Acute Acoustics Ltd
8 Bayliss Close
Quorn, Loughborough
LE12 8PF
01509 550 335
info@acuteacoustics.co.uk

NOISE ASSESSMENT REPORT

A. R. Aggregates Urban Quarry, 92 Syston Street East
Leicester, LE1 2JW

Client: A. R. Aggregates Ltd.

Report by
P M Dyson BSc Dip Acoustics MIOA

Acute Acoustics Ltd.

Report Date: 19th March 2019
Ref: 2335 Leicester – A R Aggregates NIA [Rev A]
Site Visited by: Peter Dyson
Site Visit: 5 February 2019

CONTENTS

1.0 INTRODUCTION

A. R. Aggregates Ltd (ARAL) instructed Acute Acoustics Ltd (AAL) to undertake a noise assessment to consider the impact of an aggregates recycling facility at A. R. Aggregates Urban Quarry, 92 Syston Street East, Leicester, LE1 2JW. This is to support an application for an increase of tonnage from 75,000 to 150,000 tonnes per annum.

This report considers relevant assessment criteria, measurements made on site and makes predictions of noise levels at nearby dwellings using machine usage data from the client. Acoustic terminology is explained at Appendix 1; Acute Acoustics qualifications at Appendix 2, references at Appendix 3, Detailed Measurement results at Appendix 4, calculations at Appendix 5, plan of the site at Appendix 6 and aerial view showing the site and receptors considered in the assessment at Appendix 7.

2.0 ASSESSMENT CRITERIA

2.1 BS4142

BS.4142:2014 “Methods for Rating and Assessing Industrial and Commercial Sound” describes a method for assessing the impact of sound produced on industrial and commercial premises.

The Standard requires that the ambient noise (total noise including the “problem” noise) is measured in terms of the equivalent continuous sound level LAeq [see Appendix 1 for acoustic terms], which is then corrected for the residual noise (total noise excluding the “problem” noise) also measured as an LAeq, to give the specific noise (from the “problem” noise alone).

A correction for character is made if the noise contains a distinguishable discrete, continuous note [whine, hiss, screech, hum etc.]. If appropriate an addition of up to 6 dB can be made to the specific noise.

Similarly if there are distinct impulses in the noise [bangs, clicks, clatters, or thumps], a further correction of 3, 6 or 9dB can be made as appropriate.

If the noise is neither tonal nor impulsive but is otherwise readily distinctive in comparison with the residual acoustic environmental a correction of 3dB can be made.

Finally if the noise is irregular enough to attract attention another correction of 3dB can be made. The final figure, including any character corrections is known as the Rating level.

This Rating Level is then compared with the measured background [LA90] level.

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3.0 SITE DESCRIPTION & OPERATIONS

The site of the facility is situated to the east of Syston Street East amongst a number of other industrial use sites.

- A. E. Burgess & Sons operates an aggregate and other materials waste recycling and skip hire business adjacent to the facility.
- F G S Ingredients Ltd, catering food and drink supplier is situated to the north of the site.
- Travis Perkins Leicester Timber is situated further to the north of the site.
- Dhamecha Cash and carry is situated to the north west of the site.
- Thimbles Fabrics & Craft Ltd is situated further to the north west of the site.
- D K Transport is a trucking company situated to the west of the site.
- Shoezone occupies the site to the south.

The mainline railway runs to the east of the site and carries frequent passenger trains with some freight traffic.

There are a number of industrial units on the opposite side of the railway line including:

- Attock Metal and LPG scrap yard.

It is understood that ARAL has operated at this site for some 9 years carrying out the processing of aggregate waste.

The site consists of a processing area where a MC Kleemann Mobicat MC110Z Crusher and Sanviq QA450 are situated; reception area where incoming waste is delivered to; bays of processed materials and office building adjacent to the weighbridge. Materials handling is carried out using a Hyundai R220LC 360 loader and Volvo L110F front shovel loader. There are no plans for additional heavy plant to be added.

The site layout plan, included at Appendix 6 shows the position of bays for processed materials, position of concrete pad where the crusher is situated, screener, office building and weighbridge.

The boundary treatments between the site and surrounding sites to the west and east are 5m high earth bunds and 4m high concrete fences respectively.

3.1 Hours of Operation

It is understood that heavy plant is operated from 07:00-16:00 although site opening hours for delivery/collection of aggregates is 07:30-18:00 Monday to Friday and 07:30-13:00 on Saturdays.

3.2 Nearest Noise Sensitive Receptors

The nearest noise sensitive premises are all completely hidden from view of the site by a combination of the earth bunds or 4m high concrete fences boundary treatments together with railway embankment and numerous industrial units between.

Receptor 1 - dwellings to the west of the site at 293-325 Kashmir Road at a distance of some 380m from the nominal centre of the processing area.

Receptor 2 – dwellings to the south east of the site on Sandpiper Close at a distance of some 275m from the nominal centre of the processing area.

Receptor 3 – dwellings to the north west of the site on Constable Avenue at a distance of some 500m from the nominal centre of the processing area.

Receptor 4 – dwellings to the south east of the site on the opposite side of the railway embankment on Pembroke Street at a distance of some 105m from the nominal centre of the processing area.

4.0 SOURCE NOISE

4.1 Source Noise Measurements

The site was visited on 5th February 2019 when the site was carrying out aggregate processing operations and noise measurements were made of the crusher operating whilst being fed by the 360 and screener operating whilst being fed by the front shovel loader.

