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Environmental Noise Assessment

Walyunga Road Clay Pit, Bullsbrook

Reference: 16073667-01b.docx

Prepared for:

BGC Brikmakers



Member Firm of Association of Australian Acoustical Consultants

Report: 16073667-01b.docx

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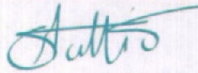
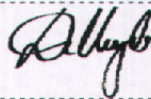
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Table of Contents

1	INTRODUCTION	1
2	CRITERIA	3
3	METHODOLOGY	7
3.1	Meteorological Information	7
3.2	Topographical Data	7
3.3	Ground Absorption	8
3.4	Source Sound Levels	8
4	RESULTS	9
4.1	Sand Extraction, Loading and Transportation	10
4.2	Existing Stockpiles Relocation	11
4.3	Clay Transportation	11
4.4	New Pit Extraction and Process Plant	12
5	DISCUSSION	13

List of Tables

Table 2-1	Adjustments Where Characteristics Cannot Be Removed	3
Table 2-2	Baseline Assigned Noise Levels	4
Table 2-3	Influencing Factor Calculation	4
Table 2-4	Assigned Noise Levels - Residences East of GNH	5
Table 2-5	Assigned Noise Levels - Residences West of GNH	5
Table 3-1	Modelling Meteorological Conditions	7
Table 3-2	Source Sound Power Levels	8
Table 4-1	Predicted Noise Levels from Existing Operations	9
Table 4-2	Predicted Noise Levels - Sand Extraction in New Stockpile Area	11
Table 4-3	Predicted Noise Levels - Clay Stockpiles Removal	11

Table 4-4 Predicted Noise Levels - Clay Extraction and Process Plant	12
Table 4-5 Predicted Noise Levels - Clay Extraction and Process Plant to South East	13

List of Figures

Figure 1-1 Project Locality And Receivers (Circled)	2
Figure 4-1 Truck Pass By Noise Predictions	10
Figure 4-2 Process and Clay Extraction in SE Corner Combined Noise Levels	14
Figure 4-3 Process and Clay Extraction in SW Corner Combined Noise Levels	15
Figure 4-4 Process and Clay Extraction in NE Corner Combined Noise Levels	16
Figure 4-5 Process and Clay Extraction in NW Corner Combined Noise Levels	17
Figure 4-6 Process Plant Relocation and Mitigated Noise Levels	18

Appendices

A	Proposed Site Layout
B	Terminology

1 INTRODUCTION

An expansion of clay extraction is proposed on the eastern part of Lot 5 (plan P7892), Walyunga Road, Bullsbrook (refer *Figure 1-1*). It is noted the site is already established with existing operations occurring on western side of the Lot.

This report has been prepared to predict the likely noise impacts from the expanded operations to the nearest noise-sensitive premises and compare the results against the *Environmental Protection (Noise) Regulations 1997*.

The site is adjacent the Walyunga National Park, approximately 7kms south of Bullsbrook and is bounded by Walyunga Road to the south, Great Northern Highway to the west, the national park to the east and rural/residential lots to the north. Noise-sensitive receivers were identified around the project site as follows (distances are with reference to the closest extraction area boundary):

- 1950 Great Northern Highway - located approximately 660 metres to the north east;
- 1992 Great Northern Highway - located approximately 610 metres to the north;
- 1913 Great Northern Highway - located approximately 660 metres to the west;
- 1849 Great Northern Highway - located approximately 855 metres to the south west; and,
- 151 Walyunga Road - located approximately 780 metres to the south east.

It is also noted that a caretaker residence is located on site, due south of the new pit and noise emissions from the site were also assessed at this location.

The site will be developed in stages as follows:

- Sand extraction and loading in the new stockpile area just south east of the expanded pit;
- Existing clay stockpiles in the new pit area to be moved to new stockpile area;
- Clay extraction in new pit, starting south and moving northward; and,
- Crushing and screening may also be undertaken with the process plant located within the new stockpile area and surrounded by the clay stockpiles.

The proposed hours of operations are as follows:

- Mining and processing, 7am to 6pm Monday to Saturday; and,
- Loading of clay, 6am to 6pm Monday to Saturday.

A site layout is shown in *Appendix A*.

