund with respect to mobile home as assessed from a building of a measured height and relative to the bund (Photographs, Appendix F, page 37) = 3m
- Estimated height of bund from ground level of Phase 6 = 5m (this is also assessed at 4m)
- The distance between the top of the bund on the southern boundary of The Site and the most eastern mobile home on that boundary, taken from Google Earth, of 33m. Distance between average distance of lorries and Bund 3 = 323m (Google Earth)
- The Bund 3 Barrier height = 3m (Soil – Maximum 3m)

The calculation gives:

Tipper Lorries on Access Road	
$L_{WA'}$ 100% on-time	105 dB
Correction by formula F.6 for distance and on-time	-70 dB
Barrier attenuation	-7 dB
Soft Ground	0 dB
Air Absorption	-3 dB
Downwind Correction	+2 dB
Impact at Receiver $L_{Aeq(1h, free field)}$	**27 dB**

Should the barrier be closer to 4m than 5m high, there is no reduction in the barrier attenuation.

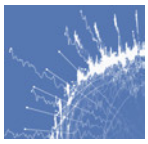


Tipper Lorries. Assumption of barrier height with respect to existing ground level at Phase 6 of 5m.

Barrier Calculation Day - Source Data (two barriers)	
Source to barrier 1	323.00
Source to barrier 2	982.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	1.50
Barrier 1 height difference to receiver	0.50
Height difference source to receiver	2.00
Barrier top (or distance between barriers)	659.00
Height difference between barriers	2.00
Source to receiver direct (c)	1015.00
Between barriers (e)	659.00
Source to barrier top (a)	323.00
Receiver to barrier top (b)	33.00
Path difference (c-(a+b+e))	0.01

Tipper Lorries. Assumption of barrier height with respect to existing ground level at Phase 6 of 4m.

Barrier Calculation Day - Source Data (two barriers)	
Source to barrier 1	323.00
Source to barrier 2	982.00
Barrier 2 to receiver	33.00
Barrier 1 height difference to source	1.50
Barrier 1 height difference to receiver	0.50
Height difference source to receiver	2.00
Barrier top (or distance between barriers)	659.00
Height difference between barriers	1.00
Source to receiver direct (c)	1015.00
Between barriers (e)	659.00
Source to barrier top (a)	323.00
Receiver to barrier top (b)	33.00
Path difference (c-(a+b+e))	0.01



Appendix E Predicted Period of Mineral Workings – Chear Fen

The Non-Technical Summary states in 3.5:

> *Based on exploratory information and allowing for boundary standoffs, it is anticipated that Mitchell Hill contains 1.45 million tonnes of workable sand and gravel and Chear Fen contains 0.25 million tonnes. In total the site will yield some 1.7 million tonnes of workable mineral.*

It continues in 3.6:

> *….the objective is for each phase to broadly account for one and half years' worth of working*.

And that in 3.7:

> *It is planned that mineral would be worked at a rate of 140,000 tonnes per annum tonnes. On this basis it is estimated that the deposit would be worked over a 12 year period.*

As a proportion of the period of mineral workings, Chear Fen has less workable tonnage than other phases with 0.25m tonnes for two Phases (6 & 7). At the conditioned rate of extraction of 140,000 tonnes per annum, Chear Fen will provide for 14.7% of the minerals. This would broadly account for 21 months of working.

The total area of Chear Fen is 13.2 hectares (Non-Technical Summary, 2018, 2.11), of which the outlined working area of Phase 6 is estimated to be 4.6 hectares and Phase 7 to be 5.4 hectares. As a proportion of 21 months, Phase 6 would be worked for approximately 9-months.

Appendix F Photographs

The Site from the south eastern corner atop the bund looking west

The Site looking north from Long Drove

Bund looking west. The southern aspect is at a greater height from ground level than that of the northern aspect

Building used for assessing bund height with respect to The Site. Looking east

Monitoring position looking south

Monitoring position looking north

Monitoring position looking west

Top soil removal by 2 x excavators and 2 x ADTs on Phase 4. Looking south from The Site

Top soil deposited at the eastern edge of Phase 5