APPENDIX 8

NOISE ASSESSMENT

ENVIRONMENTAL NOISE ASSESSMENT

OF

YALYALUP MINE

FOR

Doral Mineral Sands Pty Ltd

2 April 2020

AES-890059-R01-1-02042020

Acoustic Engineering Solutions
www.acousticengsolutions.com.au

DOCUMENT CONTROL

Environmental Noise Impact Assessment

Prepared for:	**Doral Mineral Sands Pty Ltd**
	Lot 7 Harris Road
	Picton WA 6229
Contact:	Craig Bovell

Prepared by:	Dr Roy Ming
	Acoustic Engineering Solutions
	roy.ming@acousticengsolutions.com.au
	0408 944 982

Revision:	1
Date:	2 April 2020
Doc NO:	AES-890059-R01-1-02042020

Acoustic Engineering Solutions

ABN: 64 451 362 914

EXECUTIVE SUMMARY

Acoustic Engineering Solutions (AES) has been commissioned by Doral Mineral Sands Pty Ltd (Doral) to undertake an environmental noise impact assessment of the Yalyalup mining operations. The aim of this assessment is to determine whether or not the noise emissions from the proposed mining operations would comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

An acoustic model has been developed using SoundPlan v8.0. Several preliminary modelling exercises were undertaken to assist the engineering noise control designs. Based on the modelling results, Doral will implement the following engineering noise controls to minimise the noise emissions from the mine site:

- Select quieter mobile equipment as practical as possible.
- Build a 6m U-shaped bund and a 6m ore stockpile at the Feed Prep.
- Low the Feed Prep floor 2m below the natural ground surface.
- Modify the McKloskey including the change from diesel powered to electric plus a silencer on the exhaust outlet.
- Silence the pit generator.
- Insulate or partly enclose the apron feeder, scalping and double-deck screens.
- Locate the concentrator as far as possible to any of the most affected residences.
- Install drapes in the ground level of the concentrator.
- Build 1.8m U-shaped noise bunds close to the roadside booster pumps between the feed prep and the concentrator.

Seven worst-case operational scenarios are modelled to represent the proposed construction and mining activities. Noise levels at the eighteen closest residential premises (within 2km from the mine site boundaries) are predicted for worst-case meteorological conditions.

A tonality assessment in received noise levels is undertaken based on the dominating noise sources and their contributions. It concludes that tonality will not be present at most of the closest residences except at R10 and R11 for scenario 1 and at R4 for scenario 5.

Predicted noise levels are adjusted in accordance with the Regulations, and then assessed against the noise limits set by the Regulations. The assessment concludes that:

- Full compliance is achieved for scenarios 4, 6 and 7.
- For scenarios 2 and 3, compliance is achieved on Monday to Saturday, but exceedance is predicted on Sunday and public holidays.
- For scenario 5, non-compliance is predicted at R4, and the exceedance for Monday to Saturday mainly results from the 5 dB tonality adjustment.

To achieve full compliance for scenarios 2 and 3 or to minimize noise impact at R4 for scenario 5, an administrative control may be implemented to schedule the mining activities of scenarios 2, 3 and 5 on Monday to Saturday and those of scenarios 4 and 6 on Sunday and public holidays.

TABLE OF CONTENTS

1.0 INTRODUCTION

Acoustic Engineering Solutions (AES) has been commissioned by Doral Mineral Sands Pty Ltd (Doral) to undertake an environmental noise impact assessment of the proposed Yalyalup mining operations. The Yalyalup mine is proposed to operate 24 hours a day and 7 days a week.

The objective of this assessment is to determine whether or not the noise emissions from the proposed mining operations would result in noise levels exceeding the noise limits (assigned noise levels) imposed under the Environmental Protection (Noise) Regulations 1997 (the Regulations) at the closest noise-sensitive (residential) premises.

To achieve the objective the following activities have been undertaken:

- Review documentation provided by Doral, including mining schedules, site plans, topographical data and equipment lists.
- Create an acoustic model for the proposed construction and mining activities.
- Undertake preliminary modellings to assist with the noise control designs for reducing noise emissions from the mine site.
- Predict the noise levels at the closest noise sensitive premises for calm and worst case meteorological conditions for various operating scenarios.
- Assess the likelihood of tonality being present in noise emissions from the proposed mining operations.
- Generate worst case noise contours for the mine site and surrounding area.
- Calculate the influencing factors of the closest noise sensitive receivers.
- Assess the noise emissions from the proposed mining operations for compliance with the Regulations at the closest noise sensitive receivers.
- Recommend noise mitigation options if necessary.

Figure 1 in APPENDIX A presents an aerial view of the mine site and surrounding area including the closest residences within 2km from the mine-site boundaries. The black lines represent the proposed pit edges. Figure 2 shows the mine site layout and the number of mining pits.

2.0 NOISE CRITERIA

2.1 THE REGULATIONS

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the *Regulations*). The *Regulations* set noise limits which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises. These noise limits are defined as 'assigned noise levels' at receiver locations. *Regulation* 7 requires that "noise emitted from any premises or public place when received at other premises 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".

