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Construction Noise Assessment

Borehole Drilling Works – No. 3 & 4
Dove Valley Park, Derby

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Client:		Acoustic Consultant:
PGFI III Ltd		Acoustic Consultants Ltd 194 West St Bedminster Bristol BS3 3NB

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the external noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.



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1. Introduction

PGFI III Ltd appointed Acoustic Consultants Limited to provide a noise assessment for the Borehole Drilling works at Dove Valley Park, Derby.

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 5228:2009.

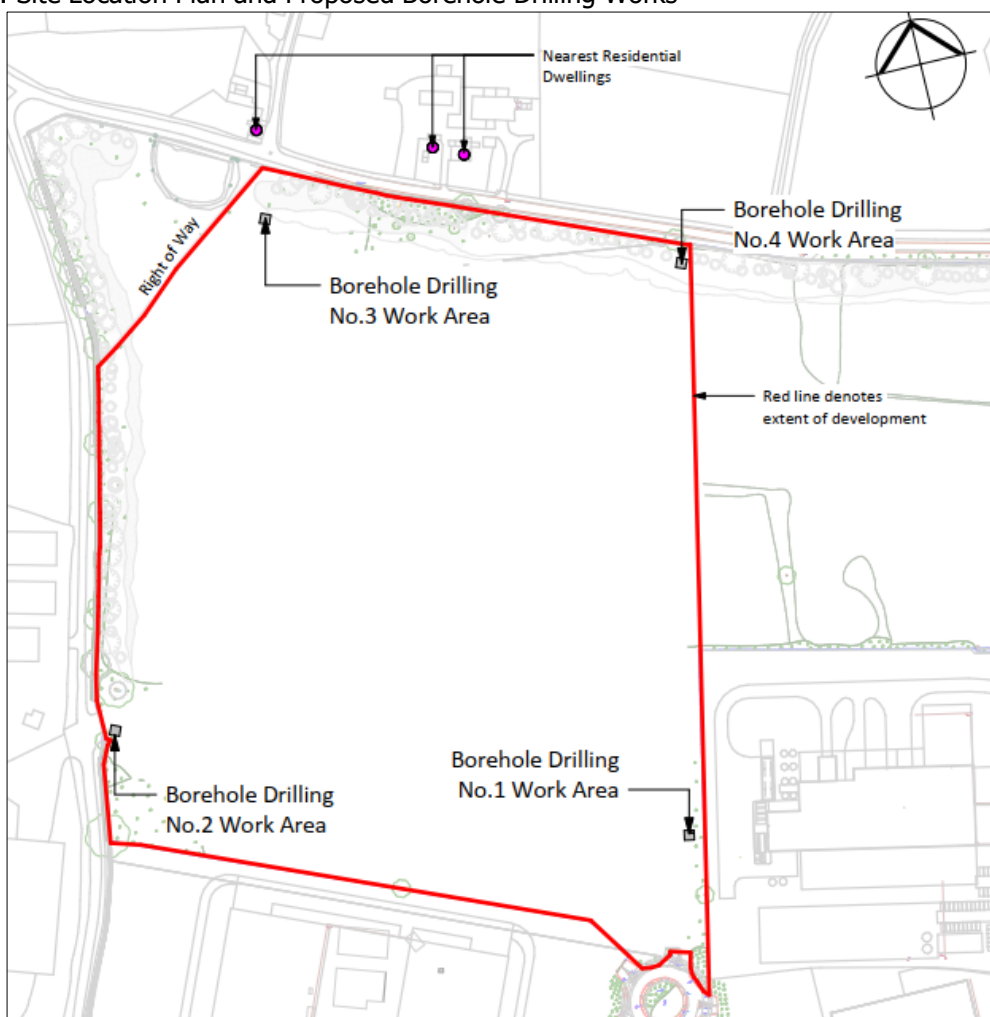
The author of this report is a full Member of the Institute of Acoustics with over 10 years' experience within the field and as such is considered suitably qualified to undertake a noise impact assessment.



