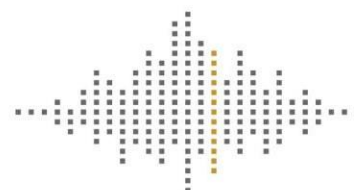


10. Noise

SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

Mitchell Hill Farm, Cottenham

Proposed Extraction of Sand
and Gravel

Sound Level Assessment

Prepared by

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sponsoring
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Contents

- 1.0 Introduction
- 2.0 The Proposed Development
- 3.0 The Neighbourhood
- 4.0 Minerals Policy and Sound Level Threshold
- 5.0 Sound Level Predictions
- 6.0 Assessment
- 7.0 Summary and Conclusion

Annexes

- 1. Calculation sheets

Figures

- 1. Block Plan
- 2. Site Layout
- 3. Aerial Image
- 4. Phase 1 Drawing
- 5. Phase 4 Drawing
- 6. Phase 6 Drawing

1.0 Introduction

- 1.1 Frimstone Ltd operate a sand and gravel workings at the Gravel Diggers site in Cottenham. That site is nearing the end of its reserve. The plan is to extract mineral from the land immediately to the west. That land is known as Mitchell Hill.
- 1.2 The Mitchell Hill location is high-lighted on the plan attached at Figure 1 to this Report. Much of its eastern boundary would be alongside the Gravel Diggers site and the access (and egress) would be via the route established for the existing workings.
- 1.3 There are residential properties just to the south-east of the proposed Mitchell Hill application site. Some of them are in closer proximity to the proposed operations than they are the existing workings. Residential receptors to the west would include Mitchell Hill Farm itself, and properties along Twenty Pence Road which would form the western boundary of the application site.
- 1.4 Sharps Redmore have been appointed by Frimstone Ltd to review the proposals in terms of sound emissions to existing residential neighbours. During the course of the review, recommendations for plant locations, acoustic screening and stand-off margins have been provided. The scheme now presented represents the results of refinements to an initial proposal aimed at controlling sound emissions from the proposed development.
- 1.5 Sharps Redmore is an independent acoustics consultancy practice. The Company was formed in 1990 and has office bases around the UK. The Company is competent in the field of assessing sound levels from mineral workings and has more than 20 years' experience working with operators and authorities in the minerals, wastes and recycling industries. The author of the Report has Corporate Membership of the Institute of Acoustics and holds a MSc in environmental acoustics from the London South Bank University.

2.0 The Proposed Development

- 2.1 It is proposed to extract sand and gravel from the Mitchell Hill application site and to restore the land use to part agricultural and part nature conservation.
- 2.2 Sand and gravel would be excavated by conventional plant and processed on site. Product sales would be via lorries using the purpose-built road built for the existing Gravel Diggers site. The internal road would be extended to link with the new processing plant compound within the application site. The compound would feature substantial earth-mounding on all boundaries as part of the environmental protection measures.
- 2.3 Some inert material would be imported for the land-raising/restoration phases. Worked phases south of the east-west portion of Long Drove would be restored to agricultural use. To the north of that Long Drove section, the land would not receive imported material. Instead, the soils and over-burden stripped and stored prior to the excavations would be placed back to achieve a lower level nature conservation area.
- 2.4 Excavations, processing and restoration work would be performed during daytime hours only. Over-night de-watering of excavations is not anticipated.
- 2.5 In terms of equipment, it would be expected to comprise the following:
- For excavations: 1 x tracked excavator. (For example, a Volvo, 20t unit, as operated on the Gravel Digger site), plus 2 x articulated dump trucks. (For example, Volvo 30t units as on Gravel Diggers).
 - For processing: 1 x static plant, as operated on Gravel Diggers, with its attendant loading shovel. (Doosan unit).
 - For back-filling/restoration: 1 x tracked blade. (bulldozer, typical, mid-range capacity), with tipper lorries.
 - Tipper Lorries: Typically, 8-wheeled units of 20t payload. Number of movements per day expected to average 80, split approximately 50% 'sales' of mineral and 50% imports.
 - Recycling. Approximately 10% of the total number of tipper lorry movements would be associated with recyclable material imports. Stone and hardcore would be recovered from those imports by means of screening and crushing plant sited within the compound. Crushing would be performed as an occasional basis, amounting to a total of approximately two weeks per year.
- 2.6 A more detailed description of the proposed site and its development is contained within the Supporting Statement prepared by Clover Planning¹ on behalf of Frimstone Ltd. For the purpose of the sound level assessment, an operational model has been defined by Sharps Redmore. Further explanation is provided at section... of this Report.

¹ Clover Planning. January 2018. Supporting Statement.
Planning Application for Extraction of Sand and Gravel.
Mitchell Hill Farm, Cottenham.

2.7 Sharps Redmore has been provided with layout and phasing drawings. The key drawings examined and made use of for sound level predictions are attached as follows:

- Block Plan. CP/FRIM/MH/02. (Attached as Figure 1)
- Site Layout. CP/FRIM/MH/03. (Attached as Figure 2)
- Phases 1,2,3,4,5,6,7,8,9,10. CP/FRIM/MH/03a to 03k
- Restoration Plan. CP/FRIM/MH/04

3.0 The Neighbourhood

- 3.1 A comprehensive description of the site and neighbourhood is provided in Section 4.0 of the Supporting Statement. In terms of existing residential neighbours to whom the proposed mineral workings would represent closer proximity working compared to the Gravel Diggers site, Sharps Redmore have identified the following:
- Gravel Diggers Farm (Bungalow); Gravel Diggers (house) and Elm Farm (house), all located close to the southern boundary of the Application site and south of the plant compound.
 - The Lakes to the west of Twenty Pence Road and west of Phase 4.
 - Twenty Pence Cottage, to the west of Twenty Pence Road and Phase 6.
- 3.2 These receptors can be seen at Figure 2. In addition, Sharps Redmore understand a former piggery, situated a little to the north-east of The Lakes, may be under consideration for a change of use to residential occupation.
- 3.3 The area in the vicinity of dwellings is mostly characterised by the sound of distant road traffic. Twenty Pence Road lies to the west of the Mitchell Hill site and under the prevailing wind direction, that traffic sound carries over to the three receptors near Gravel Diggers Farm. Under more easterly wind directions, A10 traffic sound becomes more evident.
- 3.4 Sharps Redmore undertook baseline sound level monitoring in May and July of 2012, in preparation for the then planning application for the Gravel Diggers site. Based on that monitoring, it was considered that under calm/neutral atmospheric conditions, the background level of sound was 40 dB ($L_{A90,1hr}$). That background sound level served to indicate a not-to-exceed threshold for the Gravel Diggers routine workings of 50 dB ($L_{Aeq,1hr}$). Such a limit was subsequently specified in the Gravel Diggers consent², at condition 46(a).
- 3.5 During 2017, Sharps Redmore performed further site visits and baseline sound level checks. The survey dates coincided with no significant workings underway on Gravel Diggers so that the background levels were representative of a future time without sound from existing operations. The monitoring locations were as illustrated on the annotated Google Earth image at Figure 3 attached: Table 3.5 summarises the survey results:

² Cambridgeshire County Council. 11th February 2014
Consent. Application ref: S/02279/11/CW and S/02575/12/CW
Gravel Diggers Farm, Waterbeach

Table 3.5

Mitchell Hill Farm Application Site.