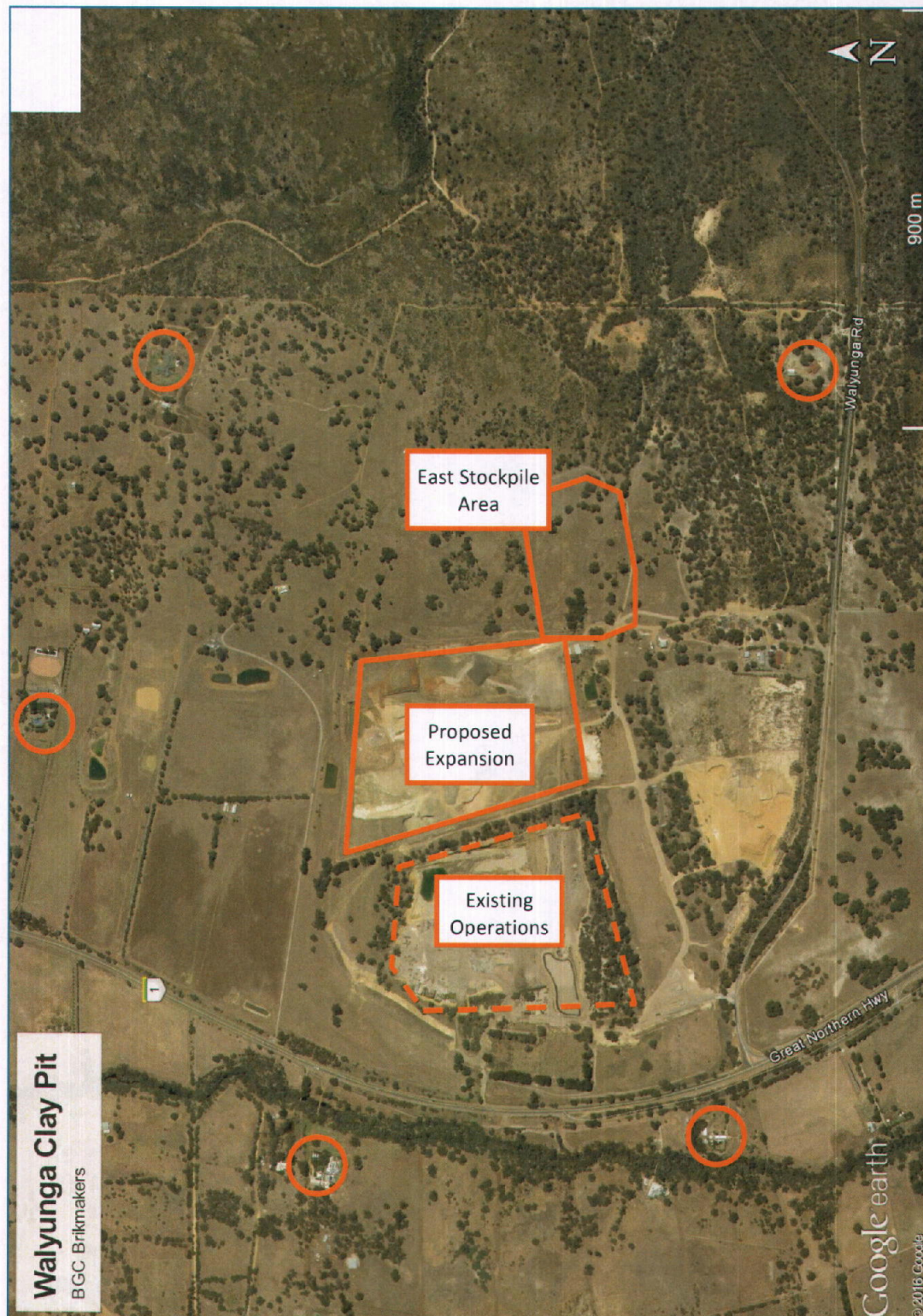


Figure 1-1 Project Locality And Receivers (Circled)

Appendix B presents a description of some of the terminology used throughout this report.

2 CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (1) Noise emitted from any premises or public place when received at other premises –

- (a) Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and
- (b) Must be free of –
 - i. tonality;
 - ii. impulsiveness; and
 - iii. modulation,
 when assessed under regulation 9"

A "...noise emission is taken to significantly contribute to a level of noise if the noise emission ... exceeds a value which is 5 dB below the assigned level..."

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

- (a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and
- (b) The noise emission complies with the standard prescribed under regulation 7 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Caretaker residence associated with Industrial Premises	All hours	65	80	90

1. *highly sensitive area* means that area (if any) of noise sensitive premises comprising —
- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - (b) any other part of the premises within 15 metres of that building or that part of the building.

An influencing factor of 0 dB has been calculated for the noise sensitive premises due north and east of Great Northern Highway. For the residences west of the highway, the influencing factor has been calculated as 2 dB on the basis Great Northern Highway (GNH) is considered a major road (> 15,000 vehicles per day) within 450 metres of the residences. This is summarised on Table 2-3.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0 dB
Commercial Land	0 %	0 %	0 dB
Transport Factor			0 to 2 dB
Total			0 to 2 dB

Tables 2-4 and 2-5 show the assigned noise levels including the influencing factor and transport factor at the receiving locations.

Table 2-4 Assigned Noise Levels - Residences East of GNH

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
1950 Great Northern Highway 151 Walyuna Road Highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45	55	65
	0900 to 1900 hours Sunday and public holidays (Sunday)	40	50	65
	1900 to 2200 hours all days (Evening)	40	50	55
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35	45	55
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

1. **highly sensitive area** means that area (if any) of noise sensitive premises comprising —
- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - (b) any other part of the premises within 15 metres of that building or that part of the building.

Table 2-5 Assigned Noise Levels - Residences West of GNH

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
1849, 1913 and 1992 Great Northern Highway Highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	47	57	67
	0900 to 1900 hours Sunday and public holidays (Sunday)	42	52	67
	1900 to 2200 hours all days (Evening)	42	52	57
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	37	47	57
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

2. **highly sensitive area** means that area (if any) of noise sensitive premises comprising —
- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - (b) any other part of the premises within 15 metres of that building or that part of the building.

It is noted the assigned noise levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as a period of time of not less than 15 minutes, and not exceeding 4 hours, which is determined by an

inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission. An *inspector or authorised person* is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Environment Regulation. Acoustic consultants or other environmental consultants are not appointed as an *inspector or authorised person*. Therefore, whilst this assessment is based on a 4 hours RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

It is further noted that under regulation 3, certain types of noise emission do not have to comply with the Regulations. In the case of this assessment these are:

(a) noise emissions from the propulsion and braking systems of motor vehicles operating on a road;

(g) noise emissions –

- a. from a device for warning pedestrians installed at a pedestrian crossing on a road; or
- b. from a device for warning of the passage of a train installed at a level crossing; or
- c. from a safety warning device fitted to a building as a requirement of the Building Code as defined in the *Building Regulations 2012* regulation 3; or
- d. for the purpose of giving a warning required under the *Mines Safety and Inspection Regulations 1995* regulation 8.26,

if every reasonable and practicable measure has been taken to reduce the effect of the noise emission consistent with providing an audible warning to people;

(h) noise emissions from –

- a. a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment; or
 - b. a startup or movement alarm fitted to plant,
- if
- c. it is a requirement under another written law that such an alarm be fitted; and
 - d. it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these Regulations;

It is considered that reversing alarms fitted to commercial vehicles and mobile plant e.g. HV trucks or loaders, are not exempt under the Regulations since they are not specifically required under another written law. The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers.

If deemed to be required, an alternative reversing alarm type should be considered. Such alternative, which can more readily comply with the Regulations, include alarms emitting a broadband signal in-lieu of a tonal 'beep'.

3 METHODOLOGY

Computer modelling has been used to predict the noise impacts at various receivers. The advantage of modelling is that it is not affected by background noise sources and can provide the noise level for various weather conditions and operating scenarios if necessary.