The sound level meter was a Svan 949 (s/n 8520), mounted on a tripod at a height of 1.2m and fitted with a wind muff. The meter calibrated correctly before and after the measurements using a Castle calibrator type GA607 (s/n 039893). The meter and calibrator had been laboratory calibrated within the preceding 2 years.

The weather conditions during the monitoring period were overcast and dry with temperatures of 6-7 degrees Celsius; wind speeds were low, 0-1 Beaufort scale and were checked with a Kestrel 2000 hand held anemometer (s/n 2080552) to check that wind speed did not exceed 5m/s at the microphone position.

(Weather information was from observations made at the time of the site visit.)

4.2 Source Noise Results

The main results obtained in dB are shown below in Figure 1 and the frequency analysis results are show at Appendix 4/dBLin.

Source Description	Duration,T	LAeq,T	LAmax[F]
Crusher idling @10m	00:04:04	80.5	82.5
Crusher operating @10m	00:05:02	82.9	92.1
Screener operating @10m	00:05:15	85.3	90
Site operating as measured at weighbridge	00:05:30	67.9	76.4
Shovel loader fills Transit Flatbed truck	00:01:07	75.1	87.6

Figure 1: Results of Source Noise Measurements/dB

Graph 1 at Appendix 4 shows that noise from the crusher and screener did not have any strongly tonal content.

4.3 HGV Noise Levels

Noise levels previously measured by AAL at other aggregate and IBA waste recycling sites are shown below in Figure 2/dB. The frequency analysis results are shown at Appendix 4/dBLin.

Operation/Equipment	Duration,T	LAeq,T	LAmax[S]
44 ton artic tipper delivers load @5m (1)	00:04:58	79.8	96.1
44 ton artic tipper delivers load @5m (2)	00:04:40	82.4	94.5
Tipper truck loaded by Volvo Loader@5m	00:04:29	75.8	84.3
Komatsu WA470 Front End Loading Shovel @7m	00:02:02	76.6	86.5
Komatsu WA320 P2 Front End Loading Shovel @7m	00:02:02	76.5	82.3
8 Wheeler being loaded by WA470 @5m	00:01:38	77.3	91.2
Volvo L110 Front Loader@10m manoevering and moving rubble	00:01:40	74.4	82
Scania P420 Start and Drive off @4m	00:00'40	70.3	80.7
Scania P420 Drive up @4m	00:00'37	66	74.1
Komatsu 360 loader moving aggregate waste @7m	00:01:36	77.4	83.3

Figure 2: Results of HGV Noise Measurements/dB

4.4 Heavy Plant Usage & HGV Movements

It is understood that the crusher is typically used for 2.5-3 days per week and the screener for ≈1.5 days per week and are loaded by the 360 and front shovel loader.

Vehicle movement data for waste materials delivered to site and processed product leaving site has been supplied by ARAL for a typical day's operations.

Waste In

There are on average 27 HGV tipper truck movements delivering approximately 400 tonnes of waste materials which equates to 3 movements per hour (to the nearest whole number) carrying an average of 15 tonnes of waste material.

Materials Out

There are on average 22 HGV truck movements dispatching 400 tonnes of processed materials which equates to just under 3 movements per hour (to the nearest whole number) carrying an average of 18 tonnes of processed materials.

HGV Movements for 150,000 Tonnes

A maximum permitted limit of 150,000 tonnes equates to 545 tonnes per day (150,000/(50 weeks a year x 5.5 days per week)) which equates to 36 HGV deliveries per day or **4** deliveries per hour (rounded up to the nearest whole number) and 30 HGV dispatches or **3** dispatches per hour (rounded up to the nearest whole number).

4.5 Heavy Plant and HGV 'On Times'

Using the movement data from above with durations of vehicle movements from Figure 2 above, the hourly 'On Times' for HGV and heavy plant movements have been calculated. The number of movements calculated for 150,000 tonnes have been used.

A 1 hour period containing 100% 'On Time' for both the crusher and screener (which includes the 360 and front shovel loading waste materials) together with additional 50% usage of the 360 and front loader (to cover periods when they are loading HGVs) and typical HGV

deliveries and dispatches has been considered in the following analysis.

A dispatch movement comprises a drive up, load and drive off.

4 x Delivery HGVs: 4m40s per vehicle = 1120s/hr = 31.1% 'On Time'.
3 x Empty HGVs Drive up: 37s per vehicle = 111s/hr = 4.1% 'On Time'.
3 x Loading operation: 1m38s per vehicle = 294/hr = 10.9% 'On Time'.
3 x Loaded HGVs drive off: 40s per vehicle = 120s/hour = 4.4% 'On Time'
1 x 360 loader = 50% 'On Time' (in addition to loading screener).
1 x Front loader = 50% 'On Time' (in addition to loading crusher).
1 x Crusher = 100% 'On Time'
1 x Screener = 100% 'On Time'

5.0 RECEPTOR NOISE MEASUREMENTS

At the time of the site visit, noise measurements were made at each of the four receptors while the site was operating normally. The main results are shown below in Figure 3/dB. The frequency analysis results are shown at Appendix 4/dBLin.

Receptor	Duration,T	LAeq,T	LA1	LA10	LA90	LAmax[F]
1	00:15:00	57.8	64.4	58.6	52.9	79.4
2	00:15:00	65	73.7	66	58.2	87.3
3	00:15:00	58	64.4	60.4	54	66.8
4	00:15:00	57.1	67.4	60.3	49.8	77.4

Figure 3: Receptor Noise Measurement Main Results/dB

Graph 2 at Appendix 4 shows that ambient noise at the four receptor positions contained no strongly tonal content.