Baseline Sound Level Monitoring. 2017

Location, Date and Time	Observation	Levels Observed	
		Background L _{A90,t}	Ambient L _{Aeq,t}
1. Gravel Diggers. Long Drove, north of dwelling 24th Nov 2017.			
1330-1345hrs	Mostly Twenty Pence Road traffic. Occasional flocks of seagulls elevate the ambient. Weather: dry, clear skies, 7°c, calm/very light variable breeze.	38 dB	49 dB
1345-1400hrs		39 dB	46 dB
1400-1415hrs		39 dB	43 dB
1415-1430hrs		39 dB	51 dB
1430-1445hrs		38 dB	48 dB
1445-1500hrs		38 dB	50 dB
2. Twenty Pence Road. Long Drove, 25m east of junction (B1049) 24th Nov 2017.			
1315-1330hrs	Twenty Pence Road dominant throughout. Occasional sound of chainsaw or similar but not influential on background readings.	44 dB	59 dB
1330-1345hrs		41 dB	58 dB
1345-1400hrs		39 dB	58 dB
1400-1415hrs		39 dB	59 dB
1415-1430hrs		41 dB	59 dB
1430-1445hrs		43 dB	59 dB
3. Long Drove. 250m East of junction with B1049 19th Sept 2017.			
1445-1500hrs	25m east of junction.	41 dB	58 dB
1500-1515hrs	250m east of junction	38 dB	50 dB
	Weather: Dry, overcast, 14°c, light northerly breeze		

- 3.6 The 2017 survey results indicated a background sound level applicable to the Gravel Diggers Farm location of 38 dB ($L_{A90,t}$). This was slightly lower than the 40 dB ($L_{A90,1hr}$) value previously observed (2012) and adopted for the Gravel Diggers assessment. At a location closer to Twenty Pence Road and indicative of receptors at The Lakes, Twenty Pence Cottage and potentially the former piggery, a background sound level of 40 dB ($L_{A90,t}$) would be representative. The property Mitchell Hill Farm itself is approximately 300m from Twenty Pence Road. This dwelling is unlikely to be as sensitive to the proposed mineral workings as a receptor having no association with the development. A background sound level of between 38 dB and 40 dB ($L_{A90,1hr}$) would be a reasonable value to adopt.
- 3.7 Sound level recordings were performed using Type 1/Class 1 meters, mounted on tripods to a height of notionally 1.5m above local ground level. Windshields of 90mm diameter were fitted in order to minimise any wind sound at the microphone. Field calibration checks were performed before and after the surveys. No drift in the calibration value was noted.

4.0 Minerals Policy and Sound Level Threshold

4.1 In March 2012, the Government published its National Planning Policy Framework³. The NPPF set out the Government's planning policies for England and how they are expected to be applied. The previous Minerals Policy Statement⁴ was revoked and replaced by the Technical Guidance to the NPPF.

4.2 Paragraphs 142 to 149 inclusive of the Framework address 'Facilitating the sustainable use of minerals'. Paragraph 143 lists matters that the Government expects local planning authorities to take account of in the preparation of local plans. Where noise is relevant, local planning authorities should:

- *"Set out environmental criteria, in line with policies in this Framework, against which planning applications will be assessed so as to ensure that permitted operations do not have unacceptable adverse impacts on the natural and historic environment or human health, including from noise....; and take 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...."*

4.3 Paragraph 144 of the Framework sets out matters that local planning authorities are expected to consider when determining planning applications. Where noise is relevant, they should:

- *"Ensure that any unavoidable noise, and any blasting vibrations are controlled, mitigated or removed at source*, and establish appropriate noise limits for extraction in proximity to noise sensitive properties".*

* Reference is provided to Technical guidance on minerals that is published alongside the Framework.

4.4 The Technical Guidance document explains that it *"...retains key elements.... of the existing minerals policy statements and mineral planning guidance notes which are considered necessary and helpful in relation to these policy areas"*. The MPS2: Annex 2 is not retained in its entirety. However, the paragraphs 30 and 31 of the Technical Guidance reproduce almost word-for-word the noise standards previously recommended in paragraphs 2.19 and 2.20 of MPS2: Annex 2. Those standards can be summarised as follows:

- i) For Routine extraction workings:
Daytime: $L_{Aeq,1hr,free-field}$ = ' $L_{A90} + 10$ dB' or '55 dB', whichever the lower.
Night-time: $L_{Aeq,1hr,free-field}$ = 42 dB
- ii) For Temporary essential workings:
Daytime: $L_{Aeq,1hr,free-field}$ = 70 dB

³ Department for Communities and Local Government (DCLG) March 2012. National Planning Policy Framework and Technical Guidance

⁴ ODPM. MPS2. Annex 2. Noise. 2005. Controlling and mitigating the environmental effects of minerals extraction in England.

- 4.5 These limit values are repeatedly, the on-line Planning Practice Guidance⁵
- 4.6 Given the guidance and the background sound levels most recently observed, the threshold values deemed appropriate for the proposed Mitchell Hill workings are as follows:
- i) For Routine extraction and backfill workings:
A daytime limit of 48 dB ($L_{Aeq,1hr,free-field}$) at Gravel Diggers Farm,
Gravel Diggers and Elm Farm
A daytime limit of 50 dB ($L_{Aeq,1hr,free-field}$) at The Lakes and
Twenty Pence Cottage. (Also potentially, to the piggery if a
Change of use to residential were permitted).
A daytime limit of 49 dB ($L_{Aeq,1hr,free-field}$) at Mitchell Hill Farm.
 - ii) For the daytime screening and crushing of imported
store and hardcore, the same limits as 'i)' above.
 - iii) For daytime temporary works comprising soil-stripping bund construction,
bund removal, and final restoration, a limit of 70 dB ($L_{Aeq,1hr,free-field}$)
for notionally 8 weeks in total per year.

⁵ On-line PPG. 2014. Paragraph 21. (Ref ID: 27-021-20140306)

5.0 Sound Level Prediction

Methodology

- 5.1 The method by which sound levels have been predicted for the proposed workings at Mitchell Hill follows closely the guidance of BS 5228:2009⁶. Sharps Redmore has included refinements to take account of air 'absorption' (attenuation) over large distances and to allow for the slight enhancement effect of 'wind carryover'. In the first case, an air absorption rate of 4 dBA/km has been found from experience to be reasonable. (However, this benefit is downgraded or ignored altogether if barrier attenuation is significant). In the second case, it used to be normal practice to add 2 dBA to sound level predictions (MPG11:1993⁷) although that advice did not follow in later replacement guidance. Sound level prediction in this Report include a +2 dBA effect for receptors downwind of the source. The enhancement is diminished for receptors side-on to the wind direction or within 150m. For receptors upwind, no enhancement is applied. This approach is robust given the advice in BS 8233:2014⁸ on meteorological effects amounting to typically +2 dB downwind and -10 dB upwind.
- 5.2 The procedure for estimating the level of sound from vehicles following a haul route has been simplified. The 'acoustic centre' of the haul road path has been modelled as the vehicles average location and distance from the receptor. Combined with the duration of the vehicle movement along the haul route and the number of movements per hour, an equivalent result is obtained to that based on the 'line source' method. The former provides a more understandable and clearer approach.