The *Regulations* do allow for special conditions, which have been made to allow for reasonable amounts of economic, cultural and social activity at levels that may exceed the assigned levels, but are within normal community expectations. Noise from construction activities is one such special condition that is not required to comply with the assigned noise levels; but it must set out management practices.

2.2 ASSIGNED NOISE LEVELS

The *Regulations* set assigned noise levels differently for noise sensitive premises, commercial and industrial premises. For noise sensitive premises, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on land use zonings within circles of 100 metres and 450 metres radius from the noise receiver locations, including:

- the proportion of industrial land use zonings;
- the proportion of commercial zonings; and
- the presence of major roads.

For noise sensitive premises, the time of day also affects the assigned levels.

The *Regulations* define three types of assigned noise levels:

- L_{Amax} assigned noise level means a noise level which, measured as an $L_{A\ Slow}$ value, is not to be exceeded at any time.
- L_{A1} assigned noise level which, measured as an $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.
- L_{A10} assigned noise level which, measured as an $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

The L_{A10} noise limit is the most significant for this study since this is representative of continuous noise emissions from the mining activities.

Table 2-1 presents the assigned noise levels at various premises.

Table 2-1: Assigned noise levels in dB(A)

Type of Premises Receiving Noise	Time of Day	Assigned Noise Levels in dB(A)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + Influencing factor	55 + Influencing factor	65 + Influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + Influencing factor	50 + Influencing factor	65 + Influencing factor
	1900 to 2200 hours all days	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	35 + Influencing factor	45 + Influencing factor	55 + Influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

2.3 CORRECTIONS FOR CHARACTERISTICS OF NOISE

Regulation 7 requires that that "noise emitted from any premises or public place when received at other premises must be free of:

(i) tonality;

(ii) impulsiveness; and

(iii) modulation.

when assessed under *Regulation* 9".

If the noise exhibits intrusive or dominant characteristics, i.e. if the noise is impulsive, tonal, or modulating, noise levels at noise-sensitive premises must be adjusted. Table 2-2 presents the adjustments incurred for noise exhibiting dominant characteristics. That is, if the noise is assessed as having tonal, modulating or impulsive characteristics, the measured or predicted noise levels have to be adjusted by the amounts given in Table 2-2. Then the adjusted noise levels must comply with the assigned noise levels. *Regulation* 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

Table 2-2: Adjustments for dominant noise characteristics

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.			Adjustment where noise emission is music	
Where tonality is present	Where Modulation is present	Where Impulsiveness is present	Where Impulsiveness is not present	Where Impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

An assessment of tonality in noise emissions from the mining activities is included in Section 5.1 based on the point modelling results at the closest noise sensitive receivers.

2.4 INFLUENCING FACTORS

Influencing factor varies from residence to residence depending on the surrounding land use. Traffic flows on roads in the vicinity of the Yalyalup mine site are insufficient for any of the roads to be classified as either major or secondary roads. Therefore no transport factors apply.

Eighteen (18) noise sensitive (residential) locations surrounding the Yalyalup mine site (within 2km) are selected for detailed assessment of noise impact. These residential locations are shown in Figure 1 in APPENDIX A. Most of the closest residences are located at more than 450m away from any mining pits or SEPs except R4, R13 to R15 and R17. Schedule 3 Clause 3 of the Regulations classifies the mining pits as Type A land (industrial and utility premises). Due to the presence of the mine site, the calculated influencing factor ranges from 0.7 dB to 3.9 dB, which are rounded to 1 dB to 4 dB according to the Regulations. Table 2-3 presents the calculated assigned noise levels for the 18 selected residential locations.

Table 2-3: Calculated assigned noise levels (L_{A10}) in dB(A)

Closest Residents	Influencing Factor in dB	Assigned Noise levels (L_{A10}) in dB(A)		
		Day[1] Monday to Saturday	Evening[2] Day[3] for Sunday and Public Holiday	Night[4]
R4 & R13	4	49	44	39
R14 & R15	2	47	42	37
R17	1	46	41	36
Others	0	45	40	35

1 0700 to 1900 hours for Monday to Saturday.
2 1900 to 2200 hours for all days.
3 0900 to 1900 hours for Sunday and public holidays.
4 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays.

3.0 NOISE MODELLING

3.1 METHODOLOGY

An acoustic model has been developed using SoundPlan v8.0 program developed by SoundPLAN LLC. The CONCAWE[5,6] prediction algorithms are selected for this study. The acoustic model is used to generate noise contours for the area surrounding the mine site and also to predict noise levels at the closest noise sensitive (residential) receivers.

The acoustic model does not include noise emissions from any source other than the proposed mining operations. Therefore, noise emissions from road traffic, aircrafts, animals, domestic sources, etc are excluded from the modelling.