5.1 Subjective Assessments

It was noted at the time of the site visit that constant road traffic noise was clearly the dominant source at Receptors 1, 2 & 3. Road noise was more distant but still the dominant constant noise source at Receptor 4 together with railway noise and some birdsong.

There was the occasional metallic impact noise but this is considered to have emanated from the Attock Metal scrap yard nearby as no metal recycling is undertaken at the ARAL site. Tonal reversing alarms were occasionally just audible but it was not possible to pin point the location as there are so many industrial units in the area.

No noise that could be attributed to the site was noticed at any of the receptor positions. No tonal content was noticed at any of the receptors which agrees with Graph 2 at Appendix 4.

6.0 CALCULATION OF RECEPTOR NOISE LEVELS

6.1 Barrier Attenuation

As stated above, there are earth bunds and concrete fences along sections of the boundary. In addition, there is a railway embankment some 6m high to the east of the site and many industrial units situated between the site and nearby noise sensitive dwellings.

Appendix 5 shows calculations of earth bund and concrete fence barrier attenuation using the Maekawa method with the frequency analysis results of the sum of the crusher and screener noise levels.

Calculations have been carried out for the barrier attenuation at 1.5m receptor height and show levels of 12dB attenuation at receptors 1 & 2, 9dB at receptor 3 and 13dB attenuation at Receptor 4.

10dB further attenuation has been added for additional buildings, railway embankment etc. between the site and receptors.

The calculated noise levels are shown below in Figure 3/dB.

Receptor	SPL/dBA
1	34
2	40
3	32
4	44

Figure 3: Predicted Receptor Noise Levels/dB

These noise levels can be used as Specific Sound Levels for BS4142 assessment using the LA90 levels shown in Figure 3 above.

7.0 BS4142 ASSESSMENT

7.1 Receptor 1

Specific Sound Level = 34dBA

Tonal Noise Correction = 0dBA

Impulsive Character Correction = 0dB

Other Sound Characteristics (assumed to be noticeable) = 3dB

Intermittency Correction = 0dB

Rating Level = 37dB

Background Noise Level = 53dB

Rating Level, 37dB – Background Level, 53dB = -16dB

A BS4142 assessment is an indication of **a low impact** depending on context.

7.2 Receptor 2

Specific Sound Level = 40dBA

Tonal Noise Correction = 0dB

Impulsive Character Correction = 0dB

Other Sound Characteristics (assumed to be noticeable) = 3dB

Intermittency Correction = 0dB

Rating Level = 43dB

Background Noise Level = 58dB

Rating Level, 43dB – Background Level, 58dB = -15dB

A BS4142 assessment is an indication of **a low impact** depending on context.

7.3 Receptor 3

Specific Sound Level = 32dBA

Tonal Noise Correction = 0dB

Impulsive Character Correction = 0dB

Other Sound Characteristics (assumed to be noticeable) = 3dB

Intermittency Correction = 0dB

Rating Level = 35dB

Background Noise Level = 54dB

Rating Level, 35dB – Background Level, 54dB = -19dB

A BS4142 assessment is an indication of **a low impact** depending on context.

7.4 Receptor 4

Specific Sound Level = 44dBA

Tonal Noise Correction = 0dB

Impulsive Character Correction = 0dB

Other Sound Characteristics (assumed to be noticeable) = 3dB

Intermittency Correction = 0dB

Rating Level = 47dB

Background Noise Level = 50dB

Rating Level, 47dB – Background Level, 50dB = -3dB

A BS4142 assessment is an indication of **a low impact** depending on context.

These BS4142 assessments support the subjective assessment that noise from the site was inaudible at the receptor positions as other environmental noise sources, specifically road traffic, completely masked noise from the ARAL site.

8.0 UNCERTAINTIES

8.1 In order to reduce uncertainties:

- Noise monitoring was carried out following procedures within

BS7445-1 when meteorological conditions were favourable.

- Noise levels of site activity were measured when typical operations were being undertaken.
- Calculations of noise impact have used machine usage for the maximum proposed permitted tonnage rather than existing levels of usage for worst case consideration.

9.0 DISCUSSION & RECOMMENDATIONS

9.1 Context

The latest version of BS4142 places a degree of importance on context and how the noise impact compares to the pre-existing noise climate. A new or unfamiliar noise source introduced to an environment may be perceived by receptors as being louder or more annoying that a noise source similar to existing environmental noises.

In this instance, the site has operated for some 9 years with no known noise complaints; there are other long established recycling sites in the vicinity carrying out similar operations and producing noise of a similar nature and so the noise impact from the site is within the industrial noise context of the area and considered to be lower than a noise different in content than the existing climate.

It could be argued that the 3dB character correction added for being noticeable is not required as the site noise is within the context of the area thus the BS4142 assessments would all be 3dB lower.

9.2 Discussion

The assessment conducted shows that noise associated with the site close to the noise sensitive receptors is considered to be acceptable and unlikely to cause complaints.

It should be noted that any significant increase in heavy plant usage or changes to machinery operated may lead to changes of noise impact to the nearby noise sensitive dwellings and other receptors. It may be necessary to re-evaluate the noise impact should any further changes be required.

9.3 Recommendations

- The earth bund and concrete fence should be regularly maintained to ensure no loss of acoustic performance.
- All heavy plant and other vehicles operating at the site should be fitted with white noise reversing alarms. Brigade Electronics Ltd supplies alarms that can be fitted to both new vehicles and retro fitted to

existing vehicles http://brigade-electronics.com/products/reversing-and-warning-alarms/.