Model

- 5.3 The following model has been derived to cover the operational modes and phases expected.
- Preparations. Temporary works including the formation of earth mounds, soil storage (noise bunds) are assumed to be undertaken by a tracked blade (bulldozer) sculpting the landform. The machine's sound emission is modelled at 108 dB (L_{WA} '-the apparent sound power level). This work is normally the most significant element given the relatively close proximity to residential neighbours and the type of plant. Bund removal operations normally employ an excavator at the soil loading point. Excavators are normally of several dB-lower sound output.

⁶ BSI. BS8228-1:2009 + A1:2014

Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.

⁷ DOE. Minerals Planning Guidance. MPG11:1993
The control of noise at surface mineral workings.

⁸ BSI. BS 8233:2014

Guidance on sound insulation and noise reduction for buildings.

- Excavations. Routine excavations are modelled on a tracked 360° excavator of notional 2m source height and 102 dB L_{WA}' output. (The existing Gravel Diggers workings use a Volvo, for which site readings by Sharps Redmore show such a rating). The excavator is modelled as operating on the exposed mineral surface. The typical time to load an articulated dump truck is 3 minutes. Articulated dump trucks (adt's) are modelled at an average speed of 18 kph and of a source height 2.5m. The adt's are assumed to drive on the exposed mineral surface rather than on a haul road below ground level. Site sound level tests indicated apparent sound power emission values during hauling of 102 dB L_{WA}' . Sharps Redmore have taken a more cautious value, 3 dB higher.
- Processing plant. The existing processing plant has been measured by Sharps Redmore and found to have an apparent sound power emission of 108 dB (L_{WA}'). The plant's acoustic source height is estimated at 4.5m above ground level. The Doosan loading shovel was of very low sound output and did not add to the effective emission of the processing plant.
- Backfilling. For the majority of the time, a bulldozer would operate below ground level. On the outer fringes of the proposed site, the fill would restore ground level back to similar elevations as before. A slight doming would be formed towards the land form centre. A bulldozer is modelled as active back at pre-existing ground levels on the outer edge of the Phase closest to the receptor, and with a sound output of 108 dB L_{WA}' and 1.5m source height. Tipper lorries bringing fill are modelled in the same manner as adt's, with a 105 dB L_{WA}' output. The source height is taken to be 1.5m above ground level. In an average hour, 2 x loads are modelled, equating to 4 x movements.
- Final Restoration. This would involve removing soil stockpiles/bunds and placing the material on the backfilled land form. It is normally an operation which places the most significant source, the bulldozer, further from receptors than the bunds it constructed earlier. Accordingly, Final Restoration works sound emissions are considered of no greater significance than the Preparations and are therefore not modelled separately.
- Recycling Plant. A mobile screen and mobile crusher would be located in the southern position of the plant compound. Screening and crushing would be an intermittent operation. The location of the compound (that is as remote from receptors as practicable) in conjunction with the tall mounding (noise bunds) of sub-soils forming the compound perimeter would serve to minimise the sound from the intermittently active plant. An apparent sound power emission of 115 dB L_{WA}' has been found by Sharps Redmore to typify the majority of such screening and crushing operations. The plant source height has been modelled at 2.5m above ground level.

5.4 Where noise bunds are present, their acoustic benefit has been estimated by the 'path-length-difference' method which features in the BS 5228-Part 1. Receptors are consistently modelled at 1.5m above local ground level.

Sound Level Predictions

- 5.5 Calculation sheets for daytime routine operations are attached at Annex 1 for review, as follows:
- Sheets 1 to 3. Gravel Diggers Farm Phase 1 workings. (Figure 4)
 - Sheets 4 to 6. Receptor: Elm Farm & Gravel Diggers Phase 1 workings. (Figure 4)
 - Sheets 7 to 9. Mitchell Hill Farm Phase 1 workings. (Figure 4)
 - Sheets 10 to 12. The Lakes Phase 4 workings. (Figure 5)
 - Sheet 13. Piggery Phase 4 workings. (Figure 5)
 - Sheet 14. Twenty Pence Cottage Phase 6 workings. (Figure 6)
- 5.6 For temporary (Preparations and Final Restorations) works, a sound level prediction is made on the basis of a bulldozer operating on the closest noise bund. A bulldozer working in relatively close proximity of a residential receptor point would represent the likely most significant element of the Temporary operations. Table 5.6 illustrates the situation for the property Gravel Diggers. The bund B1 would be no closer than 50 metres of the property.

Table 5.6
Sound level predictions
Temporary Works
Gravel Diggers

Source	Level
Bulldozer. L_{WA}'	108 dB
Minimum distance from B1	50m
Adjust for distance	-42 dB
Level, $L_{Aeq,1hr,free-field}$	66 dB
All other receptors would have bunds at greater than 50m distance.	

- 5.7 The results are considered in the following Assessment.

6.0 Assessment

- 6.1 Reference is made to the calculation sheets attached at Annex 1. Table 6.1 summarises and assesses the findings.

Table 6.1

Summary of Predictions and Assessment

	Contribution. (values are $dBL_{Aeq,1hr, free-field}$)		
Receptor	Excavations	Backfilling	Recycling
1. Gravel Diggers Farm			
Predicted Levels:	46 dB	47 dB	45 dB
Calc sheet:	1	2	3
Limit:	48 dB	48 dB	48 dB
Compliance expected?:	Yes	Yes	Yes

2. Elm Farm & Gravel Diggers			
Predicted Levels:	46 dB	47 dB	45 dB
Calc sheet:	4	5	6
Limit:	48 dB	48 dB	48 dB
Compliance expected?:	Yes	Yes	Yes

3. Mitchell Hill Farm			
Predicted Levels:	42 dB	46 dB	43 dB
Calc sheet:	7	8	9
Limit:	49 dB	49 dB	49 dB
Compliance expected?:	Yes	Yes	Yes

4. The Lakes (Piggery/in brackets)			
Predicted Levels:	46 dB	50 dB (50dB)	42 dB
Calc sheet:	10	11(13)	12
Limit:	50 dB	50 dB	50 dB
Compliance expected?:	Yes	Yes	Yes

5. Twenty Pence Cottage			
Predicted Levels:	50 dB	No backfill	<42 dB*
Calc sheet:	14	-	-
Limit:	50 dB	-	-
Compliance expected?:	Yes	Yes	Yes

*See The Lakes, Calc sheet 12

- 6.2 For Routine workings the expectation is that a limit value consistent with national guidance would be achievable. A point to note is that the intermittent sound from the proposed aggregates recycling (screening and crushing) could likely be timed with a temporary cessation of excavations or backfilling in order to maintain a cumulative sound level in line with the national limit.
- 6.3 Reference is made to the calculation at Table 5.6. That calculation illustrates that the likely most significant component of Temporary works would be satisfactory in the context of the 70 dBL_{Aeq,1hr,free-field} limit.

7.0 Summary and Conclusion

- 7.1 This assessment has been preceded by a review of the proposed Mitchell Hill workings. That review has resulted in refinements to the scheme aimed at reducing sound levels to appropriate thresholds. The thresholds have been informed by baseline sound level monitoring. The scheme assessed features significant sound level mitigation measures.
- 7.2 A prediction of sound levels has been made. The closest working Phase to a receptor has been considered and plant has been modelled or active at ground level rather than at an excavated (below ground) elevation.
- 7.3 The expectation is that sound levels likely to arise from Routine workings would be satisfactory in the context of national guidance threshold values.
- 7.4 Temporary operations would give rise to higher levels of sound, but for brief periods at the start and end of the life of the workings. The higher levels of sound are expected to be compliant with the limit permitted for Temporary operations.
- 7.5 It is concluded that the proposed workings would be able to proceed without generating sound in excess of recommended limits.