2. The Site

The development site where the borehole drilling No.3 & 4 works will take place is located at Dove Valley Park, Derby. Boreholes No. 1 and 2 are already covered by planning consent and took place at the southern boundary location of the site. The nearest noise sensitive residential dwellings are located to the north of the site. The proposed site and location of the borehole drilling works No. 3 & 4 is shown below in Figure 1. Each borehole is understood to be carried out independently and not simultaneously.

Figure 1: Site Location Plan and Proposed Borehole Drilling Works





3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2018. Section 15 entitled 'Conserving and enhancing the natural environment addresses noise as a requirement of planning. Paragraph 170 states:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁶⁰
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

⁶⁰ See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).

The NPPF does not prescribe any assessment methodology or criteria to assess the adverse effect of noise.



3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices and to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion. This applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long term vision of Government noise policy. This long-term vision is supported by three noise policy aims as follows:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.”

The NPSE introduces the concept of “Significant adverse” and “Adverse” impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact, it states the following in relation to the second noise policy aim:



"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does however, emphasise that in dealing with noise, Local Planning Authorities are required to take a balanced approach in considering the benefits of development against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise referred to here is based on the current version (January 2015) as provided on the Planning Guidance Website. It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

It provides generic guidance on how to determine the noise impact and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:

Table 1: NPPG Noise – Perception of Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required



		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels however the NPPG identifies that where noise is audible, it is not necessarily intrusive. The effect and impact on people are based primarily on the level of noise.



4. Assessment Methodology

4.1. British Standard 5228:2009 – Part 1 - Noise

The significance of construction noise impact on nearby noise sensitive properties is provided in British Standard 5228 part 1 2009 Annex E.

Annex E3 of British Standard 5228:2009 Part 1 provides an assessment and provides construction noise limiting criteria based on absolute levels and the changed caused to the existing noise environment.

Annex E3.2, Example method 1 – The ABC method provides the "threshold of significant effect at dwellings when the total noise level, rounded to the nearest decibel, exceeds the listed value"; see below. In addition, the "Table can be used as follows: for the appropriate period (night, evening/ weekend or day), the ambient noise level is determined and rounded to the nearest 5dB. This is then compared with the total noise level, including construction. If the total noise level exceeds the appropriate category value, then a significant effect is deemed to occur".

Table E.1 Example threshold of significant effect at dwellings			
Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00–07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
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 level 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.			
^{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.			
^{D)} 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

It is understood that the borehole drilling works will occur during the daytime period (07.00-19.00 hrs) and potentially during Saturdays (07.00-13.00 hrs). The ambient noise levels at the nearest residential dwellings are expected to be lower than any of the daytime threshold values shown on Table E.1 above, and therefore a Category A threshold value of 65dB can be used.

Based on the above Annex E assessment methods, we will consider a construction noise assessment threshold value of 65dB $L_{Aeq}(T)$ for the daytime period.



5. Borehole Drilling Activities

5.1. Proposed Operation

We have been advised *"the development of the mineral water conductor is intended in several Steps takes place. In a first step, a pilot hole is drilled and closed expanded a test well. During this development will be in the open Drilling itself and in the experimental well hydraulic, hydrochemical and geophysical Investigations carried out.*

These investigations should provide proof of whether the mineral water conductor to be developed meets the requirements for sustainable management. If the results are positive, then a long-term pumping test is carried out in the experimental well."

The works are completed in different phases. The following describes the different phases as supplied by the client:

Phase 1: In the first phase, the hole is drilled to a depth of max. 80 m in diameter of about 650 mm, including the setting of a standpipe about DN 800 to 6 m u. G., brought down become. After the intermediate level of 80 m has been reached, measurements are taken in the open borehole carried out. To protect the borehole is a steel barrier tube (Diameter about 508 mm) cemented.

Phase 2: After hardening of the cementation in phase 2, the hole with a diameter from about 475 mm to the intermediate stage of approx. 150 m deepened. After reaching the Intermediate shifts are performed in open borehole measurements (Chapter 10). This section is intended to protect the borehole with cemented barrier piping (Diameter: approx. 340 mm).

Phase 3: After hardening of the cement, the hole is in phase 3 with a diameter from approx. 311 mm to the intermediate level of 185 m. In the open hole Geophysical measurements and packer tests are carried out (Chapter 10). It will no locking tube introduced.