The software used was *SoundPLAN 7.4* with the CONCAWE algorithms selected. These algorithms have been selected as they include the influence of wind and atmospheric stability. Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1 Meteorological Information

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1 Modelling Meteorological Conditions

Parameter	Day (0700-1900)	Night (1900-0700)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	4	3
Wind Direction*	All	All
Pasquil Stability Factor	E	F

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.2 Topographical Data

Topographical data was based on that provided by the client and publicly available e.g. *GoogleEarth*, with the existing and new pit contours data provided in 0.2 metre intervals.

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. sand). In this instance, a value of 1.0 has been used as an average across the study area.

3.4 Source Sound Levels

The sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2 Source Sound Power Levels

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	31.5	63	125	250	500	1k	2k	4k	
Sand Extraction, Loading and Transport and Existing Stockpiles Relocation									
Komatsu WA500 Wheel Loader	109	122	107	108	104	106	102	96	110
HV Truck moving at 25 km/h, L _{max}	113	108	103	99	97	97	94	91	101
New Pit Extraction									
Komatsu D375 Dozer	99	114	120	113	112	107	104	95	113
Komatsu D375 Dozer (with HushPak)	99	110	101	97	103	99	95	91	104
Volvo EC700CI Excavator	-	113	106	105	105	101	99	96	107
40t haul truck e.g. CAT 740	99	96	116	105	100	100	96	90	106
Process Plant									
Volvo EC460 Excavator	-	112	105	104	104	100	98	95	106
Komatsu WA470-6A Wheel Loader	110	109	110	107	105	102	97	91	107
Komatsu WA600-6 Wheel Loader	113	112	113	110	108	105	100	94	110
McCloskey Jaw Crusher	104	106	114	113	111	108	105	99	113
Terex Pegson Track Mounted Impact Crusher 428	-	105	105	105	105	105	105	105	112
Finlay 693 Supertrak and 883 Reclaimer/Screen	111	106	107	108	107	105	104	102	111
Edge Stacker (Radial)	111	112	110	110	105	109	106	95	113
Existing Operations (Western side)									
McCloskey Jaw Crusher, 2 off	104	106	114	113	111	108	105	99	113
Finlay Screen, 1 off	111	106	107	108	107	105	104	102	111

With regards to the above, please note the following:

- All sources were modelled as point sources two metres above local ground with the exception of the Finlay 693, 883 and Stacker which were modelled as line sources approximately 20 metres long, starting 1m above local ground and finishing 5m above local ground;
- Source levels are based on measurements of equipment specified or of similar size/capacity; and,
- All levels represent L_{10} noise levels with the exception of the HV truck which represents a L_{max} level used in predicting truck pass by noise.

4 RESULTS

The predicted noise levels for each main development stage are presented in the following sections, along with an assessment against the *Environmental Protection (Noise) Regulations 1997*. It is noted existing operations are, and will be, occurring on site during each of the proposed expansion stages. As no background noise monitoring was undertaken to determine ambient noise levels, noise from the existing operations were estimated at each receiver by means of noise modelling of the main pieces of plant, being the crushers and the screen. The results are presented in *Table 4-1*.

Table 4-1 Predicted Noise Levels from Existing Operations

Receiver	Predicted Noise Level dB L_{A10}	Comment
151 Walyunga Road	36	More than 5 dB below assigned noise levels
1849 Great Northern Highway	46	Noise from expansion not to significantly contribute to assigned level of 47 dB L_{A10}
1913 Great Northern Highway	44	Noise from expansion not to significantly contribute to assigned level of 47 dB L_{A10}
1950 Great Northern Highway	33	More than 5 dB below assigned noise levels
1992 Great Northern Highway	35	More than 5 dB below assigned noise levels
Caretaker Residence	43	More than 5 dB below assigned noise levels

It can be seen the receivers to the north east and south east are not likely to be affected by the noise emissions from the existing site and, therefore, the noise from the east expansion is to comply with the assigned noise levels at those receivers, that is 45 dB L_{A10} . At the receivers due west, the noise emissions from the expansion are to comply with a level that is 5 dB below the assigned levels, that is 42 dB L_{A10} .

4.1 Sand Extraction, Loading and Transportation

Sand extraction in new stockpile area to east will involve one Komatsu WA500 front end loader working behind a 3 metres high face and moving eastward.

In addition, the excavated sand will be transported off-site by HV trucks without being screened with the trucks entering and exiting the site from Walyunga Road. Despite the short distance travelled on site, trucks are expected to be driving on site for more than 10% of the time and noise levels from trucks pass by are to comply with the L_{10} assigned levels.

In determining the L_{A10} level from each truck movement, the noise level to the closest receivers were modelled assuming trucks access site at a rate of 7 trucks per hour, or 1 truck every 8.5 minutes, and a travel speed along the access road of 25 km/hr.

The above results in predicted HV truck noise to be 34 dB L_{A10} and 54 dB L_{A10} at the residence to the south east and the caretaker residence respectively and Figure 4-1 shows the predicted pass by noise at both receivers. These predicted noise levels from the trucks were then incorporated into the overall noise level predictions.