Annex 1

Calculation Sheets. 14-off

Calc Sheet 1. Jan 2018
Gravel Diggers Farm
Routine Excavations, Phase 1, Hauling, Plant and Tipper

1. Excavator. In Phase 1

■ LWA', on 100% time	: 102 dB
■ Distance correction to 330 metres	: -58 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m from plant, 3m tall	: -7 dB
■ Air absorption (4 dBA/km)	: -1 dB
■ Downwind correction. N	: 0 dB
■ LAeq,1hr,free-field Excavation in Phase 1	: 36 dB

2. Dump trucks. Phase 1 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	1	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 1=450m@18kph
■ Average/acoustic centre distance	:	380m	500m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-60 dB	-62 dB	B5=6m agl,160m from pile
■ Downwind correction	:	+1 dB	+2 dB	B9=5m agl,320m from pile
■ Barrier, B1,3,9	:	At 140m	B5&9	B1,3=6dB.B9=6dB.B5=5
■ Barrier effect*	:	-6dB	-7 dB	B5+B9=7dB
■ Soft ground, say	:	n/a	n/a	ADT load time~3mins
■ On-time per segment: (to nearest 10 seconds)	:	90sec	60sec	Surge pile tip time ~ 1min
■ Correction for on-time per hour	:	-16 dB	-18 dB	
■ Correction for 8x loads/16x passes per hour	:	+12 dB	+9 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	B1=3m agl,140m from adt
■ Air absorption (4 dBA/km)	:	-1 dB	-1 dB	ADT=2m agl. B1=6dB
■ LAeq,1hr,free-field, Dump Trucks from Phase 1	:	38 dB	31 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	480m	B5, 6m tall@150m=6dB
■ Correction for distance	:	-62 dB	B1, 3m tall@360m=5dB
■ Soft ground	:	n/a	Ab, combine B5&B1=7dB
■ Barrier	:	B5,1	Hs=4.5m agl
■ Barrier effect**	:	-7 dB	
■ Air absorption	:	n/a	
■ Downwind correction, N	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	41 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	200m	130	90	120	200
■ Correction for distance	:	-54 dB	-50	-47	-50	-54
■ Downwind correction, N	:	+2 dB	+2	+1	0	0
■ Barrier or soft ground	:	B1	grd	fence	grd	fence
■ Barrier or soft ground effect	:	-7 dB	-3	-8	-3	-7
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ LAeq,1hr,free-field, Lorries (42dB)	:	32 dB	37	36	35	29

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	46dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 2. Jan 2018
Gravel Diggers Farm
Routine Backfill, Phase 1, Tippers and Bulldozer

1. Bulldozer. In Phase 1

■ LWA', on 100% time	: 108 dB
■ Distance correction to 330 metres	: -58 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m, 3m tall	: -8 dB
■ Air absorption (4 dBA/km)	: 0 dB
■ Downwind correction. N	: 0 dB
■ LAeq,1hr,free-field Backfill in Phase 1	: 42 dB

2. Tippers. To Phase 1

■ Consider Segments*:	:	F	*Notes
■ LWA', on 100% time	:	105 dB	Seg F=300m@18kph
■ Average/acoustic centre distance	:	360m	
■ Correction for distance (Point source)	:	-59 dB	
■ Downwind correction	:	+1 dB	
■ Barrier B1,3,9	:	At 100m	
■ Barrier effect*	:	-7dB	
■ Soft ground, say	:	n/a	
■ On-time per segment: (to nearest 10 seconds)	:	60sec	
■ Correction for on-time per hour	:	-18 dB	
■ Correction for 2x loads/4x passes per hour	:	+6 dB	
■ Correction for no. trucks	:	0 dB	B1=3m agl,
■ Air absorption (4 dBA/km)	:	-1 dB	Tipper=1.5m agl. B1=7dB
■ LAeq,1hr,free-field, Tippers	:	27 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	480m	B5, 6m tall@150m=6dB
■ Correction for distance	:	-62 dB	B1, 5m tall@360m=5dB
■ Soft ground	:	n/a	Ab, combine B5&B1=7dB
■ Barrier	:	B5,9	
■ Barrier effect**	:	-7 dB	
■ Air absorption	:	n/a	
■ Downwind correction	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	41 dB	

4. Tipper Lorries on Access Road

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	200m	130	90	120	200
■ Correction for distance	:	-54 dB	-50	-47	-50	-54
■ Downwind correction, N	:	+2 dB	+2	+1	0	0
■ Barrier or soft ground	:	B1	grd	fence	grd	fence
■ Barrier or soft ground effect	:	-7 dB	-3	-8	-3	-7
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ LAeq,1hr,free-field, Lorries (42dB)	:	32 dB	37	36	35	29

5. Combined Activity

■ Bulldozer, Tippers, Plant	:	47dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 3. Jan 2018
Gravel Diggers Farm
Crushing & Screening

1. Crushing & Screening plant

■ L _{WA'} , on 100% time	:	115 dB
■ Distance, typically	:	410m
■ Correction for distance	:	-60 dB
■ Soft ground	:	n/a
■ Barrier	:	B5,9
■ Barrier effect**	:	-12 dB
■ Air absorption	:	n/a
■ Downwind correction	:	+2 dB
■ Assumed on 100% of time per hour	:	0dB
■ L _{Aeq,1hr} free-field, plant	:	45 dB

****Notes**

B5, 6m tall@50m=11dB
 B9, 5m tall@220m=9dB
 Ab, combine B5&B9=12dB
 Plant Hs=2.5m
 Hreceptor=1.5m

Calc Sheet 4. Jan 2018
Elm Farm & Gravel Diggers
Routine Excavations, Phase 1, Hauling, Plant and Tipplers

1. Excavator. In Phase 1

■ LWA', on 100% time	: 102 dB
■ Distance correction to 220 metres	: -55 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m from plant, 3m tall	: -7 dB
■ Air absorption (4 dBA/km)	: 0 dB
■ Downwind correction. N	: 0 dB
■ LAeq,1hr,free-field Excavation in Phase 1	: 40 dB

2. Dump trucks. Phase 1 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	1	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 1=450m@18kph
■ Average/acoustic centre distance	:	260m	450m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-56 dB	-61 dB	B5=6m agl,150m from pile
■ Downwind correction, N	:	+1 dB	+2 dB	B9=5m agl,300m from pile
■ Barrier	:	B1,3	B5&9	B5=5dB.B9=7dB.
■ Barrier effect*	:	-6dB	-8 dB	B5+B9=8dB
■ Soft ground, say	:	n/a	n/a	ADT load time~3mins
■ On-time per segment: (to nearest 10 seconds)	:	90sec	60sec	Surge pile tip time ~ 1min
■ Correction for on-time per hour	:	-16 dB	-18 dB	
■ Correction for 8x loads/16x passes per hour	:	+12 dB	+9 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	B3=3m agl,100m from adt
■ Air absorption (4 dBA/km)	:	-1 dB	-1 dB	ADT=2m agl. B1=6dB
■ LAeq,1hr,free-field, Dump Trucks from Phase 1	:	42 dB	31 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	450m	B5, 6m tall@150m=8dB
■ Correction for distance	:	-61 dB	B9, 5m tall@300m=8dB
■ Soft ground	:	n/a	Ab, combine B5&B9=10dB
■ Barrier	:	B5,9	
■ Barrier effect**	:	-10 dB	
■ Air absorption	:	n/a	
■ Downwind correction, N	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	39 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	180m	150	190	230	320
■ Correction for distance	:	-53 dB	-52	-54	-55	-58
■ Downwind correction, N	:	+2 dB	+1	0	0	0
■ Barrier or soft ground	:	B1	B1	fence	grd	fence
■ Barrier or soft ground effect	:	-7 dB	-7	-8	-4	-7
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ LAeq,1hr,free-field, Lorries (37dB)	:	33 dB	30	28	28	25