3.2 MODELLING SCENARIOS

Doral advised:

- The mine is proposed to operate 24 hours a day and 7 days a week. During evening and night periods (7pm to 7am), all mining activities at pits stop and only the concentrator and the Feed Prep operate with the process water pumps and roadside booster pumps.
- At the Feed Prep, a D7 dozer operates during daytime period (7am to 7pm) while a CAT980K Loader operates during evening and night periods (7pm to 7am).
- Construction activities in the mine start before any mining activities. Multiple topsoil stockpiles are built during the construction phase, including a U-shape stockpile at the Feed Prep, at multi-locations between the mining pits and some of the closest residences. These stockpiles are designed to reduce mining noise impact on the closest residences.
- Pits 25 and 15 to 17 will be mined during quarter 3 (Q3) 2021.
- Pits 19 and 30 will be mined during quarter 2 (Q2) 2022.
- Pits 9 and 50 will be mined during quarter 1 (Q1) 2023.
- Pits 55, 56 and 72 will be mined during quarter 2 (Q2) 2024.
- Pits 46 and 65 will be mined during quarter 4 (Q4) 2024.
- During the day-time period between 7am and 7pm, mining activities occur simultaneously at two different pits:
  - A CAT980K loader operates in one pit with the fixed plant of the McKloskey R230, a vibration screen, a fed pump and a pit generator.
  - A CAT390 excavator loads ore at another pit to AH500 trucks.

---

[5] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[6] The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981.

- Hitachi AH500 trucks will transport ore from a mining pit to the Feed Prep. Three AH500 trucks operate during Q2 2022 and Q1 2023 while four AH500 trucks operate for the other mining periods (Q3 2022, Q2 and Q4 2024).
- One Watercart will operate for all scenarios.
- Following noise controls will be implemented:
  - Operate quieter mobile equipment as possible.
  - Build a 6m U-shaped bund (open in north) and a 6m ore stockpile at the Feed Prep.
  - Low the Feed Prep floor 2m below the natural ground surface.
  - Modify the McKloskey including the change from diesel powered to electric (run by a silenced generator) plus a silencer on the exhaust outlet.
  - Silence the pit generator.
  - Acoustically insulate or partly enclose the apron feeder, scalping and double-deck screens.
  - Locate the concentrator as far as possible to any of the most affected residences.
  - Install drapes in the ground level of the concentrator.
  - Build 1.8m U-shaped noise bunds close to the roadside booster pumps between the feed prep and the concentrator. The opening of U-shaped bunds is towards either east or west.

Based on the above mining activities, seven (7) operational scenarios are modelled to represent the worst-case construction and mining activities:

Scenario 1: Construction phase for day-time period (7am to 7pm) only.

Scenario 2: Day-time mining activities in pits 25 and 15 to 17 during quarter 3 (Q3) 2021.

Scenario 3: Day-time mining activities in pits 19 and 30 during quarter 2 (Q2) 2022.

Scenario 4: Day-time mining activities in pits 9 and 50 during quarter 1 (Q1) 2023.

Scenario 5: Day-time mining activities in pits 55, 56 and 72 during quarter 2 (Q2) 2024.

Scenario 6: Day-time mining activities in pits 46 and 65 during quarter 4 (Q4) 2024.

Scenario 7: Evening and night-time (7pm to 7am) operations when only the concentrator and the feed prep operate with the process water pumps and roadside booster pumps.

Figure 3 to Figure 9 in APPENDIX B show the assumed operating locations of the fixed plant and mobile equipment for the above operational scenarios. For scenarios 2 to 6, the pit fixed plant is located in the "mined out" area. An FEL 980K operates close to McKloskey R230.

The pits are mined towards the most affected residences so that the pit fixed plant and mobile equipment operate at least 50m behind ore faces. This will ensure that the most affected residences are located in the shadow areas of ore faces, and reduce pit noise propagation towards the most affected residences. For shallow pits, however, ore faces may have little impact on noise propagation.

3.3 INPUT DATA

3.3.1 Topography

Topographical data for the acoustic model were provided by Doral in dxf file format. These ground contours were amended to incorporate details of mining pits, SEPs, topsoil stockpiles and noise bunds, which were also provided by Doral. The mining pits in each scenario were modified to allow pit equipment operate (about 50m) behind ore faces.

No building effects are considered in the acoustic model. An absorptive ground is assumed while reflective surfaces are assumed for the SEPs.

3.3.2 Noise Sensitive Premises

Eighteen (18) nearest residential locations surrounding the Yalyalup mine site (within 2km) are selected for detailed assessment of noise impacts. These residential locations are shown in Figure 1 in APPENDIX A.

R18 is slightly more than 2km from the mine site (boundary). R18 is included because no closer residence is located to the south-east boundary of the mine site.

3.3.3 Source Sound Power Levels

Table 3-1 presents the sound power levels, which were measured in the Doral Yoongarillup mine in late 2017 during the multiple mine-site visits.

Table 3-1: Sound power levels

Equipment	Octave Band Sound Power Levels in dB(lin)									O/A dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Modified McKloskey R230	103.7	109.9	105.8	106.8	102.3	99.9	95.6	91.8	85.1	**105.1**
CAT 980K FEL	90.1	96.8	100	97.1	98.1	95.9	93.1	85.1	77.6	**100.4**
Silenced Pit Generator	97.3	106.0	101.2	97.7	86.5	75.2	70.4	67.4	59.3	**91.8**
Pit Feed Pump	106.9	101.9	96.6	95.6	91.9	95.2	93	97	83.1	**101.4**
Vibration Screen	106.4	107	108.4	109.2	104.6	101	97.8	95.6	93.4	**107.3**
Process Water Pumps	98.7	100.4	101.4	99.4	93.6	93.1	90.6	89.7	84.8	**98.8**