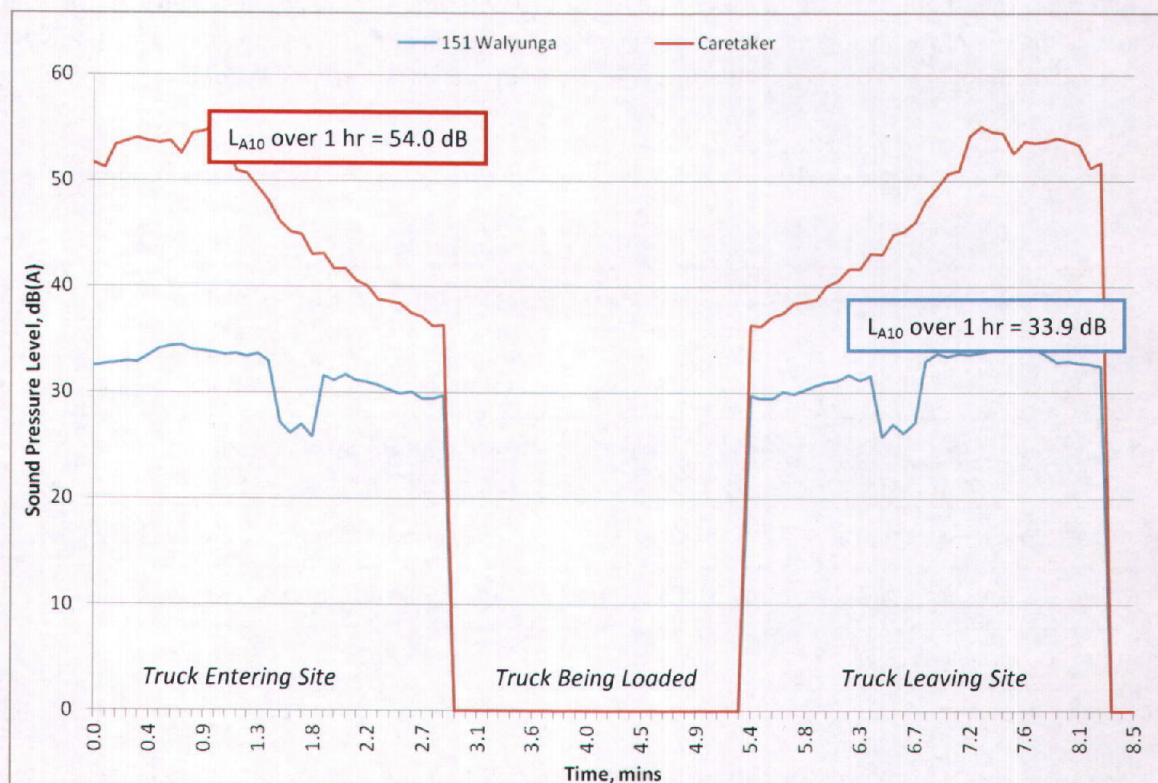


Figure 4-1 Truck Pass By Noise Predictions

With the sand extraction noise, a worst-case scenario will occur when the loader will be excavating at a location closest to the residence to the south east. Table 4-2 presents the predicted overall noise levels at each receiver i.e. sand extraction/loading and HV trucks, noting that at the caretaker residence the noise levels are dominated by the HV truck noise.

Table 4-2 Predicted Noise Levels - Sand Extraction in New Stockpile Area

Receiver	Predicted Noise Level dB L _{A10}	Assessment
151 Walyunga Road	40	Complies with the Regulations
1849 Great Northern Highway	32	Complies with the Regulations
1913 Great Northern Highway	31	Complies with the Regulations
1950 Great Northern Highway	34	Complies with the Regulations
1992 Great Northern Highway	32	Complies with the Regulations
Caretaker Residence	54	Complies with the Regulations

4.2 Existing Stockpiles Relocation

The existing stockpiles will be relocated using one Komatsu WA500 front end loader working in the new pit area. Noise levels at all receivers were predicted for various locations of the loader within the pit area and the highest predicted level at each receiver is presented in *Table 4-3*.

Table 4-3 Predicted Noise Levels - Clay Stockpiles Removal

Receiver	Predicted Noise Level dB L _{A10}	Assessment
151 Walyunga Road	38	Complies with the Regulations
1849 Great Northern Highway	35	Complies with the Regulations
1913 Great Northern Highway	38	Complies with the Regulations
1950 Great Northern Highway	38	Complies with the Regulations
1992 Great Northern Highway	39	Complies with the Regulations
Caretaker Residence	44	Complies with the Regulations

4.3 Clay Transportation

It is proposed to start hauling clay from 6am and therefore compliance with the night-time assigned noise levels is required. Such operation is similar to that of loading sand whereby truck enter/leave site at a rate of 7 trucks per hour and one WA500 loader will be used to load the trucks.

It is noted at this stage clay stockpiles at least 5 metres high will be present with the loader working from behind those stockpiles to load the trucks. Noise levels of 35 dB L_{A10} were predicted at the closest receiver 151 Walyunga Road and therefore no noise mitigations are required.

Should the noise emissions from trucks accessing the site be tonal when assessed at the closest receiver, the following additional control measures would be required:

- Noise bunds on the east side of the access road, from entry point to within stockpile area, 5 metres in height; and,
- A minimum stockpile height of 10 metres will be required for the loader to operate behind.

It is understood that truck movements associated with the existing operations on site are already occurring and therefore no significant change of impact is expected from the proposed clay haulage.

4.4 New Pit Extraction and Process Plant

The proposed clay extraction operations will run simultaneously with the process plant and therefore their combined noise levels were predicted. At the start of this stage, it was assumed the existing stockpiles are at least 5 metres high and arranged so that they are surrounding the process plant (refer *Figures 4-2 to 4-5*).

During processing materials flow will generally be: Excavator loading jaw crusher → Impact crusher → Screen → Stacker. However, it is possible for the Finlay 883 reclaimer/screen to also be operational at the same time.

Clay extraction will involve the D375 dozer and an excavator working in the new pit area behind a 5 metres high face and moving northward.

For the purposes of modelling, it has therefore been assumed that all the equipment above will be operating simultaneously. This, coinciding with worst-case wind conditions, is likely to be a rare occurrence and therefore the predictions are considered to be conservative. For instance, it is noted that from a dust management point of view, crushing is not undertaken during strong easterly winds, which will result in lower noise levels at the western receivers.

Noise levels at all receivers were predicted for various phases of extraction within the pit area e.g. south-east corner of pit, and the highest predicted combined noise level at each receiver is presented in *Table 4-4*.

Table 4-4 Predicted Noise Levels - Clay Extraction and Process Plant

Receiver	Predicted Noise Level dB L _{A10}	Assessment
151 Walyunga Road	47	Minimum of 2 dB required to comply
1849 Great Northern Highway	42	Complies with the Regulations
1913 Great Northern Highway	42	Complies with the Regulations
1950 Great Northern Highway	44	Complies with the Regulations if no tonality
1992 Great Northern Highway	36	Complies with the Regulations
Caretaker Residence	54	Complies with the Regulations

It can be seen that compliance can be achieved at all receivers with the exception of 151 Walyunga Road and, should the noise emissions be considered tonal, at 1950 Great Northern Highway.