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	46dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 5. Jan 2018
Elm Farm & Gravel Diggers
Routine Backfill, Phase 1, Tippers and Bulldozer

1. Bulldozer. In Phase 1

■ L _{WA'} , on 100% time	: 108 dB
■ Distance correction to 220 metres	: -55 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m from plant, 3m tall	: -7 dB
■ Air absorption (4 dBA/km)	: -1 dB
■ Downwind correction. N	: 0 dB
■ L _{Aeq,1hr,free-field} Backfill in Phase 1	: 45 dB

2. Tippers. To Phase 1

■ Consider Segments*:	:	F	*Notes
■ L _{WA'} , on 100% time	:	105 dB	Seg F=300m@18kph
■ Average/acoustic centre distance	:	250m	
■ Correction for distance (Point source)	:	-56 dB	
■ Downwind correction, N	:	+1 dB	
■ Barrier B1,3,9	:	At 100m	
■ Barrier effect*	:	-7dB	
■ Soft ground, say	:	n/a	
■ On-time per segment: (to nearest 10 seconds)	:	60sec	
■ Correction for on-time per hour	:	-18 dB	
■ Correction for 2x loads/4x passes per hour	:	+6 dB	
■ Correction for no. trucks	:	0 dB	B1=3m agl,
■ Air absorption (4 dBA/km)	:	0 dB	Tipper=1.5m agl. B1=7dB
■ L _{Aeq,1hr,free-field} , Dump Trucks from Phase 1	:	31 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ L _{WA'} , on 100% time	:	108 dB	**Notes
■ Distance, typically	:	450m	B5, 6m tall@150m=8dB
■ Correction for distance	:	-61 dB	B9, 5m tall@300m=8dB
■ Soft ground	:	n/a	Ab, combine B5&B9=10dB
■ Barrier	:	B5,9	
■ Barrier effect**	:	-10 dB	
■ Air absorption	:	n/a	
■ Downwind correction	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ L _{Aeq,1hrfree-field} , plant	:	39 dB	

4. Tipper Lorries on Access Road

■ Consider segments	:	A	B	C	D	E
■ L _{WA'} , on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	180m	150	190	230	320
■ Correction for distance	:	-53 dB	-52	-54	-55	-58
■ Downwind correction, N	:	+2 dB	+1	0	0	0
■ Barrier or soft ground	:	B1	B1	fence	grd	fence
■ Barrier or soft ground effect	:	-7 dB	-7	-7	-4	-7
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ L _{Aeq,1hr,free-field} , Lorries (37dB)	:	33 dB	30	28	28	25

5. Combined Activity

■ Bulldozer, Tippers, Plant	:	47dB
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6. Assessment

■ Notional limit for Routine Workings, L _{Aeq,1hr,free-field}	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 6. Jan 2018
Elm Farm & Gravel Diggers
Crushing & Screening

1. Crushing & Screening plant

■ L _{WA'} , on 100% time	:	115 dB
■ Distance, typically	:	350m
■ Correction for distance	:	-59 dB
■ Soft ground	:	n/a
■ Barrier	:	B5,9
■ Barrier effect**	:	-12 dB
■ Air absorption	:	n/a
■ Downwind correction	:	+2 dB
■ Assumed on 100% of time per hour	:	0dB
■ L _{Aeq,1hr} free-field, plant	:	46 dB

****Notes**

B5, 6m tall@50m=11dB
 B9, 5m tall@200m=9dB
 Ab, combine B5&B9=12dB
 Plant Hs=2.5m
 Hreceptor=1.5m

Calc Sheet 7. Jan 2018
Mitchell Hill Farm
Routine Excavations, Phase 1-2 border, Hauling, Plant and Tipplers

1. Excavator. In Phase 1-2 border

■ LWA', on 100% time	: 102 dB
■ Distance correction to 350 metres	: -59 dB
■ Soft ground	: -5 dB
■ Air absorption (4 dBA/km)	: -1 dB
■ Downwind correction. NE	: +2 dB
■ $L_{Aeq,1hr,free-field}$ Excavation in Phase 1-2	: 39 dB

2. Dump trucks. Phase 1 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	3	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 3=400m@18kph
■ Average/acoustic centre distance	:	450m	700m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-61 dB	-65 dB	B6=5m agl, 70m from pile
■ Downwind correction	:	+2 dB	+2 dB	
■ Barrier	:	no	B6	
■ Barrier effect*	:	0 dB	0 dB	
■ Soft ground, say	:	-6 dB	-7 dB	ADT load time~3mins
■ On-time per segment: (to nearest 10 seconds)	:	80sec	60sec	Surge pile tip time ~ 1min
■ Correction for on-time per hour	:	-17 dB	-18 dB	
■ Correction for 8x loads/16x passes per hour	:	+12 dB	+9 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	
■ Air absorption (4 dBA/km)	:	-2 dB	-2 dB	ADT=2m agl.
■ $L_{Aeq,1hr,free-field}$, Dump Trucks from Phase 1-2	:	36 dB	27 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	750m	
■ Correction for distance	:	-66 dB	B6, 5m tall@130m=5dB
■ Soft ground	:	n/a	
■ Barrier	:	B6	
■ Barrier effect**	:	-5 dB	
■ Air absorption	:	-3 dB	
■ Downwind correction, NE	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ $L_{Aeq,1hr,free-field}$, plant	:	36 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	750m	800	850	900	1000
■ Correction for distance	:	-66 dB				
■ Downwind correction, NE	:	+2 dB				
■ Barrier or soft ground	:	B3	B3	fence	grd	fence
■ Barrier or soft ground effect	:	-6 dB				
■ Segment length	:	200m				
■ On-time per segment	:	40sec				
■ Correction for on-time per hour	:	-20 dB				
■ Correction for 4-off movements per hour, average	:	+6 dB				
■ Air absorption	:	ignore				
■ $L_{Aeq,1hr,free-field}$, Lorries (21 dB)	:	21 dB				

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	42dB
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6. Assessment

■ Notional limit for Routine Workings, $L_{Aeq,1hr,free-field}$	:	49dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 8. Jan 2018