Equipment	Octave Band Sound Power Levels in dB(lin)									O/A dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Booster Pump	90.4	85.0	81.7	83.7	83.5	81.3	80.2	79.8	78.9	**87.6**
Concentrator with Drapes	108.8	109.3	104.4	100.2	98.5	96.9	93.9	89.5	80.5	**101.8**
Trommel	103.8	105.3	100.6	95.3	96.4	99.0	94.0	92.9	87.1	**102.3**
Scrubber	101.9	103.1	105.2	106.9	105.6	103.2	98.3	95.7	90.9	**107.8**
Apron Feeder with Control	93.0	97.3	95.3	98.7	101.2	98.9	96.8	91.7	84.8	**103.7**
Scalping Screen with Control	98.3	97.7	103.7	102.7	103.7	99.7	95.7	93.7	88.7	**105.1**
Double Deck Screen with Control	103.8	109.8	106.8	102.8	101.8	99.8	98.8	94.8	88.8	**105.5**
D7 Dozer	94.7	101.8	112.9	105.2	108.3	103.9	100.6	97.3	93.5	**109.5**
D9 Dozer	99.1	104.0	118.6	107.8	106.5	104.7	103.5	98.0	91.7	**110.6**
CAT 390 Excavator	84.8	105.9	106.8	102.1	102.5	98.4	95.9	89.8	83.9	**104.1**
CAT 330 Excavator	53.8	108.3	106.8	99.5	101.0	95.6	92.0	87.7	82.0	**101.8**
Hitachi AH500	106.5	108.6	109.8	105.8	104.6	99.9	98.6	92.7	88.3	**106.4**
Watercart	104.4	108.6	108.0	101.5	104.1	103.0	98.8	92.7	85.5	**106.9**
16H Grader	99.5	100.4	104.9	104.5	101.9	106.3	99.7	93.9	86.4	**108.5**

3.4 METEOROLOGY

SoundPlan calculates noise levels for defined meteorological conditions. In particular, temperature, relative humidity, wind speed and direction data are required as input to the model. For this study the worst case meteorological conditions[7] have been assumed, as shown in Table 3-2. The calm meteorological conditions are obtained by assuming a zero wind speed.

[7] The worst case meteorological conditions were set by the EPA (Environmental Protection Act 1986) Guidance note No 8 for assessing noise impact from new developments as the upper limit of the meteorological conditions investigated.

Table 3-2: Worst-case meteorological conditions assumed in the modelling.

Time of day	Temperature Celsius	Relative Humidity	Wind speed	Pasquill Stability Category
Day (0700 --- 1900)	20 Celsius	50%	4 m/s	E
Evening (1900 --- 2200)	15 Celsius	50%	3 m/s	F
Night (2200 --- 0700)	15 Celsius	50%	3 m/s	F

Table 3-2 indicates that the evening and night have the same worst-case meteorological conditions.

4.0 MODELLING RESULTS

4.1 PREDICTED NOISE LEVELS

Noise levels for the 7 construction and mining scenarios have been predicted at the 18 residential receivers for a range of day and night-time meteorological conditions including calm conditions and worst-case winds in 8 cardinal directions.

The full point prediction results for different wind conditions are presented in Table C1 to Table C7 in APPENDIX C. Those tables indicate that wind direction has a big impact on the noise levels received at the closest residential locations.

Table 4-1 summarises the predicted worst-case noise levels in dB(A) at the closest residential locations. The predicted noise levels for scenarios 1 to 6 are the worst-case day-time noise levels while the predicted noise levels for scenario 7 are the worst-case evening/night-time noise levels. The highest noise level is predicted at R13 for scenarios 1 and 2, at R15 for scenario 3, and at R4 for scenarios 4 to 7. The worst-case night-time noise levels are predicted of below 37.1 dB(A).

Table 4-1: Predicted worst-case noise levels in dB(A).

Closest Residences	Predicted Worst-Case Noise Levels in dB(A)						
	S1	S2	S3	S4	S5	S6	S7
R1	26.4	24.6	25.4	26.6	25.5	26.4	21.4
R2	27.7	25.8	26.5	27.7	26.7	27.7	22.6
R3	34.2	30.2	30.7	31.6	32.9	34.4	28.2
R4	41.5	39.6	39.4	40.5	49.9	43.4	37.1
R5	28.2	27.2	24.6	24.5	27.7	24.9	22.3
R6	26.7	28.3	25.4	23.4	24.0	23.2	19.3
R7	29.5	31.4	28.1	25.9	26.5	25.7	21.7
R8	33.5	35.2	30.5	28.2	29.3	27.7	24.9
R9	34.0	36.2	31.3	28.7	29.9	28.3	25.1

Closest Residences	Predicted Worst-Case Noise Levels in dB(A)						
	S1	S2	S3	S4	S5	S6	S7
R10	35.3	37.7	32.3	29.7	30.8	29.2	26.1
R11	36.1	38.8	33.0	30.3	31.4	29.9	26.7
R12	32.1	34.4	31.6	29.1	29.5	29.1	25.0
R13	42.6	47.9	40.4	36.6	37.1	36.4	33.2
R14	41.2	45.6	39.8	36.2	36.6	36.2	32.5
R15	42.5	44.4	45.8	39.7	39.5	39.5	35.8
R16	39.0	40.9	40.6	36.7	36.3	36.3	32.3
R17	37.8	39.2	41.0	37.7	36.4	36.8	32.5
R18	22.6	22.4	22.9	23.2	21.8	22.7	17.5

4.2 NOISE CONTOURS

Noise contours have been generated for the worst-case meteorological conditions given in Table 3-2. The noise contours are presented in Figure 10 to Figure 16 in APPENDIX D, starting from 25 dB(A) to 60 dB(A) with a 5 dB interval. These noise contours represent the worst-case noise propagation envelopes at 1.5m above the ground, i.e., worst-case propagation in all directions simultaneously.