Phase 4: The hole will be approximately 311 mm in diameter until the next intermediate step from approx. 220 m deepened. The section from 185 m to 220 m will be explained as in chapter 10 Measured. The hole remains open.

Phase 5: In phase 5, the hole is deepened to the final depth of 250 m and the section of 220 m to 250 m is tested with the measuring program described in Chapter 9. During drilling, the customer must carry out a flushing monitoring and a Be kept monitoring log. This includes detection of the parameter temperature and electrical conductivity per drill.

This information must be provided by the drilling company in a Table. Furthermore, by the drilling company in the table details made to flushing losses, inserts and possible addition of additives become. Flush additives are to be avoided. Are these from a drilling point of view necessary, then the mission must be agreed with the BL



and approved by the BL. The audit trail is the BL on request, but at least weekly to transfer (digital, exchange format: .XLS or similar).

Phase 6 (extension to the experimental well):

Based on the measurements carried out in phases 1 to 5 in the open borehole the expansion to the experimental well is established. The test well should be filled with stainless steel tubes up to max. 200 m length and winding wire Filter elements (total length 50 m) to be expanded. By the shown in Appendix 4 Backfilling should the well hydraulically sealed against other inflow areas become. With a smaller depth, the hole should be backfilled accordingly. After the finishing works, the well should be pre-sanded. This is the disbanding provided by "Lufthebeverfahren". Following the advance dispatch is followed by one "Schockentsandung". For this purpose, a period of one day is scheduled. Following the shock dispatch must be through the successful disbanding, and thus the performance of the well, with a power pump test (duration 6 h) demonstrated become. According to the DVGW guideline W119, the residual sand content of the well must be removed $<0.01 \text{ g / cm}^3$. The drilling contractor keeps a construction journal that is always viewed by the contractor and the BL can be."