With the process plant being the most significant contributor at both receivers above, it is recommended to locate the process plant to the south east corner of the new stockpile area, against the ridge line created by the difference in elevation between the surrounding natural ground and stockpile area. This will maximise noise barrier effects to both receivers i.e. stockpile area is at RL 55 and natural ground at RL 68-70, resulting in the predicted noise levels in *Table 4-5*.

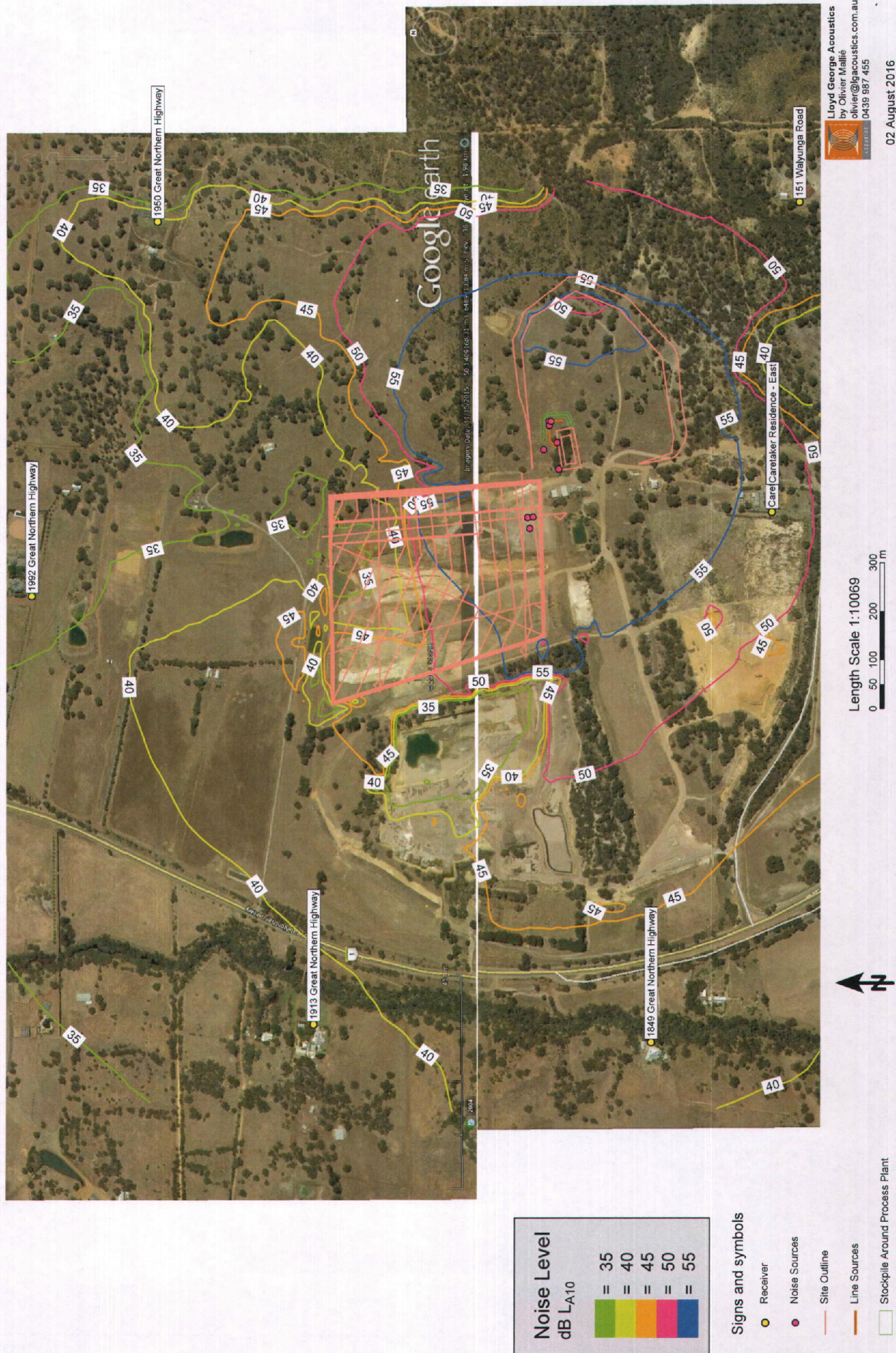
Table 4-5 Predicted Noise Levels - Clay Extraction and Process Plant to South East