Figure 10 presents the worst-case day-time noise contours for construction phase.

Figure 11 to Figure 15 present the worst-case noise contours for day-time mining operations.

Figure 16 presents the worst-case noise contours for night-time mining operations.

Detailed locations of the fixed plant and mobile equipment for each scenario are presented in Figure 3 to Figure 9 in APPENDIX B.

5.0 COMPLIANCE ASSESSMENT

5.1 TONALITY ASSESSMENT

Assessment of tonality in received noise levels depends on the existing level of ambient noise (i.e. whether tonality is likely to protrude above background noise) as well as the severity and duration of any tonality. *Regulation* 9(1) specifies two criteria for assessing tonality. The first is based on instantaneous sound pressure levels and the second is based on average sound pressure levels. Very strong tonality which protrudes significantly above background noise may satisfy the first criteria. Less severe tonality may satisfy the second criteria provided that it persists for at least 10% of the representative assessment period.

Many of the items of mining equipment have some degree of tonality when measured at close distances. However, this tonality may not always be evident at a receiver for the following reasons:

- Tonality may not protrude above ambient noise.
- Tonality from particular items of equipment may be masked by noise received from other equipment.
- The level of noise emissions from items of mobile equipment will vary depending on their locations (which may be continuously changing).
- The severity and pitch of the tonality from mobile equipment will change depending on operating conditions.

Therefore, in order to assess the likelihood of tonality being evident in received noise it is necessary to review which equipment dominates noise level at a receiver.

Since the assigned noise levels are no less than 40 dB(A) for the day-time period of Sunday and public holidays and 35 dB(A) for night for this project, the tonality adjustment of 5dB only affects the compliance status for an overall noise level greater than 35 dB(A) for day and 30 dB(A) for night. Therefore, the tonality assessment is performed at receivers where the overall noise level is above 35 dB(A) for day and 30 dB(A) for night. Table E1 to Table E7 in APPENDIX E present the assessments of whether or not tonality is likely to be evident at the receiving locations. The assessment is undertaken for worst-case sound propagation conditions.

The tonality assessments in APPENDIX E conclude that tonality will not be present (masked) at most of the closest residences except at R10 and R11 for scenario 1 and at R4 for scenario 5. According to the Regulations, predicted noise levels should be adjusted by adding 5 dB if they contain tonal components. Table 5-1 presents the adjusted noise levels. The adjusted values are expressed in ***bold italic***.

Although the tonality assessment was undertaken for worst-case conditions, it is assumed that the findings apply for all prevailing wind conditions. Therefore, the predicted noise levels at R4 presented in Table C5 for particular wind directions will also need to be adjusted before comparing predicted levels with the assigned noise limits.

Table 5-1: Adjusted worst-case noise levels in dB(A).

Closest Residences	Predicted Worst-Case Noise Levels in dB(A)						
	S1	S2	S3	S4	S5	S6	S7
R1	26.4	24.6	25.4	26.6	25.5	26.4	21.4
R2	27.7	25.8	26.5	27.7	26.7	27.7	22.6
R3	34.2	30.2	30.7	31.6	32.9	34.4	28.2
R4	41.5	39.6	39.4	40.5	***54.9***	43.4	37.1
R5	28.2	27.2	24.6	24.5	27.7	24.9	22.3
R6	26.7	28.3	25.4	23.4	24.0	23.2	19.3
R7	29.5	31.4	28.1	25.9	26.5	25.7	21.7
R8	33.5	35.2	30.5	28.2	29.3	27.7	24.9
R9	34.0	36.2	31.3	28.7	29.9	28.3	25.1
R10	***40.3***	37.7	32.3	29.7	30.8	29.2	26.1
R11	***41.1***	38.8	33.0	30.3	31.4	29.9	26.7
R12	32.1	34.4	31.6	29.1	29.5	29.1	25.0
R13	42.6	47.9	40.4	36.6	37.1	36.4	33.2
R14	41.2	45.6	39.8	36.2	36.6	36.2	32.5
R15	42.5	44.4	45.8	39.7	39.5	39.5	35.8
R16	39.0	40.9	40.6	36.7	36.3	36.3	32.3
R17	37.8	39.2	41.0	37.7	36.4	36.8	32.5
R18	22.6	22.4	22.9	23.2	21.8	22.7	17.5

5.2 COMPLIANCE ASSESSMENT

According to Regulation 13, no assigned noise levels apply for the construction phase (scenario 1).