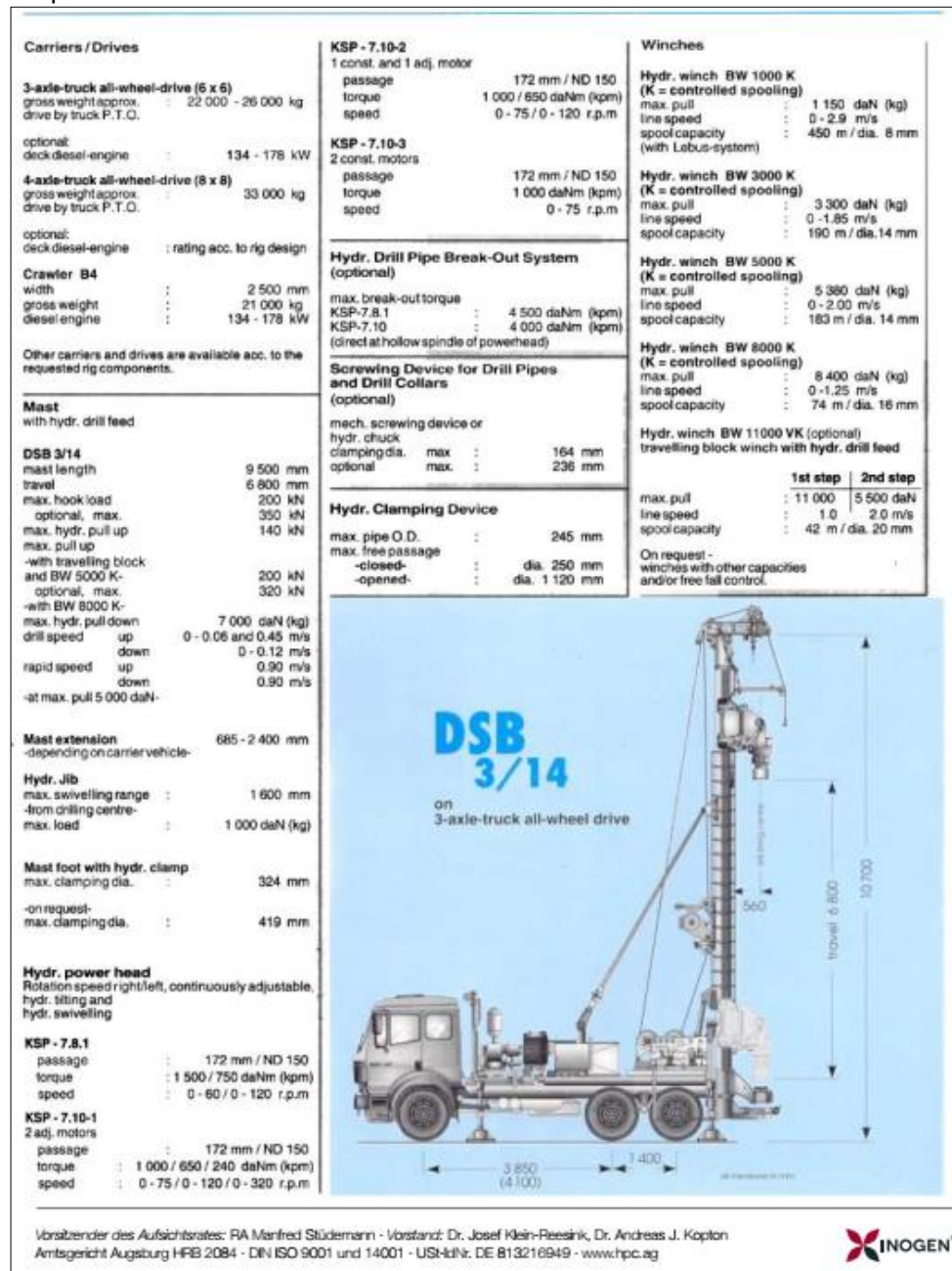
5.2. Drilling Plant

The proposal is to carry out borehole drillings in the ground using a DSB 3/14 on 3-axle-truck all-wheel drive. It is understood that each drilling activity occurs individually and one at a time.

We have been advised of the works the most significant noise is due to the borehole drilling plant. The following plant data was provided by the client:



Figure 2: Proposed Borehole Plant





5.3. Plant Noise Data

The information provided in figure above does not include any noise related data information. For this reason, we have considered British Standard 5228 Part 1 which gives noise levels for different plant. The data used in this assessment is based on

BS5227, Table C.3 Ref no.	Equipment	63	125	250	500	1k	2k	4k	8k	L _{Aeq} at 10 m
14	Large rotary bored piling rig	84	92	81	80	78	76	68	61	83

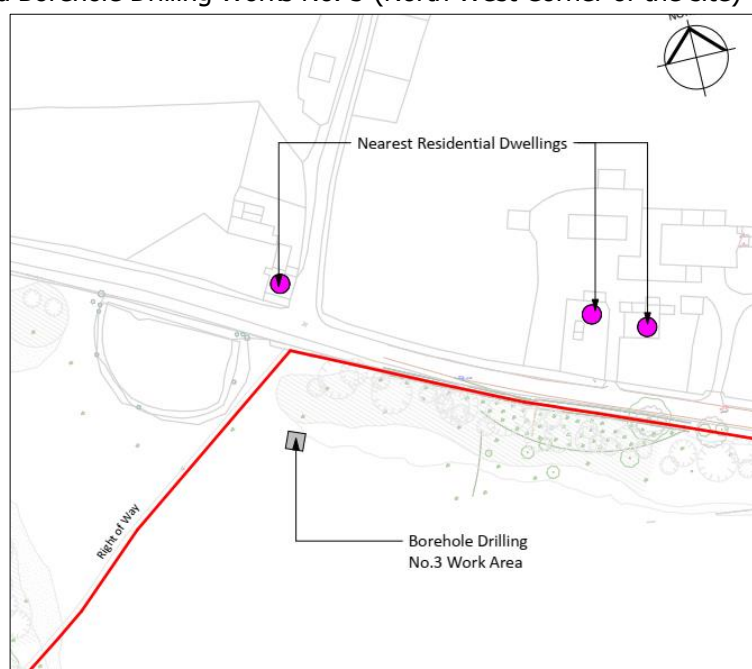
The main source of noise is considered to be the engine of the machine which powers the auger motor. The noise is considered to be continuous in character without impulsive sounds that are common with other piling methods and potentially more intrusive.