- An onsite speed limit of 5mph should be instigated to control the speed of vehicles.
- All external areas of hard standing and roadway should be regularly maintained to be smooth and flat where possible to reduce vehicle suspension noise.
- On site signage should be installed to remind employees to keep noise levels as low as possible.

10.0 CONCLUSIONS

10.1 The noise impact of an aggregates recycling operation is presented above.

10.2 BS4142 assessments of the noise impact from the aggregates recycling operation is **a low impact**.

10.3 Based on the above assessment, it is considered that the noise impact is acceptable and minimal.

10.4 Should workloads increase significantly from those described above, it may be necessary to re-evaluate the impact.

APPENDIX 1

EXPLANATION OF ACOUSTIC TERMS

The dB or the decibel, is the unit of noise. The number of decibels or the level, is measured using a sound level meter. It is common for the sound level meter to filter or 'weight' the incoming sound so as to mimic the frequency response of the human ear. Such measurements are designated **dB(A)**.

A doubling of the sound is perceived, by most people, when the level has increased by 10 dB(A). The least discernible difference is 2 dB(A). Thus most people cannot distinguish between, say 30 and 31 dB(A).

If a noise varies over time then the **equivalent continuous level, or LAeq**, is the notional constant level of noise which would contain the same amount of acoustic energy as the time varying noise.

The following table gives an indication of the comparative loudness of various noises expressed in terms of the A weighted scale:

Table 7

Source of noise	dB(A)	Nature of Noise
Inside Quiet bedroom at night	30	Very Quiet
Quiet office	40	
Rural background noise	45	
Normal conversational level	60	
Busy restaurant	65	
Typewriter @ 1m	73	
Inside suburban electric train	76	
Alarm clock ringing @ .5m	80	
Hand clap @ 1m	80	
HGV accelerating @ 6m	92	Very Loud

APPENDIX 2

The measurements were carried out and the report prepared by Peter Dyson of Acute Acoustics Ltd. A consultancy company which specialises in Environmental and Workplace Noise.

Peter Dyson holds the Institute of Acoustics Diploma in Acoustics and Noise Control, a Bachelor's degree in Mechanical Engineering, The Institute of Acoustics Certificates of Competence in Environmental Noise Assessment and in Workplace Noise Measurement. He is a Member of the Institute of Acoustics.

Peter Dyson is also an ANC accredited Sound Insulation tester for Martec Environmental Consultants Ltd. which is a consultancy company which also specialises in Environmental and Workplace Noise.

Acute Acoustics Ltd is a member of the Association of Noise Consultants.

APPENDIX 3

REFERENCES

1 BS4142:2114 “Methods for Rating and Assessing Industrial and Commercial Sound”.

2 Acoustics & Noise Control, 2nd Edition. Smith, Peters & Owen – Pearson Longman.

3 Kingspan Acoustic Performance Guide - http://www.kingspanpanels.com/Resource_Centre/Literature/Download/Various-Issues/Acoustic-Performance-Guide.aspx

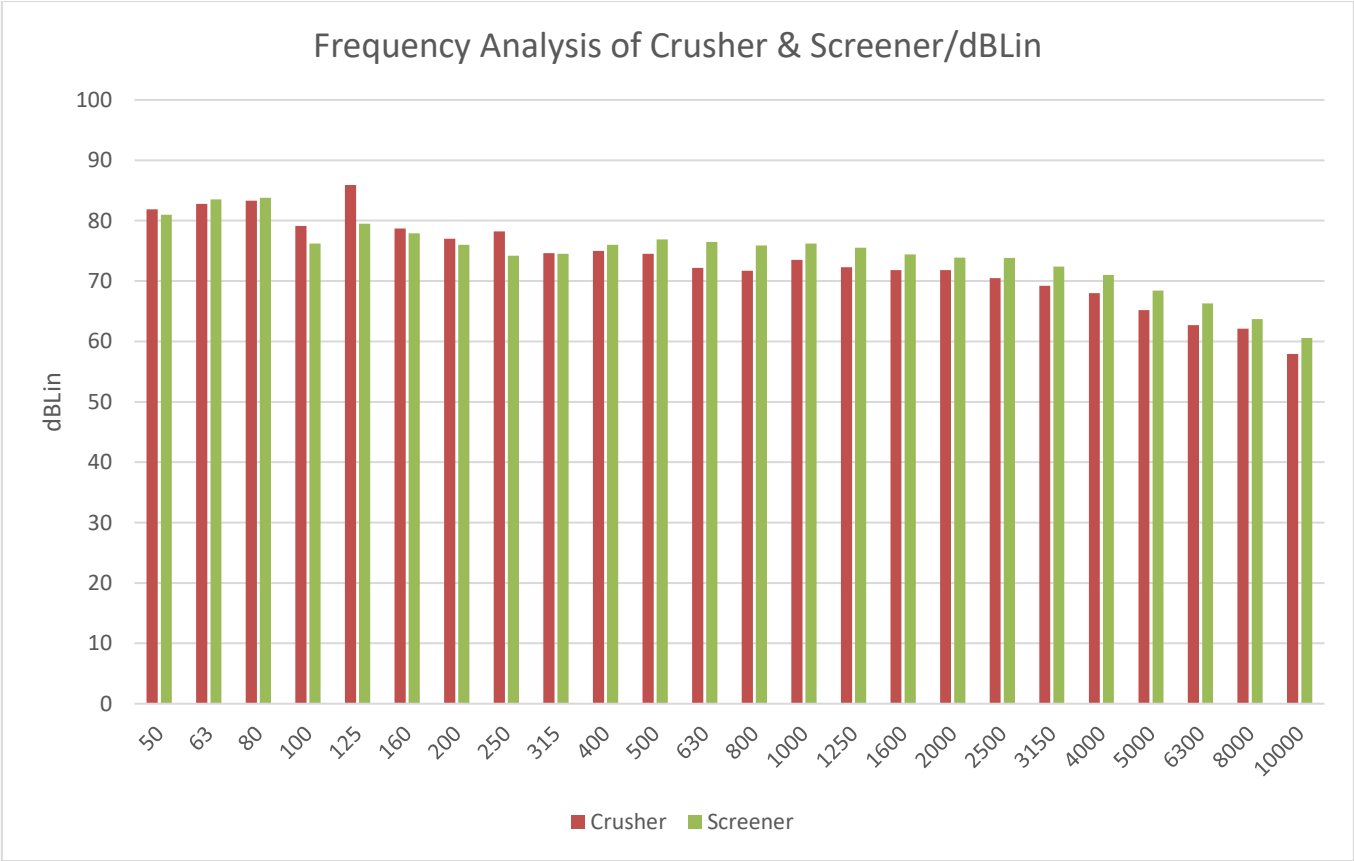
4 BS5228-1:2009 “Code of Practice for Noise and Vibration Control on Construction and Open Sites” – Part 1: Noise