Mitchell Hill Farm

Routine Backfill, Phase 1-2 border, Tippers and Bulldozer

1. Bulldozer. In Phase 1-2 border						
■	L _{WA} ', on 100% time	:				: 108 dB
■	Distance correction to 350 metres	:				: -59 dB
■	Soft ground	:				: -5 dB
■	Air absorption (4 dBA/km)	:				: -1 dB
■	Downwind correction. NE	:				: +2 dB
■	L _{Aeq,1hr,free-field} Backfill in Phase 1-2	:				: 45 dB
2. Tippers. Phase 1-2 border						
■	Consider Segments*:	:	F	H		*Notes
■	L _{WA} ', on 100% time	:	105 dB	105 dB		Seg F=200m@18kph
■	Average/acoustic centre distance	:	550m	400m		Seg H=180m@18kph
■	Correction for distance (Point source)	:	-63 dB	-60 dB		
■	Downwind correction	:	+2 dB	+2 dB		
■	Barrier	:	no	no		
■	Barrier effect*	:	0 dB	0 dB		
■	Soft ground, say	:	-6 dB	-6 dB		
■	On-time per segment: (to nearest 10 seconds)	:	40sec	40sec		
■	Correction for on-time per hour	:	-20 dB	-20 dB		
■	Correction for 2x loads/4x passes per hour	:	+6 dB	+6 dB		
■	Correction for no. trucks	:	0 dB	0 dB		
■	Air absorption (4 dBA/km)	:	-2 dB	-2 dB		Tipper=1.5m agl.
■	L _{Aeq,1hr,free-field} , Tippers to Phase 1-2	:	22 dB	25 dB		Hreceptor=1.5m agl
3. Aggs Processing Plant (as existing)						
■	L _{WA} ', on 100% time	:	108 dB			**Notes
■	Distance, typically	:	750m			
■	Correction for distance	:	-66 dB			B6, 5m tall@130m=5dB
■	Soft ground	:	n/a			
■	Barrier	:	B6			
■	Barrier effect**	:	-5 dB			
■	Air absorption	:	-3 dB			
■	Downwind correction, N	:	+2 dB			
■	Assumed on 100% of time per hour	:	0dB			
■	L _{Aeq,1hrfree-field} , plant	:	36 dB			
4. Tipper Lorries on Access Road						
■	Consider segments	:	A	B	C	D E
■	L _{WA} ', on 100% time	:	105 dB	105	105	105 105
■	Average/acoustic centre distance to seg.t	:	750m	800	850	900 1000
■	Correction for distance	:	-66 dB			
■	Downwind correction, NE	:	+2 dB			
■	Barrier or soft ground	:	B3	B3	fence	grd fence
■	Barrier or soft ground effect	:	-6 dB			
■	Segment length	:	200m			
■	On-time per segment	:	40sec			
■	Correction for on-time per hour	:	-20 dB			
■	Correction for 4-off movements per hour, average	:	+6 dB			
■	Air absorption	:	ignore			
■	L _{Aeq,1hr,free-field} , Lorries (21 dB)	:	21 dB			
5. Combined Activity						
■	Bulldozer, Tippers, Plant	:	46 dB			
6. Assessment						
■	Notional limit for Routine Workings, L _{Aeq,1hr,free-field}	:	49 dB			
■	Is limit expected to be met?	:	Yes			
■	Conclude	:	Compliant			

Calc Sheet 9. Jan 2018
Mitchell Hill Farm
Crushing & Screening

1. Crushing & Screening plant

■ L _{WA'} , on 100% time	:	115 dB
■ Distance, typically	:	700m
■ Correction for distance	:	-65dB
■ Soft ground	:	n/a
■ Barrier	:	B6
■ Barrier effect**	:	-9 dB
■ Air absorption	:	n/a
■ Downwind correction, NE	:	+2 dB
■ Assumed on 100% of time per hour	:	0dB
■ L _{Aeq,1hr} free-field, plant	:	43 dB

**Notes

B6, 5m tall@50m=9dB

Plant Hs=2.5m

Hreceptor=1.5m

Calc Sheet 10. Jan 2018
The Lakes
Routine Excavations, Phase 4, Hauling, Plant and Tipper

1. Excavator. In Phase 4

■ LWA', on 100% time	: 102 dB
■ Distance correction to 150 metres	: -52 dB
■ Barrier B11, topsoil 3m	: -7 dB
■ Soft ground	: n/a
■ Air absorption (4 dBA/km)	: 0 dB
■ Downwind correction. SE	: +2 dB
■ LAeq,1hr,free-field Excavation in Phase 4	: 45 dB

2. Dump Trucks. Phase 4 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	4/J	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 4=500m@18kph
■ Average/acoustic centre distance	:	200m	700m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-54 dB	-65 dB	B11=3m agl, 110m Lakes
■ Downwind correction, SE	:	+2 dB	+2 dB	B11=40m from excvtr
■ Barrier	:	B11	B11	B11=120m from adt
■ Barrier effect*	:	-7dB	-6 dB	B11=570m from surge
■ Soft ground, say	:	n/a	n/a	
■ On-time per segment: (to nearest 10 seconds)	:	100sec	60sec	
■ Correction for on-time per hour	:	-16 dB	-18 dB	
■ Correction for 8x loads/16x passes per hour	:	+12dB	+9 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	
■ Air absorption (4 dBA/km)	:	0 dB	-1 dB	ADT=2m agl
■ LAeq,1hr,free-field, Dump Trucks from Phase 4	:	36 dB	29 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	700m	B11,3m tall@680m=6dB
■ Correction for distance	:	-65 dB	Hsource=4.5m agl
■ Soft ground	:	n/a	
■ Barrier	:	B11	
■ Barrier effect**	:	-6 dB	
■ Air absorption	:	-1 dB	
■ Downwind correction, SE	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	38 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	950m				
■ Correction for distance	:	-68 dB				
■ Downwind correction, SE	:	+2 dB				
■ Barrier or soft ground	:	B3,2,11				
■ Barrier or soft ground effect	:	-7 dB				
■ Segment length	:	200m				
■ On-time per segment	:	40sec				
■ Correction for on-time per hour	:	-20 dB				
■ Correction for 4-off movements per hour, average	:	+6 dB				
■ Air absorption	:	-3 dB				
■ LAeq,1hr,free-field, Lorries (<20dB)	:	<20 dB				

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	46dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	50dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 11. Jan 2018
The Lakes
Routine Backfill, Phase 4, Tippers and Bulldozer

1. Bulldozer. In Phase 4

■	LWA', on 100% time	:	108 dB	
■	Distance correction to 150 metres	:	-52 dB	
■	Barrier B11, topsoil 3m	:	-8 dB	
■	Soft ground	:	n/a	
■	Air absorption (4 dBA/km)	:	0 dB	
■	Downwind correction. SE	:	+2 dB	
■	LAeq,1hr,free-field Backfill in Phase 4	:	50 dB	

2. Tippers. To Phase 4

■	Consider Segments*:	:	4/J		*Notes
■	LWA', on 100% time	:	105 dB		Seg J=500m@18kph
■	Average/acoustic centre distance	:	200m		
■	Correction for distance (Point source)	:	-54 dB		B11=3magl,110m Lakes
■	Downwind correction, SE	:	+2 dB		B11=40m from blade
■	Barrier	:	B11		B11=120m from tipper
■	Barrier effect*	:	-7dB		
■	Soft ground, say	:	n/a		
■	On-time per segment: (to nearest 10 seconds)	:	100sec		
■	Correction for on-time per hour	:	-16 dB		
■	Correction for 2x loads/4x passes per hour	:	+6		
■	Correction for no. tippers	:	0 dB		
■	Air absorption (4 dBA/km)	:	0 dB		Tipper=1.5m agl
■	LAeq,1hr,free-field, Tippers to Phase 4	:	36 dB		Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■	LWA', on 100% time	:	108 dB		**Notes
■	Distance, typically	:	700m		B11,4m tall@620m=8dB
■	Correction for distance	:	-65 dB		Hsource=4.5m agl
■	Soft ground	:	-6 dB		
■	Barrier	:	B11		
■	Barrier effect**	:	-7 dB		
■	Air absorption	:	-1 dB		
■	Downwind correction, SE	:	+2 dB		
■	Assumed on 100% of time per hour	:	0dB		
■	LAeq,1hrfree-field, plant	:	31 dB		