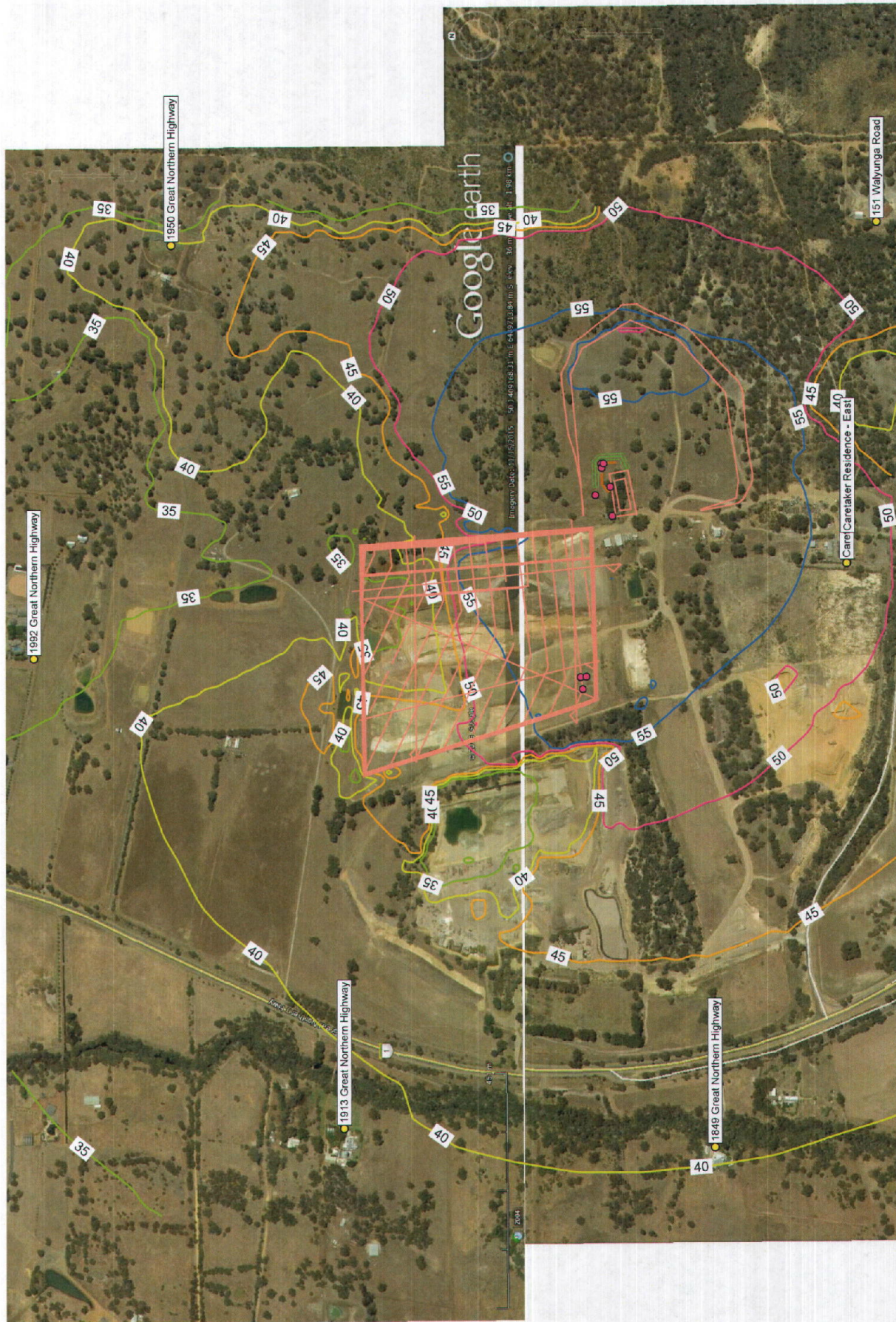
Receiver	Predicted Noise Level dB L _{A10}	Assessment
151 Walyunga Road	43	Complies with the Regulations
1849 Great Northern Highway	41	Complies with the Regulations
1913 Great Northern Highway	38	Complies with the Regulations
1950 Great Northern Highway	37	Complies with the Regulations
1992 Great Northern Highway	32	Complies with the Regulations
Caretaker Residence	54	Complies with the Regulations

The alternative location of the process plant, as well as the mitigated noise levels to the south east of the site are shown on *Figure 4-6*.

Should the noise emissions be tonal when assessed at 151 Walyunga Road, the D375 dozer is to be retrofitted with a HushPak noise control kit to further reduce overall noise levels to 40 dB L_{A10} at that receiver.

Figure 4-2





Noise Level
dB LA10



Signs and symbols

- Receiver
- Noise Sources
- Site Outline
- Line Sources
- Stockpile Around Process Plant

Figure 4-4



Noise Level
dB L_{A10}

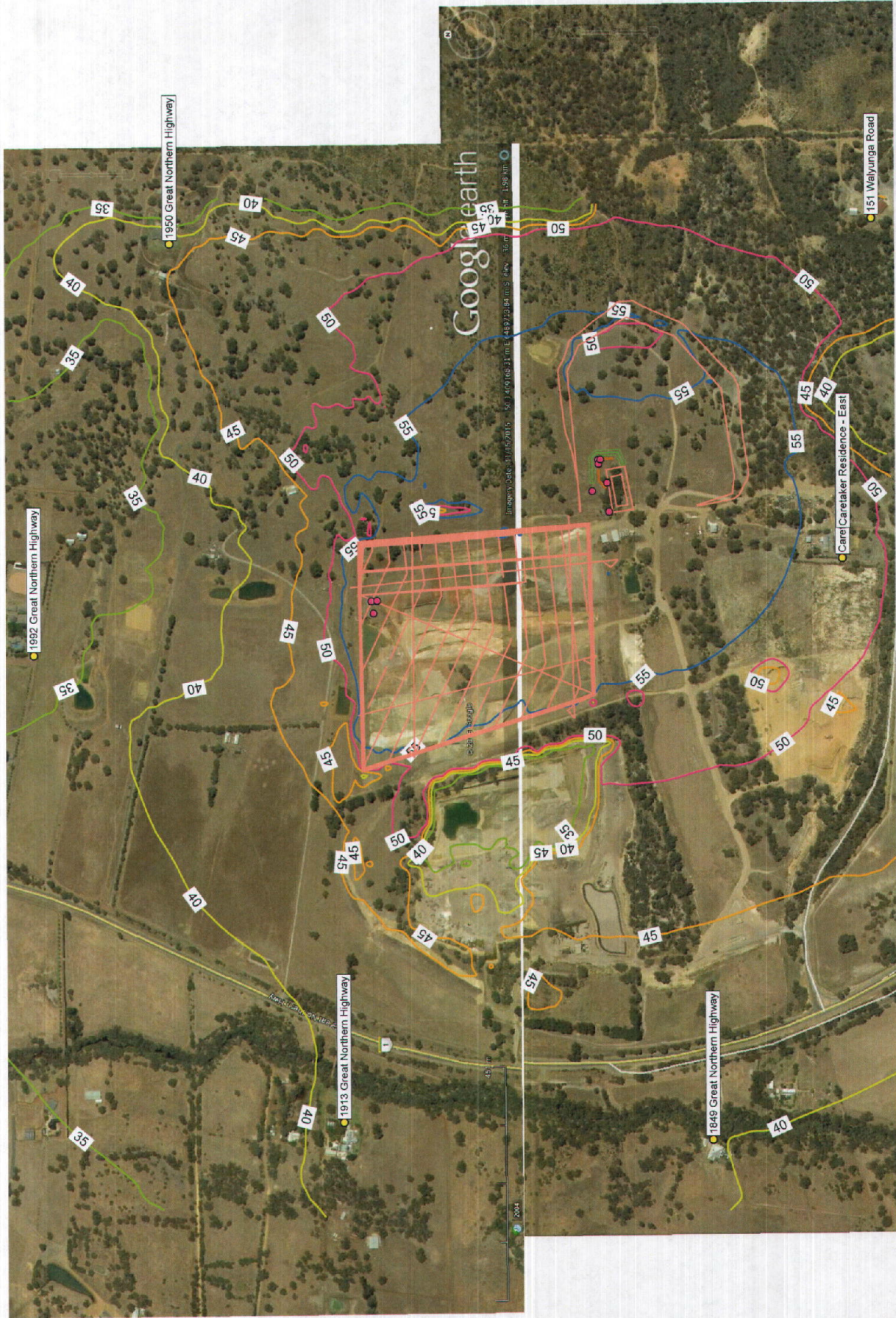


Signs and symbols

- Receiver
- Noise Sources
- Site Outline
- Line Sources
- Stockpile Around Process Plant