5 Calculation of Road Traffic Noise (CRTN) – Department of Transport and the Welsh Office, HMSO,1988, ISBN 0-11-550847-3

APPENDIX 4

Frequency Analysis Results of Source Noise Measurements/dB

	Frequency/Hz																							
Source	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
Crusher idling	77.1	76.4	76.8	76.4	82.6	74	73.3	77.4	72.1	71.9	71.4	69.1	69.9	71	69.5	69.3	69.3	68.1	66.9	67	64.3	61.5	60.4	57.9
Crushr operating	81.9	82.8	83.3	79.1	85.9	78.7	77	78.2	74.6	75	74.5	72.2	71.7	73.5	72.3	71.8	71.8	70.5	69.2	68	65.2	62.7	62.1	57.9
Screenr operating	81	83.5	83.8	76.2	79.5	77.9	76	74.2	74.5	76	76.9	76.5	75.9	76.2	75.5	74.4	73.9	73.8	72.4	71	68.4	66.3	63.7	60.6
Site operating	76.4	79.8	78.3	74.9	69.9	65	63.3	63.9	61.3	58	58.5	57.8	57.3	57.5	56.8	56.1	55.4	54.3	52.7	50.8	47.7	44.7	40.9	35.2
FSL fills Transit	85.1	86.5	87.8	80.9	73.3	69.9	69.2	67.3	66.3	65.3	65.2	64.1	64.1	63.8	64.3	63.6	63.1	62.2	60.4	59.6	59.4	57.2	54	50



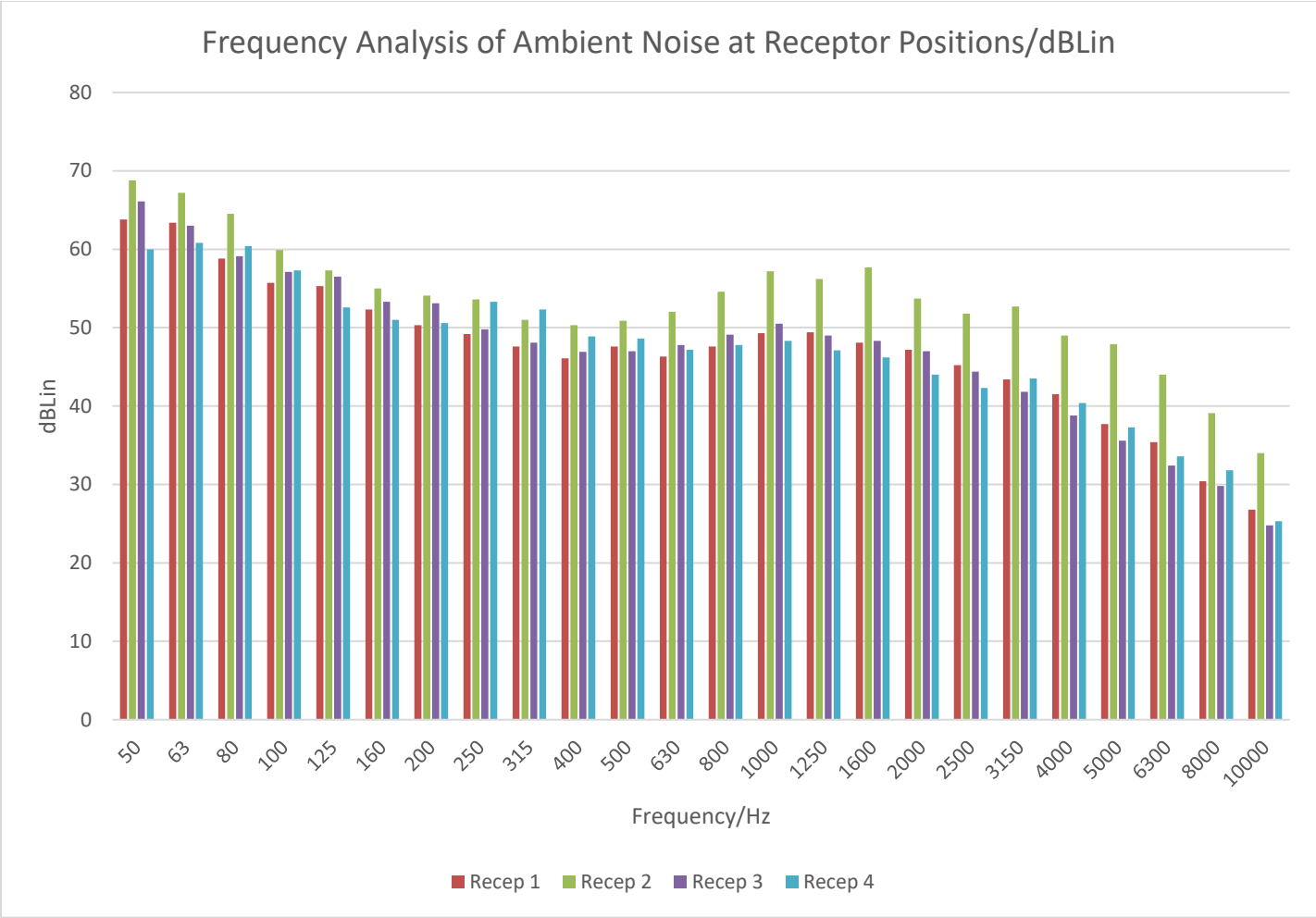
Graph 1: Frequency Analysis of Crusher & Screener/dBLin