5.2.1 Monday to Saturday

Table 5-2 presents a compliance assessment for the worst-case day-time operations on Monday to Saturday. Compliance is achieved for scenarios 2 to 4 and 6, but exceedance is predicted at R4 under calm, southeasterly to northwesterly winds for scenario 5.

Table 5-2: Compliance assessment for day-time operations on Monday to Saturday

Closest Residences	Assigned Noise Levels in dB(A)	Noise Level Exceedance & Non-compliant Wind Directions				
		Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
R4	49				0.5 – 5.9 (Calm, SE – NW)	
R13	49					
R14 and R15	47					
R17	46					
Others	45					

5.2.2 Sundays and Public Holidays

Table 5-3 presents a compliance assessment for the worst-case day-time operations on Sundays and public holidays. Compliance is achieved for scenarios 4 and 6, but exceedance is predicted at:

- R13 to R16 under westerly to easterly winds for scenario 2;
- R15 and R16 under northwesterly to easterly winds for scenario 3; and
- R4 for all wind conditions for scenario 5.

Table 5-3: Compliance assessment for day-time operations on Sundays & public holidays

Closest Residences	Assigned Noise Levels in dB(A)	Noise Level Exceedance & Non-compliant Wind Directions				
		Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
R4	44				1.9 – 10.9 All Winds	
R13	44	2.3 – 3.9 (NW – E)				
R14	42	1.9 – 3.6 (NW – E)				
R15	42	1.6 – 2.4 (W – N)	1.9 – 3.8 (NW – E)			
R16	40	0.9 (NW – N)	0.4 – 0.6 (NW – NE)			
R17	41					
Others	40					

5.2.3 Nights

The adjusted night-time noise levels of scenario 7, presented in Table 5-1, are below the night-time assigned noise levels, shown in Table 2-3, at all of the receivers. This indicates that full compliance is achieved for the proposed night-time mining operations.

From the above assessments it can be concluded that:

- Full compliance is achieved for scenarios 4, 6 and 7.
- For scenarios 2 and 3, compliance is achieved on Monday to Saturday, but exceedance is predicted on Sunday and public holidays.
- For scenario 5, non-compliance is predicted at R4. The exceedance for Monday to Saturday mainly results from the 5 dB tonality adjustment.

6.0 NOISE CONTROLS AND DISCUSSIONS

The previous section indicates that exceedance could occur at R4, R13 to R16 for the proposed day-time mining operations. APPENDIX E shows that the significant contributors to exceedance are McKloskey, Screens, AH500 Trucks, Dozer, Watercart and Scrubber. To achieve full compliance or minimize noise impact at the closest residences, the noises from the significant contributors need to be reduced.

Several preliminary modelling exercises have been undertaken to assess noise emissions of individual sources and effectiveness of proposed noise control measures. Based on the modelling results, Doral has proposed and will implement practical and feasible engineering noise control measures, detailed in section 3.2, to reduce the noise radiations from the significant contributors. Apart from these measures, noise bunds/stockpiles were proposed along the northern and southern pit edges to mitigate noise propagation toward the most affected receivers (R4 and R13 to R16). However, the modelling results indicate that these noise bunds/stockpiles are ineffective in reducing the noises received at the most affected receivers due to the following reasons:

- Noise bunds are too far away from both noise sources and receivers.
- Higher noise bunds (above 3m) are not practical and feasible. Some of pits are mined only in short periods (less than a month).
- The ground elevations of R13 to R16 are 2m to 6m higher than most pit elevations.

To achieve full compliance for scenarios 2 and 3 and/or to minimize noise impact at R4 for scenario 5, an administrative control may be implemented to schedule the mining activities of:

- Scenarios 2, 3 and 5 on Monday to Saturday; and
- Scenarios 4 and 6 on Sunday and public holidays.