BGC Brikmakers Walyunga Operations - Daytime Noise Levels
Process Plant and Clay Extraction in North-east Corner - No Noise Controls

Figure 4-5



Noise Level
dB LA10

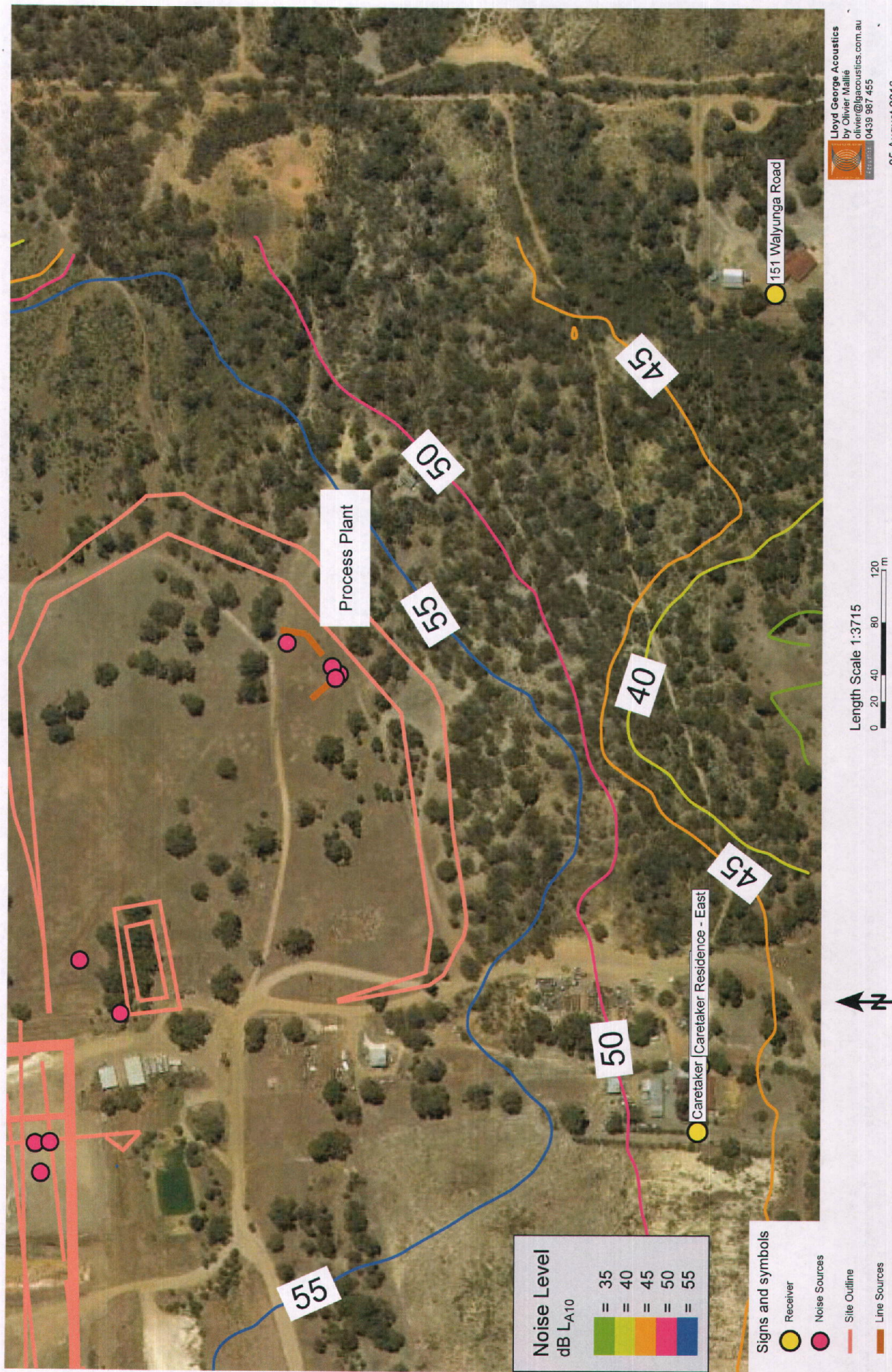


Signs and symbols

- Receiver
- Noise Sources
- Site Outline
- Line Sources
- Stockpile Around Process Plant

Length Scale 1:10069
0 50 100 200 300 m

Figure 4-6



5 DISCUSSION

In relation to hauling clay off site by trucks, the results show that provided the loader is working behind a 5 metres high minimum clay stockpile, the noise levels from loading and carting clay can comply with the night-time assigned noise levels of 35 dB L_{A10} at the closest receiver. It is understood that truck movements associated with the existing operations on western side of the Lot are already occurring at those hours and, therefore, no significant change of impact is expected from the proposed clay haulage operations.