Frequency Analysis Results of HGV Noise Measurements/dB

	Frequency/Hz							
Operation/Equipment	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
44 ton artic tipper delivers load @5m (1)	79.7	71.9	70.9	72.8	74.4	74.1	71.8	67.4
44 ton artic tipper delivers load @5m (2)	85.2	78	75.6	78.1	78.3	75.7	72.2	65.7
Tipper truck loaded by Volvo Loader@5m	94.8	81.1	73.2	69.4	69.5	69.1	63.7	58.7
Komatsu WA470 Front End Loading Shovel @7m	86	84.5	76	71.7	71.6	68.5	63.8	57.7
Komatsu WA320 P2 Front End Loading Shovel @7m	82.6	80	72.7	72.3	71.5	70.1	64.9	59.2
8 Wheeler being loaded by WA470 @5m	81.1	76.3	71.9	72.2	72.4	70.7	68.6	63.7
Volvo L110 Front Loader@10m manoevering and moving rubble	85.6	78.3	71.1	69.5	71.4	65.2	60.1	54.9
Scania P420 Start and Drive off @4m	77	72.3	70	68	64.8	63.1	57.2	49.8
Scania P420 Drive up @4m	73.9	66.3	63.6	62.8	60.2	59.6	54.2	48.9
Komatsu 360 loader moving aggregate waste @7m	77.6	78.8	77.3	74.9	71.6	70.5	64.5	59.1

Frequency Analysis of Noise Measured at Receptors/dBLin

	Frequency/Hz																						
Recep	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
1	63.8	63.4	58.8	55.7	55.3	52.3	50.3	49.2	47.6	46.1	47.6	46.3	47.6	49.3	49.4	48.1	47.2	45.2	43.4	41.5	37.7	35.4	30.4	26.8
2	68.8	67.2	64.5	59.9	57.3	55	54.1	53.6	51	50.3	50.9	52	54.6	57.2	56.2	57.7	53.7	51.8	52.7	49	47.9	44	39.1	34
3	66.1	63	59.1	57.1	56.5	53.3	53.1	49.8	48.1	46.9	47	47.8	49.1	50.5	49	48.3	47	44.4	41.8	38.8	35.6	32.4	29.8	24.8
4	60	60.8	60.4	57.3	52.6	51	50.6	53.3	52.3	48.9	48.6	47.2	47.8	48.3	47.1	46.2	44	42.3	43.5	40.4	37.3	33.6	31.8	25.3



Graph 2: Frequency Analysis of Ambient Noise at Receptor Positions/dBLin

APPENDIX 5

Receptors 1 & 3

Barrier Calculation – 5m Earth Bund

Heavy Plant Source Heights	2m
Ground Floor Receptor Height	1.5m
Barrier Height	5m
Crusher/Screener Source – Barrier	40m
Barrier to Receptor 1	240m
Barrier to Receptor 3	460m

Using Maekawa Method for Barrier Attenuation

Attenuation, Eb = 10LOG (3+40 δ/λ)dB where λ= wavelength, δ = path difference (a + b – c)

a + b = indirect path length
c = direct path length

Frequency/Hz	63	125	250	500	1000	2000	4000	8000
Source Level/dBLin	**90.6**	**88.7**	**83.8**	**83.2**	**82.3**	**80.7**	**77.4**	**70.7**

Octave Band Levels of Crusher + Screener Noise/dBLin

Receptor 1

Source Height	2	(SB) Relative Height	3	(SR) Relative Height	-0.5
Source - Barrier	40	a=	40.11234	c=	280.0004
Barrier Height	5	(BR) Relative Height	3.5	Path Diif =	0.137415
Receiver - Barrier	240	b=	240.0255		
Receiver Height	1.5	Source - Receiver	280		

Freq/Hz	Path Diff/m	Wavelength	Attenuation	Src Lev	Atten Lev
63	0.137	5.46031746	6.0	90.6	58.6
125		2.752	7.0	88.7	65.7
250		1.376	8.4	83.8	66.3
500		0.688	10.4	83.2	69.8
1000		0.344	12.8	82.3	69.5
2000		0.172	15.4	80.7	66.3
4000		0.086	18.3	77.4	60.1
8000		0.043	21.2	70.7	48.6
				87	**75**