APPENDIX A AERIAL VIEW

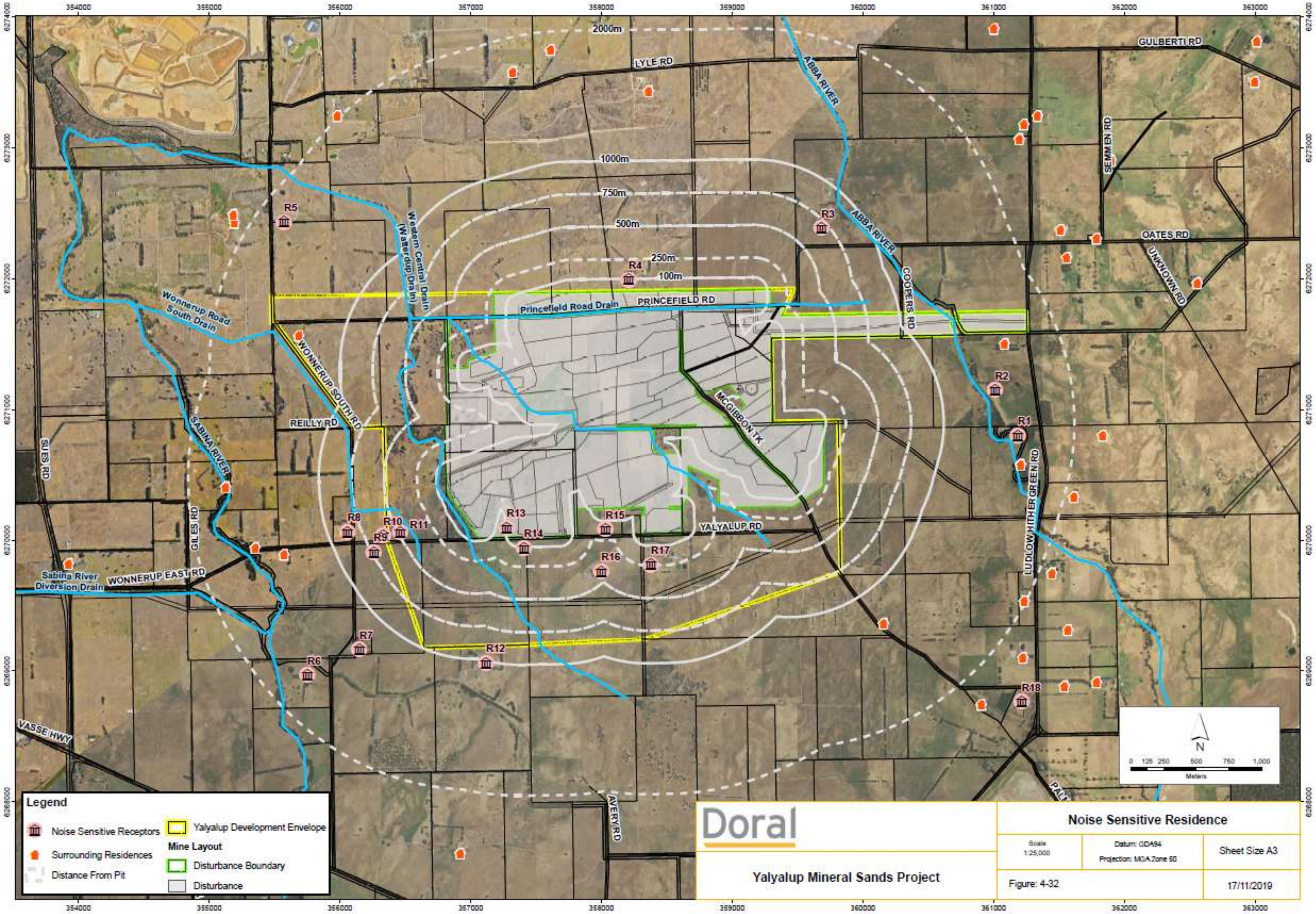

Figure 1: Aerial view of the mine site and closest residences.