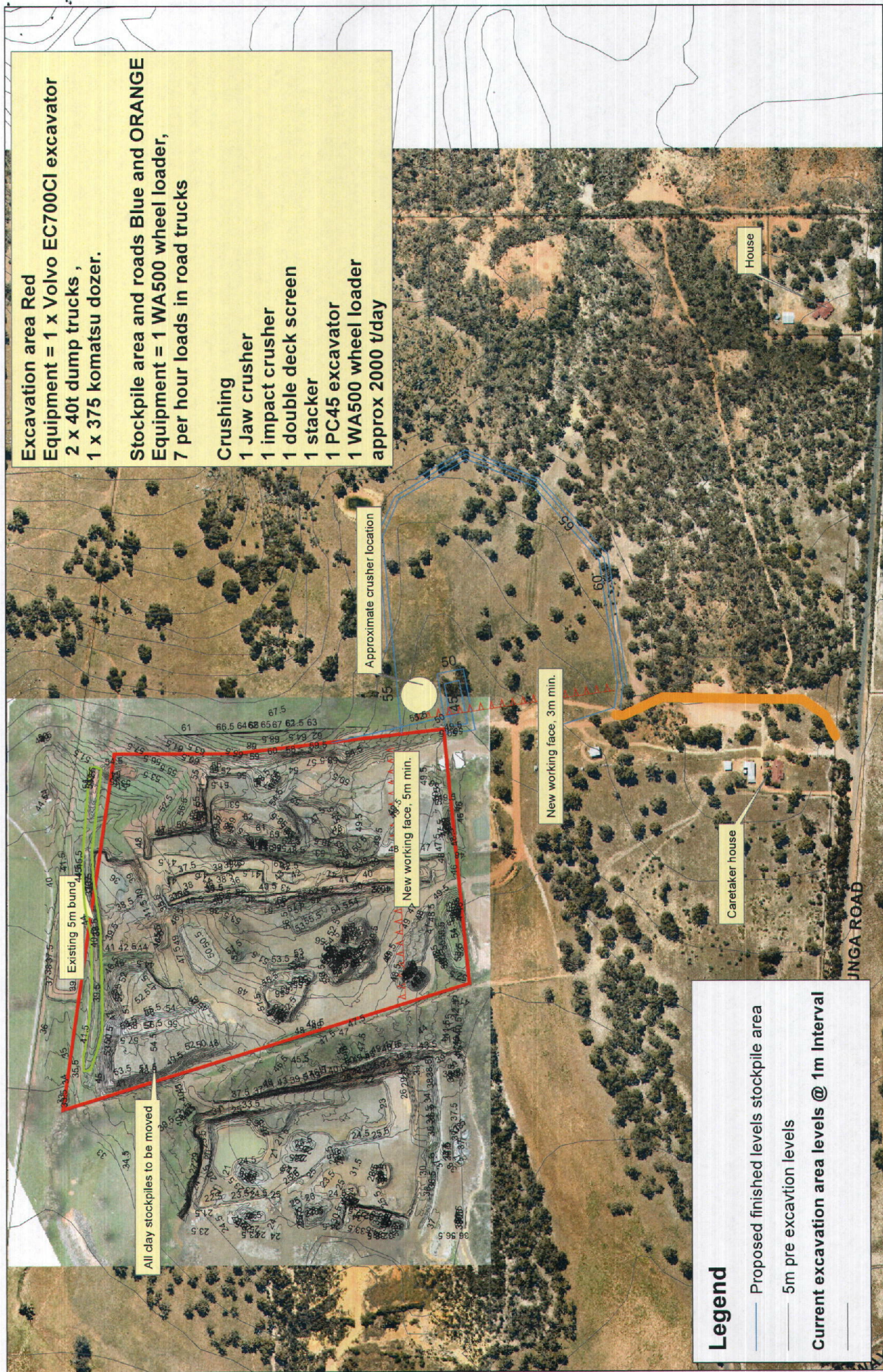
It is also recommended to locate the process plant to the south east corner of the new stockpile area, against the ridge line created by the difference in elevation between the surrounding natural ground and stockpile area.

With the above controls and the use of stockpiles as noise barriers, the proposed expansion of clay extraction can comply with the Regulations at all noise sensitive receivers during the times 0700 to 1900 Monday to Saturday.

To ensure continuing compliance with the Regulations, the clay pit will need to be carefully managed to ensure the pit face is running south-north. In addition, the location and height(s) of the stockpiles surrounding the loader (clay loading) will need to also be carefully managed to provide the required noise barrier effects.

Appendix A

Proposed Site Layout



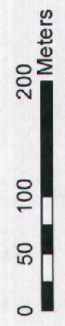
Excavation area Red
Equipment = 1 x Volvo EC700CI excavator
2 x 40t dump trucks ,
1 x 375 komatsu dozer.

Stockpile area and roads Blue and ORANGE
Equipment = 1 WA500 wheel loader,
7 per hour loads in road trucks

Crushing
1 Jaw crusher
1 impact crusher
1 double deck screen
1 stacker
1 PC45 excavator
1 WA500 wheel loader
approx 2000 t/day

Legend

- Proposed finished levels stockpile area
- 5m pre excavation levels
- Current excavation area levels @ 1m Interval



1:4,500

Noise model information - Walyunga Road

The following is an explanation of the terminology used throughout this report.

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Power Level (L_w)

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}

This is the noise level in decibels, obtained using the A frequency weighting and the S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}

This is the noise level in decibels, obtained using the A frequency weighting and the F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

L_{APeak}

This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

L_{Aeq}

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

One-Third-Octave Band

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between -

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

- (a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;
- (b) is present for at least 10% of the representative.

Impulsive Noise

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between $L_{A \text{ peak}}$ and $L_{A \text{ Max slow}}$ is more than 15 dB when determined for a single representative event;

Major Road

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10} (\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20} (\% \text{ Type B}_{100} + \% \text{ Type B}_{450})$$

where:

$\% \text{ Type A}_{100}$ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

$\% \text{ Type A}_{450}$ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

$\% \text{ Type B}_{100}$ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

$\% \text{ Type B}_{450}$ = the percentage of commercial land within
a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

Representative Assessment Period

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Peak Component Particle Velocity (PCPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

Peak Particle Velocity (PPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

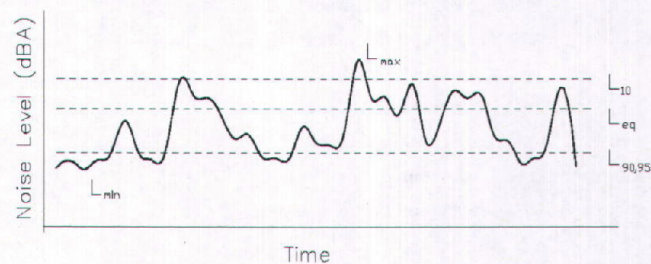
RMS Component Particle Velocity (PCPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Peak Particle Velocity (PPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Chart of Noise Level Descriptors



Typical Noise Levels