5.4. Borehole Drilling Location

Based on the client's drawings, the borehole drilling phase 1 and phase 2 works No. 3 & 4 will occur on a small area within the development site; these are shown in Figure 3 and Figure 4 below. The most sensitive receivers to drilling noise are those along the north boundary of the site; see Figure 1 above. The nearest residential houses are some 47m and 127m distance from the borehole drilling works No.3 & No. 4 respectively.

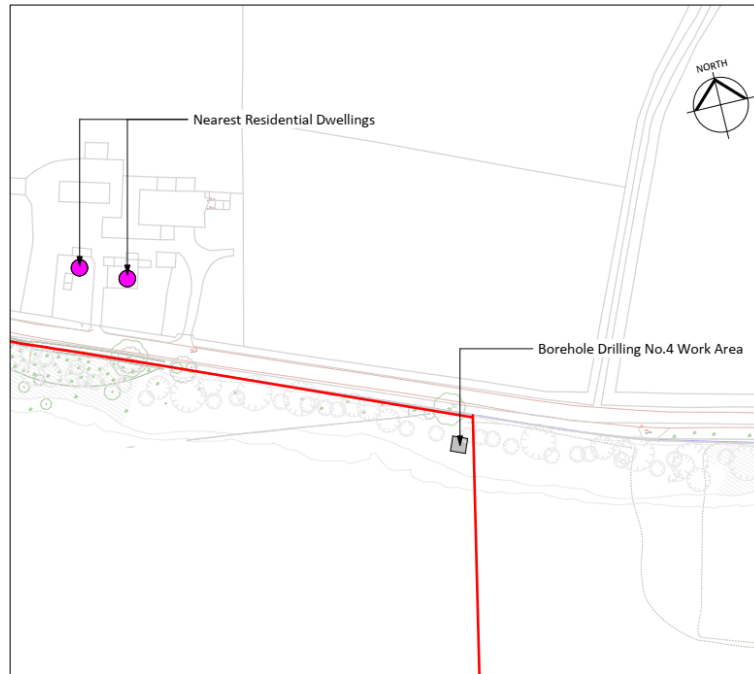
5.4.1. Location No. 3

Figure 3: Proposed Borehole Drilling Works No. 3 (North West Corner of the site)



5.4.2. Location No. 4

Figure 4: Proposed Borehole Drilling Works No. 4 (North East Corner of the site)





6. Noise Assessment

6.1. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured data noted above. The software predicts industrial noise using the general method of calculation from ISO 9613-1.

6.2. Modelling General Parameters

The modelling parameters are as follows:

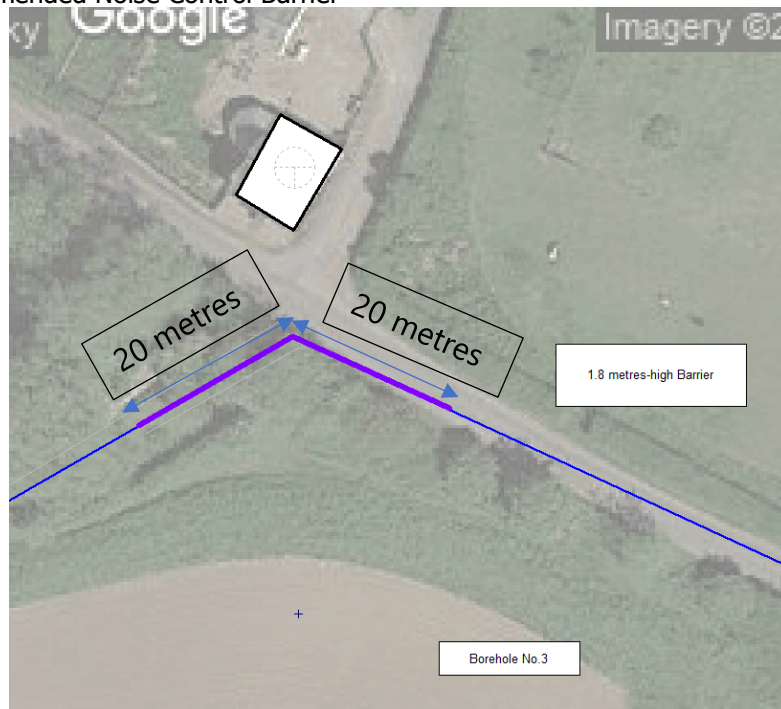
- The main noise source is from the Truck engine assumed to be 1.5m above ground.
- The source noise level is as stated in section 5.4
- The worst-case noise sensitive receiver is as noted in Section 2 and Section 5.4
- The predicted level is 1.5 above ground
- The buildings are considered to be reflective
- The ground is considered to be 'semi-hard' and assumed to be 0.5
- The 'max. Order of Reflection' was considered to be 3
- The topography was assumed to be flat.