Attenuation = 12dB

Receptor 3

Source Height	2	(SB) Relative Height	3	(SR) Relative Height	-0.5
Source - Barrier	40	a=	40.11234	c=	500.0002
Barrier Height	5	(BR) Relative Height	3.5	Path Diif =	0.125407
Receiver - Barrier	460	b=	460.0133		
Receiver Height	1.5	Source - Receiver	500		

Freq/Hz	Path Diff/m	Wavelength	Attenuation	Src Lev	Atten Lev
63	0.125	5.46031746	5.9	90.6	58.7
125		2.752	6.8	88.7	65.8
250		1.376	8.2	83.8	66.6
500		0.688	10.1	83.2	70.1
1000		0.344	12.5	82.3	69.9
2000		0.172	15.1	80.7	66.6
4000		0.086	17.9	77.4	60.5
8000		0.043	20.8	70.7	49.0
				87	**75**

Attenuation = 12dB

Receptors 2 & 4

Barrier Calculation – 4m Concrete Fence

Heavy Plant Source Heights	2m
Ground Floor Receptor Height	1.5m
Barrier Height	4m

Crusher/Screener Source – Embankment	70m
Barrier to Receptor 2	205m
Barrier to Receptor 4	35m

Receptor 2

Source Height	2	(SB) Relative Height	2	(SR) Relative Height	-0.5
Source - Barrier	70	a=	70.02857	c=	275.0005
Barrier Height	4	(BR) Relative Height	2.5	Path Diif =	0.043354
Receiver - Barrier	205	b=	205.0152		
Receiver Height	1.5	Source - Receiver	275		

Freq/Hz	Path Diff/m	**Wavelength**	**Attenuation**	**Src Lev**	**Atten Lev**
63	0.043	5.46031746	5.2	90.6	59.4
125		2.752	5.6	88.7	67.1
250		1.376	6.3	83.8	68.5
500		0.688	7.4	83.2	72.8
1000		0.344	9.1	82.3	73.3
2000		0.172	11.2	80.7	70.5
4000		0.086	13.6	77.4	64.7
8000		0.043	16.4	70.7	53.4
				87	**78**

Attenuation = 9dB

Receptor 4

Source Height	2	(SB) Relative Height	2	(SR) Relative Height	-0.5
Source - Barrier	70	a=	70.02857	c=	105.0012
Barrier Height	4	(BR) Relative Height	2.5	Path Diif =	0.116547
Receiver - Barrier	35	b=	35.08917		
Receiver Height	1.5	Source - Receiver	105		

Freq/Hz	Path Diff/m	**Wavelength**	**Attenuation**	**Src Lev**	**Atten Lev**
63	0.117	5.46031746	6.5	90.6	58.1
125		2.752	7.7	88.7	64.9
250		1.376	9.5	83.8	65.3
500		0.688	11.7	83.2	68.5
1000		0.344	14.2	82.3	68.1
2000		0.172	17.0	80.7	64.7
4000		0.086	19.8	77.4	58.5
8000		0.043	22.8	70.7	47.0
				87	**74**

Attenuation = 13dB

Calculation of Receptor Noise Levels/dB

Receptor 1										
Plant Item	**Measured SPL**	**Measuren**	**Dist to Recep/m**	**Dist Att**	**Mak Att**	**Att**	**Rec SPL**	**% On time**	**Correction**	**Activity**
Crusher	82.9	10	380	31.6	12	10	29.3	100	0.0	29.3
Screener	85.3	10	380	31.6	12	10	31.7	100	0.0	31.7
Delivery Lorry	82.4	5	380	37.6	12	10	22.8	31.1	-5.1	17.7
HGV Arrive	66	4	380	39.6	12	10	4.4	3.1	-15.1	-10.6
Loading HGV	75.8	5	380	37.6	12	10	16.2	8.2	-10.9	5.3
HGV Leaves	66	4	380	39.6	12	10	4.4	3.3	-14.8	-10.4
360 Loader	77.4	7	380	34.7	12	10	20.7	50	-3.0	17.7
Front Loader	74.4	10	380	31.6	12	10	20.8	50	-3.0	17.8
									Total	**34**