4. Tipper Lorries on Access Road

■	Consider segments	:	A	B	C	D	E
■	LWA', on 100% time	:	105 dB	105	105	105	105
■	Average/acoustic centre distance to seg.t	:	950m				
■	Correction for distance	:	-68 dB				
■	Downwind correction, SE	:	+2 dB				
■	Barrier or soft ground	:	B3,2,11				
■	Barrier or soft ground effect	:	-7 dB				
■	Segment length	:	200m				
■	On-time per segment	:	40sec				
■	Correction for on-time per hour	:	-20 dB				
■	Correction for 4-off movements per hour, average	:	+6 dB				
■	Air absorption	:	-3 dB				
■	LAeq,1hr,free-field, Lorries (<20dB)	:	<20 dB				

5. Combined Activity

■	Bulldozer, Tippers, Plant	:	50dB
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6. Assessment

■	Notional limit for Routine Workings, LAeq,1hr,free-field	:	50dB
■	Is limit expected to be met?	:	Yes
■	Conclude	:	Compliant

Calc Sheet 12. Jan 2018
The Lakes
Crushing & Screening

1. Crushing & Screening plant

■ L _{WA} ’, on 100% time	:	115 dB
■ Distance, typically	:	750m
■ Correction for distance	:	-66 dB
■ Soft ground	:	n/a
■ Barrier	:	B6,11
■ Barrier effect**	:	-9 dB
■ Air absorption	:	0 dB
■ Downwind correction	:	+2 dB
■ Assumed on 100% of time per hour	:	0dB
■ L _{Aeq,1hr} free-field, plant	:	42 dB

**Notes
B6, 5m tall@100m=8dB
B11, 3m tall@610m=5dB
Ab, combine B6&11=9dB
Plant Hs=2.5m
Hreceptor=1.5m

Calc Sheet 13. Jan 2018
Potential future dwelling at piggery
Routine Backfill, Phase 4, Tippers and Bulldozer

1. Bulldozer. In Phase 4

■	LWA', on 100% time	: 108 dB	
■	Distance correction to 110 metres	: -49 dB	
■	Barrier B11, at 80m from building subsoil, 4m tall	: -10 dB	
■	Soft ground	: n/a	
■	Air absorption (4 dBA/km)	: 0 dB	
■	Downwind correction. SE	: +1 dB	
■	LAeq1hr,free-field Backfill in Phase 4	: 50 dB	

2. Tippers. To Phase 4

■	Consider Segments*:	: 5/k		
■	LWA', on 100% time	: 105 dB		*Notes
■	Average/acoustic centre distance	: 200m		Seg k=500m@18kph
■	Correction for distance (Point source)	: -54 dB		B11=4magl,80m piggery
■	Downwind correction, SE	: +2 dB		B11=30m from blade
■	Barrier	: B11		B11=120m from tipper
■	Barrier effect*	: -7dB		
■	Soft ground, say	: n/a		
■	On-time per segment: (to nearest 10 seconds)	: 100sec		
■	Correction for on-time per hour	: -16 dB		
■	Correction for 2x loads/4x passes per hour	: +6		
■	Correction for no. tippers	: 0 dB		
■	Air absorption (4 dBA/km)	: 0 dB		Tipper=1.5m agl
■	LAeq,1hr,free-field, Tippers to Phase 4	: 36 dB		Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■	LWA', on 100% time	: 108 dB		
■	Distance, typically	: 700m		**Notes
■	Correction for distance	: -65 dB		B11,4m tall@620m=8dB
■	Soft ground	: -6 dB		Hsource=4.5m agl
■	Barrier	: B11		
■	Barrier effect**	: -7 dB		
■	Air absorption	: -1 dB		
■	Downwind correction, SE	: +2 dB		
■	Assumed on 100% of time per hour	: 0dB		
■	LAeq,1hrfree-field, plant	: 31 dB		

4. Tipper Lorries on Access Road,

■	Consider segments	: A	B	C	D	E
■	LWA', on 100% time	: 105 dB	105	105	105	105
■	Average/acoustic centre distance to seg.t	: 950m				
■	Correction for distance	: -68 dB				
■	Downwind correction, SE	: +2 dB				
■	Barrier or soft ground	: B3,2,11				
■	Barrier or soft ground effect	: -7 dB				
■	Segment length	: 200m				
■	On-time per segment	: 40sec				
■	Correction for on-time per hour	: -20 dB				
■	Correction for 4-off movements per hour, average	: +6 dB				
■	Air absorption	: -3 dB				
■	LAeq,1hr,free-field, Lorries (<20dB)	: <20 dB				

5. Combined Activity

■	Bulldozer, Tippers, Plant	: 50dB
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6. Assessment

■	Notional limit for Routine Workings, LAeq,1hr,free-field	: 50dB
■	Is limit expected to be met?	: Yes
■	Conclude	: Compliant

Calc Sheet 14. Jan 2018
Twenty Pence Cottage
Routine Excavations, Phase 6, Hauling, Plant and Tipper

1. Excavator. In Phase 6

■ LWA', on 100% time	: 102 dB
■ Distance correction to 150 metres	: -52 dB
■ Barrier B13, topsoil 3m	: 0 dB
■ Soft ground	: -2 dB
■ Air absorption (4 dBA/km)	: 0 dB
■ Downwind correction. SE	: +1 dB
■ LAeq,1hr,free-field Excavation in Phase 6	: 49 dB

2. Dump Trucks. Phase 6 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	6/l	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 6=700m@18kph
■ Average/acoustic centre distance	:	300m	900m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-58 dB	-67 dB	B11subs=4magl
■ Downwind correction, SE	:	+2 dB	+2 dB	
■ Barrier	:	B13	B11subs	B13=150m from adt
■ Barrier effect*	:	-6dB	-5 dB	B11=600m from surge
■ Soft ground, say	:	n/a	n/a	
■ On-time per segment: (to nearest 10 seconds)	:	140sec	60sec	
■ Correction for on-time per hour	:	-14 dB	-18 dB	
■ Correction for 6x loads/12x passes per hour	:	+11dB	+8 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	
■ Air absorption (4 dBA/km)	:	-1 dB	-3 dB	ADT=2m agl
■ LAeq,1hr,free-field, Dump Trucks from Phase 6	:	42 dB	25 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	900m	B11,4m tall@650m=6dB
■ Correction for distance	:	-67 dB	Hsource=4.5m agl
■ Soft ground	:	n/a	
■ Barrier	:	B11	
■ Barrier effect**	:	-6 dB	
■ Air absorption	:	-2 dB	
■ Downwind correction, SE	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	35 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	1100m				
■ Correction for distance	:	-69 dB				
■ Downwind correction, SE	:	+2 dB				
■ Barrier or soft ground	:	B3,2,11				
■ Barrier or soft ground effect	:	-7 dB				
■ Segment length	:	200m				
■ On-time per segment	:	40sec				
■ Correction for on-time per hour	:	-20 dB				
■ Correction for 4-off movements per hour, average	:	+6 dB				
■ Air absorption	:	-3 dB				
■ LAeq,1hr,free-field, Lorries (<20dB)	:	<20 dB				