6.3. Noise Control Barrier

We recommend the introduction of a 1.8 metres-height noise control barrier at the north west corner of the proposed site to protect noise emissions occurring at the borehole location No. 3;

The above barrier is approximately 20 metres long to each side, measured from the north west corner of the site. The barrier should be 1.8 metres in height and be constructed with a minimum superficial mass of at least 10kg /m². The barrier could be formed from an earth bund, brick wall, timber fence or a combination of these. Where fencing is used to form the barrier then timber used should meet the weight requirement specified above excluding the weight of supports and rails. In addition, a timber fence is only likely to provide an effective barrier where boarding is lapped, or double sheeted is used. The barrier should be continuous from ground level to the full specified height and be imperforate.

Figure 5: Recommended Noise Control Barrier

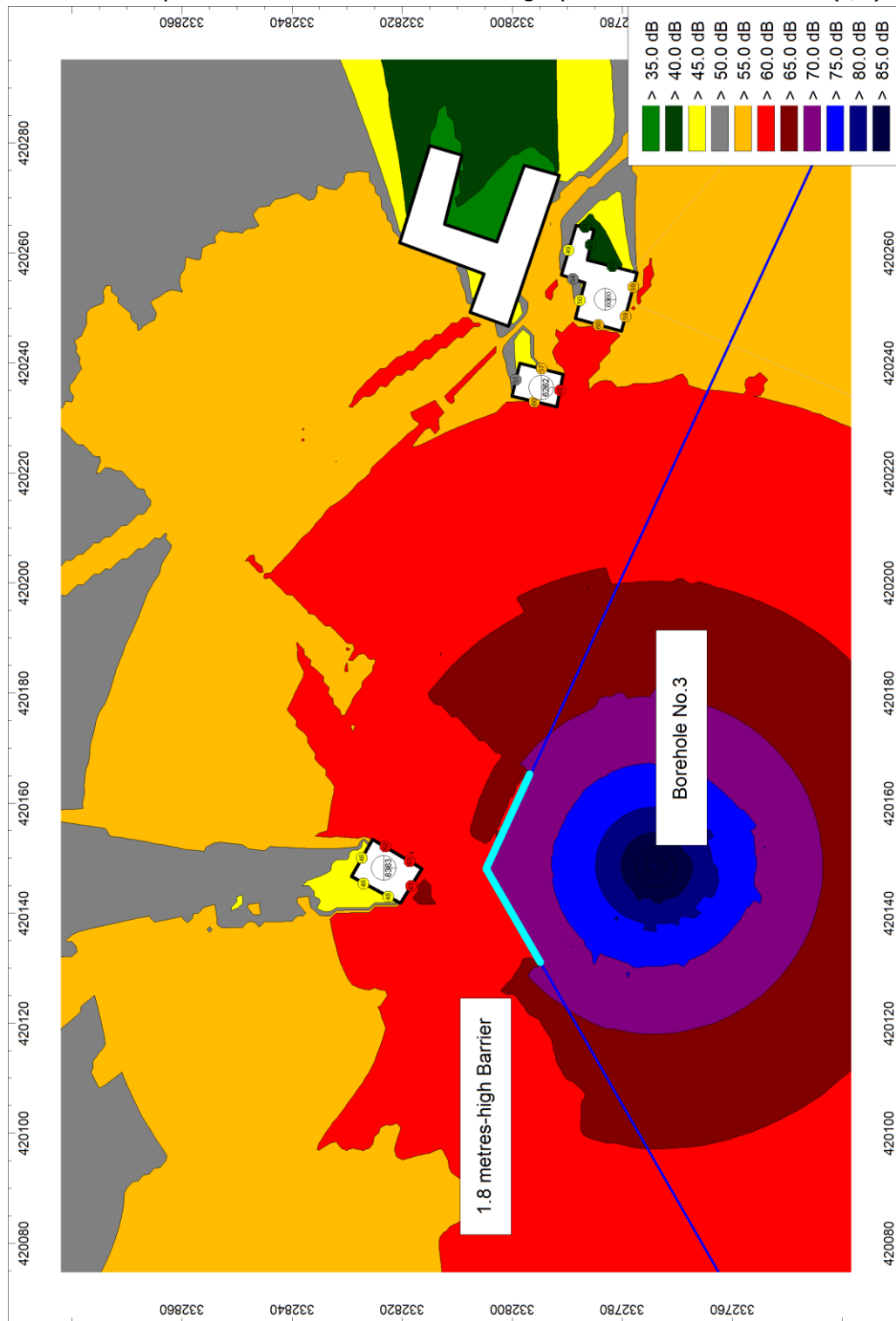


6.4. Assessment Results

The following figures provide the results of the modelling:

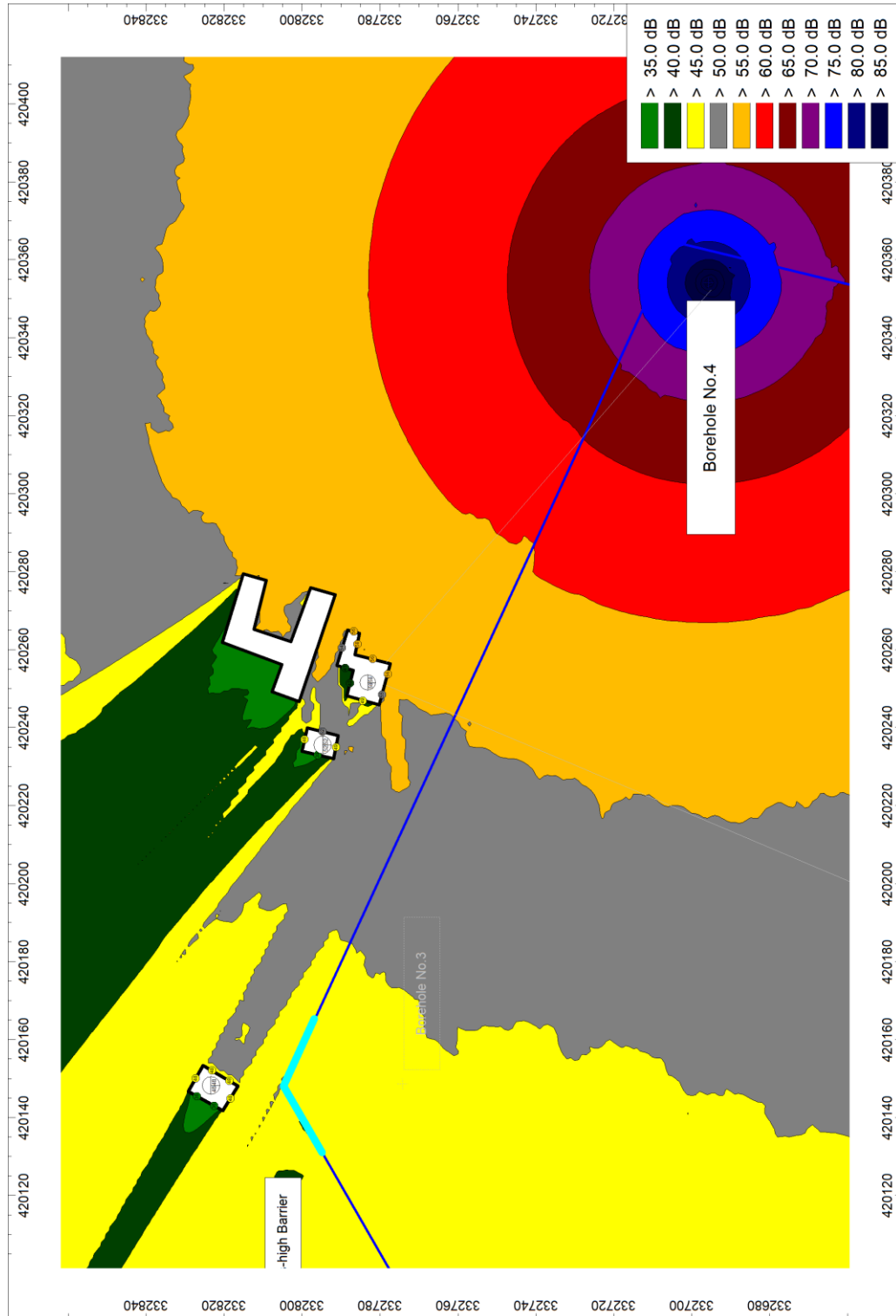
6.4.1. Location No. 3

Figure 6: Predicted Daytime noise level of Borehole Drilling Operations – Location No.3 (1/2)



6.4.2. Location No. 4

Figure 7: Predicted Daytime noise level of Borehole Drilling Operations – Location No.4





The modelling predicted noise level due to the Borehole Drilling operations for Borehole No.3 and No.4 are 63dB $L_{Aeq(T)}$ and 56 $L_{Aeq(T)}$ respectively at the nearest noise sensitive receivers. This is some -2 to -9dB lower than the BS5228 threshold daytime noise limit of 65dB $L_{Aeq(T)}$.

For this reason, we are of the opinion that the proposed Borehole Drilling works No.3 and No.4 are not expected to cause any significant effect at the nearest dwellings where the mitigation measures specified above are introduced.



7. Summary & Conclusions

PGFI III Ltd appointed Acoustic Consultants Limited to provide a noise assessment for the Borehole Drilling works No.3 and No.4 at Dove Valley Park, Derby.

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 5228:2009.

The author of this report is a full Member of the Institute of Acoustics with over 10 years' experience within the field and as such is considered suitably qualified to undertake a noise impact assessment.

The proposed scheme assessment and advice is based on the supplied drawings and discussions with the client.

It was recommended that a 1.8 metres-height noise control barrier was introduced at the north west corner of the proposed site to protect noise emissions occurring at the borehole location No. 3;

The modelling predicted noise level due to the Borehole Drilling operations No.3 & No.4. This is some -2dB to -9dB lower than the BS5228 threshold daytime noise limit of 65dB $L_{Aeq(T)}$.

For this reason, we are of the opinion that the proposed Borehole Drilling works for both boreholes No.3 & No.4 are not expected to cause any significant effect at the nearest dwellings where the noise control measures specified within this report are introduced.