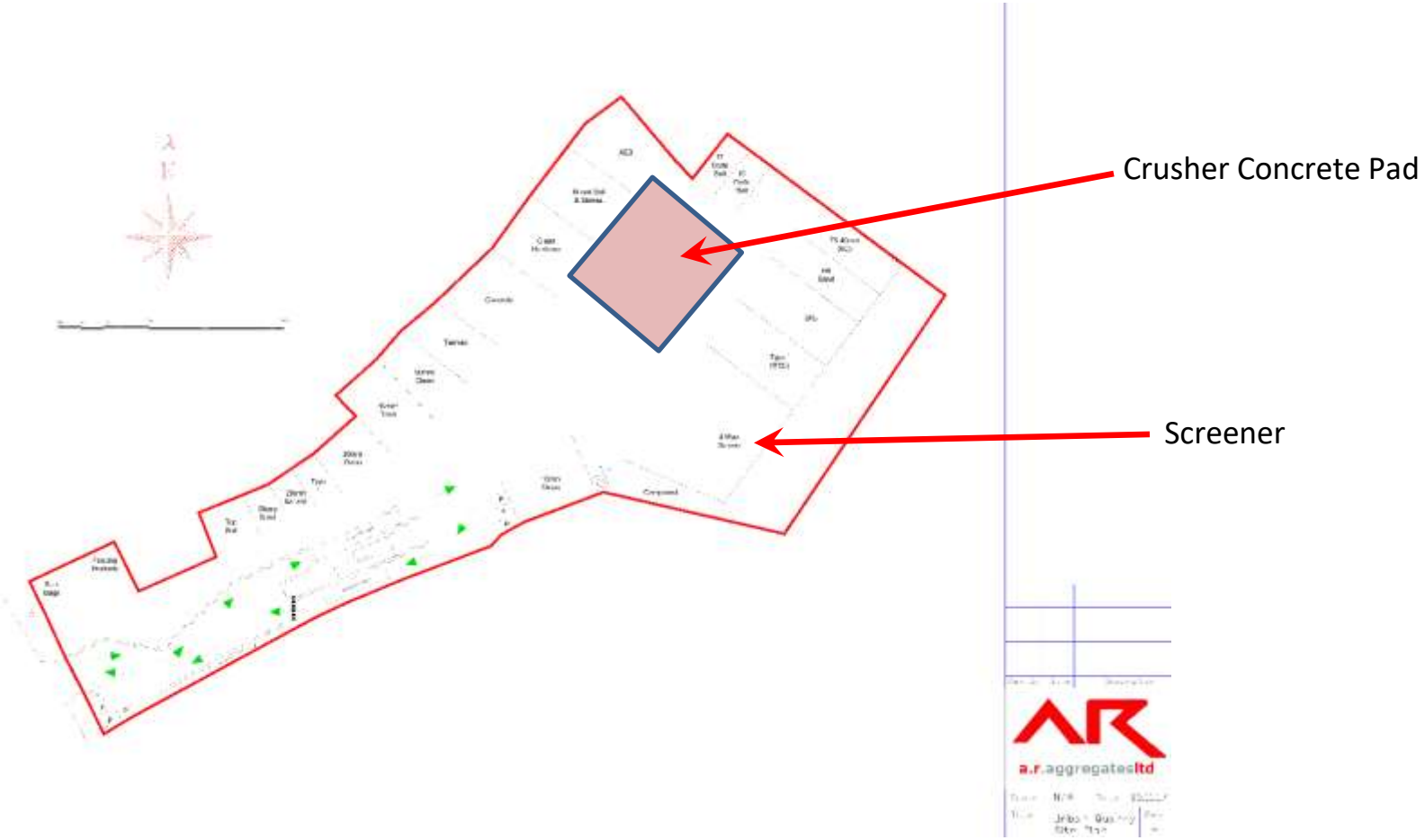
Receptor 2										
Plant Item	**Measured SPL**	**Measuren**	**Dist to Recep/m**	**Dist Att**	**Mak Att**	**Att**	**Rec SPL**	**% On time**	**Correction**	**Activity**
Crusher	82.9	10	275	28.8	9	10	35.1	100	0.0	35.1
Screener	85.3	10	275	28.8	9	10	37.5	100	0.0	37.5
Delivery Lorry	82.4	5	275	34.8	9	10	28.6	31.1	-5.1	23.5
HGV Arrive	66	4	275	36.7	9	10	10.3	3.1	-15.1	-4.8
Loading HGV	75.8	5	275	34.8	9	10	22.0	8.2	-10.9	11.1
HGV Leaves	66	4	275	36.7	9	10	10.3	3.3	-14.8	-4.6
360 Loader	77.4	7	275	31.9	9	10	26.5	50	-3.0	23.5
Front Loader	74.4	10	275	28.8	9	10	26.6	50	-3.0	23.6
									Total	**40**

Receptor 3										
Plant Item	**Measured SPL**	**Measuren**	**Dist to Recep/m**	**Dist Att**	**Mak Att**	**Att**	**Rec SPL**	**% On time**	**Correction**	**Activity**
Crusher	82.9	10	500	34.0	12	10	26.9	100	0.0	26.9
Screener	85.3	10	500	34.0	12	10	29.3	100	0.0	29.3
Delivery Lorry	82.4	5	500	40.0	12	10	20.4	31.1	-5.1	15.3
HGV Arrive	66	4	500	41.9	12	10	2.1	3.1	-15.1	-13.0
Loading HGV	75.8	5	500	40.0	12	10	13.8	8.2	-10.9	2.9
HGV Leaves	66	4	500	41.9	12	10	2.1	3.3	-14.8	-12.8
360 Loader	77.4	7	500	37.1	12	10	18.3	50	-3.0	15.3
Front Loader	74.4	10	500	34.0	12	10	18.4	50	-3.0	15.4
									Total	**32**

Receptor 4										
Plant Item	**Measured SPL**	**Measuren**	**Dist to Recep/m**	**Dist Att**	**Mak Att**	**Att**	**Rec SPL**	**% On time**	**Correction**	**Activity**
Crusher	82.9	10	105	20.4	13	10	39.5	100	0.0	39.5
Screener	85.3	10	105	20.4	13	10	41.9	100	0.0	41.9
Delivery Lorry	82.4	5	105	26.4	13	10	33.0	31.1	-5.1	27.9
HGV Arrive	66	4	105	28.4	13	10	14.6	3.1	-15.1	-0.5
Loading HGV	75.8	5	105	26.4	13	10	26.4	8.2	-10.9	15.5
HGV Leaves	66	4	105	28.4	13	10	14.6	3.3	-14.8	-0.2
360 Loader	77.4	7	105	23.5	13	10	30.9	50	-3.0	27.9
Front Loader	74.4	10	105	20.4	13	10	31.0	50	-3.0	28.0
									Total	**44**

APPENDIX 6

Site Layout



APPENDIX 7

Location Plan showing Site & nearby Receptors