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	50dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	50dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 15. Jan 2018
Chestnut Cottage
Routine Excavations, Phase 1, Hauling, Plant and Tipper

1. Excavator. In Phase 1

■ LWA', on 100% time	: 102 dB
■ Distance correction to 500 metres	: -62 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m from plant, 3m tall	: -7 dB
■ Air absorption (4 dBA/km)	: -1 dB
■ Downwind correction. NW	: + 1 dB
■ LAeq,1hr,free-field Excavation in Phase 1	: 33 dB

2. Dump trucks. Phase 1 to Aggs Proc.g Plant & Tip to surge pile

■ Consider Segments*:	:	1	2	*Notes
■ LWA', on 100% time	:	105 dB	105 dB	Seg 1=450m@18kph
■ Average/acoustic centre distance	:	500m	550m	Seg 2=surge pile, 5m tall
■ Correction for distance (Point source)	:	-62 dB	-63 dB	B7=5m agl,150m from pile
■ Downwind correction	:	+2 dB	+2 dB	
■ Barrier, B1,3,9	:	At 150m	B7, 250m	B1,3=6dB
■ Barrier effect*	:	-6dB	-5 dB	
■ Soft ground, say	:	n/a	n/a	ADT load time~3mins
■ On-time per segment: (to nearest 10 seconds)	:	90sec	60sec	Surge pile tip time ~ 1min
■ Correction for on-time per hour	:	-16 dB	-18 dB	
■ Correction for 8x loads/16x passes per hour	:	+12 dB	+9 dB	
■ Correction for 2-off trucks	:	+3 dB	+3 dB	B1=3m agl,145m from adt
■ Air absorption (4 dBA/km)	:	-1 dB	-2 dB	ADT=2m agl. B1=6dB
■ LAeq,1hr,free-field, Dump Trucks from Phase 1	:	37 dB	31 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ LWA', on 100% time	:	108 dB	**Notes
■ Distance, typically	:	520m	B7, 5m tall@180m=6dB
■ Correction for distance	:	-62 dB	
■ Soft ground	:	n/a	
■ Barrier	:	B7	Hs=4.5m agl
■ Barrier effect**	:	-6 dB	
■ Air absorption	:	-1 dB	
■ Downwind correction, NW	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ LAeq,1hrfree-field, plant	:	41 dB	

4. Tipper Lorries on Access Road, Sales

■ Consider segments	:	A	B	C	D	E
■ LWA', on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	260m	200	70	50	100
■ Correction for distance	:	-56 dB	-54	-45	-42	-48
■ Downwind correction, N	:	+2 dB	+2	+1	0	0
■ Barrier or soft ground	:	B7,5m	grd	fence	grd	grd
■ Barrier or soft ground effect	:	-10 dB	-4	-8	-1	-3
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ LAeq,1hr,free-field, Lorries (47dB)	:	27 dB	32	38	45	39

5. Combined Activity

■ Excavator, Dump Trucks, Plant, Lorries	:	48dB
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6. Assessment

■ Notional limit for Routine Workings, LAeq,1hr,free-field	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 16. Jan 2018
Chestnut Cottage
Routine Backfill, Phase 1, Tippers and Bulldozer

1. Bulldozer. In Phase 1

■ L _{WA'} , on 100% time	: 108 dB
■ Distance correction to 500 metres	: -62 dB
■ Soft ground	: n/a
■ Barrier, B3,1 at 40m from plant, 3m tall	: -8 dB
■ Air absorption (4 dBA/km)	: 0 dB
■ Downwind correction. NW	: +1 dB
■ L _{Aeq,1hr,free-field} Backfill in Phase 1	: 39
■ dB	

2. Tippers. To Phase 1

■ Consider Segments*:	:	F	*Notes
■ L _{WA'} , on 100% time	:	105 dB	Seg F=300m@18kph
■ Average/acoustic centre distance	:	500m	
■ Correction for distance (Point source)	:	-62 dB	
■ Downwind correction	:	+2 dB	
■ Barrier B1,3,9	:	At 150m	
■ Barrier effect*	:	-7dB	
■ Soft ground, say	:	n/a	
■ On-time per segment: (to nearest 10 seconds)	:	60sec	
■ Correction for on-time per hour	:	-18 dB	
■ Correction for 2x loads/4x passes per hour	:	+6 dB	
■ Correction for no. trucks	:	0 dB	B1=3m agl,
■ Air absorption (4 dBA/km)	:	-1 dB	Tipper=1.5m agl. B1=7dB
■ L _{Aeq,1hr,free-field} , Tippers	:	25 dB	Hreceptor=1.5m agl

3. Aggs Processing Plant (as existing)

■ L _{WA'} , on 100% time	:	108 dB	**Notes
■ Distance, typically	:	520m	B7, 5m tall@180m=6dB
■ Correction for distance	:	-62 dB	
■ Soft ground	:	n/a	Hs=4.5m agl
■ Barrier	:	B7	
■ Barrier effect**	:	-6 dB	
■ Air absorption	:	-1 dB	
■ Downwind correction	:	+2 dB	
■ Assumed on 100% of time per hour	:	0dB	
■ L _{Aeq,1hrfree-field} , plant	:	41 dB	

4. Tipper Lorries on Access Road

■ Consider segments	:	A	B	C	D	E
■ L _{WA'} , on 100% time	:	105 dB	105	105	105	105
■ Average/acoustic centre distance to seg.t	:	260m	200	70	50	100
■ Correction for distance	:	-56 dB	-54	-45	-42	-48
■ Downwind correction, N	:	+2 dB	+2	+1	0	0
■ Barrier or soft ground	:	B7,5m	grd	fence	grd	grd
■ Barrier or soft ground effect	:	-10 dB	-4	-8	-1	-3
■ Segment length	:	200m	30	130	30	130
■ On-time per segment	:	40sec	20	30	20	30
■ Correction for on-time per hour	:	-20 dB	-23	-21	-23	-21
■ Correction for 4-off movements per hour, average	:	+6 dB	+6	+6	+6	+6
■ Air absorption	:	ignore				
■ L _{Aeq,1hr,free-field} , Lorries (47dB)	:	27 dB	32	38	45	39

5. Combined Activity

■ Bulldozer, Tippers, Plant	:	48dB
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6. Assessment

■ Notional limit for Routine Workings, L _{Aeq,1hr,free-field}	:	48dB
■ Is limit expected to be met?	:	Yes
■ Conclude	:	Compliant

Calc Sheet 17. Jan 2018
Chestnut Farm
Crushing & Screening

1. Crushing & Screening plant

■ L _{WA'} , on 100% time	:	115 dB
■ Distance, typically	:	480m
■ Correction for distance	:	-62 dB
■ Soft ground	:	n/a
■ Barrier	:	B5,9
■ Barrier effect**	:	-13 dB
■ Air absorption	:	n/a
■ Downwind correction	:	+2 dB
■ Assumed on 100% of time per hour	:	0dB
■ L _{Aeq,1hr} free-field, plant	:	42 dB

**Notes
B5, 6m tall@50m=12dB
B7, 5m tall@230m=10dB
Ab, combine B5&B7=13dB
Plant Hs=2.5m
Hreceptor=1.5m