8. Appendix 1 – Glossary of Acoustic Terminology

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-pascals to 100 pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent sound absorption area of a room, A - hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m²), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration.

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Reverberation time, T – time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped NOTE Reverberation time is usually measured in octave or third octave bands. It is not necessary to measure the decay over the full 60 dB range. The decay measured over the range 5 dB to 35 dB below the initial level is denoted by T30, and over the range 5 dB to 25 dB below the initial level by T20.

Weighted sound reduction index, R_w – single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies NOTE The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see Annex C and BS EN ISO 717-1).

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in pascals (Pa), typically from 20 micro-pascals to 100 pascals, but commonly simplified onto the decibel scale.



Weighted standardized impact sound pressure level, $L'_{nT,w}$ - single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies. NOTE weighted standardized impact sound pressure level is used to characterize the insulation of floors in buildings (see Annex C and BS EN ISO 717-2).

Weighted standardized level difference, $D_{nT,w}$ - single-number quantity that characterizes the airborne sound insulation between rooms. NOTE Weighted standardized level difference is used to characterize the insulation between rooms in a building (see Annex C and BS EN ISO 717-1).



ACOUSTIC CONSULTANTS LTD
noise and acoustic specialists since 1987

Head Office: 194 West Street, Bedminster, Bristol, BS3 3NB

T: 0117 986 2956

www.acoustic-ltd.co.uk

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