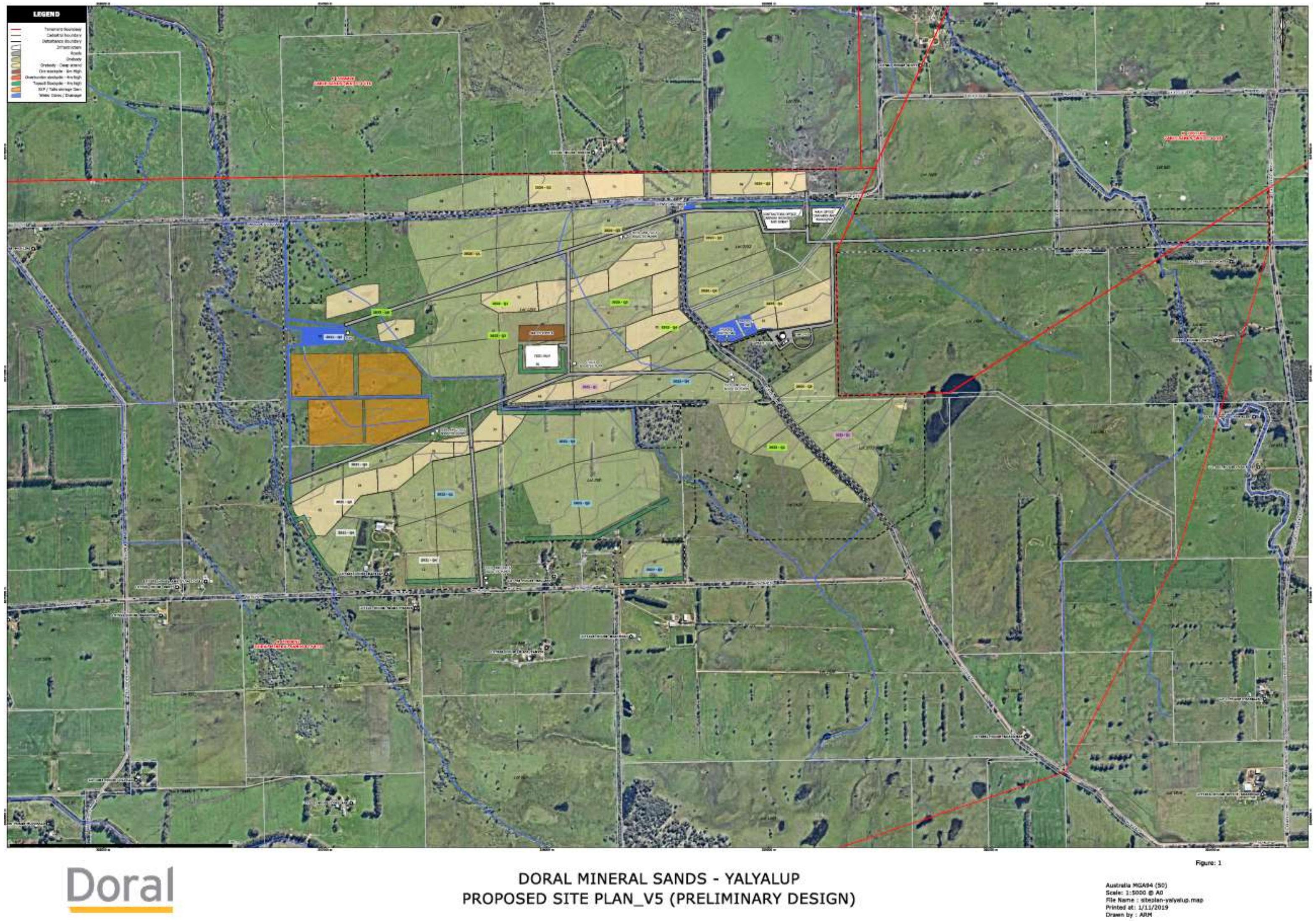

Figure 2: Site Layout and number of the mining pits.

APPENDIX B EQUIPMENT LOCATIONS

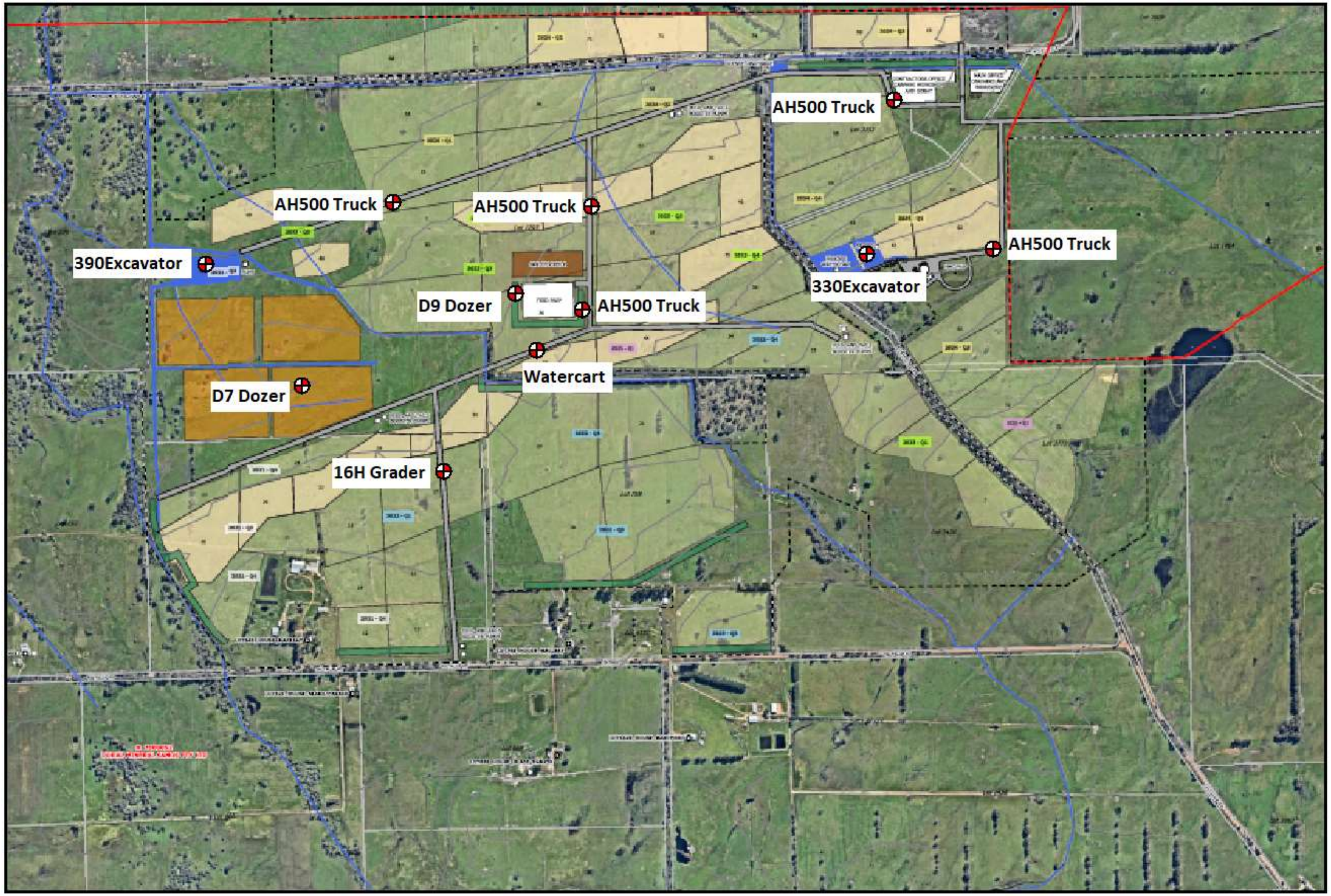

Figure 3: Assumed noise source locations for scenario 1 – Construction Phase.

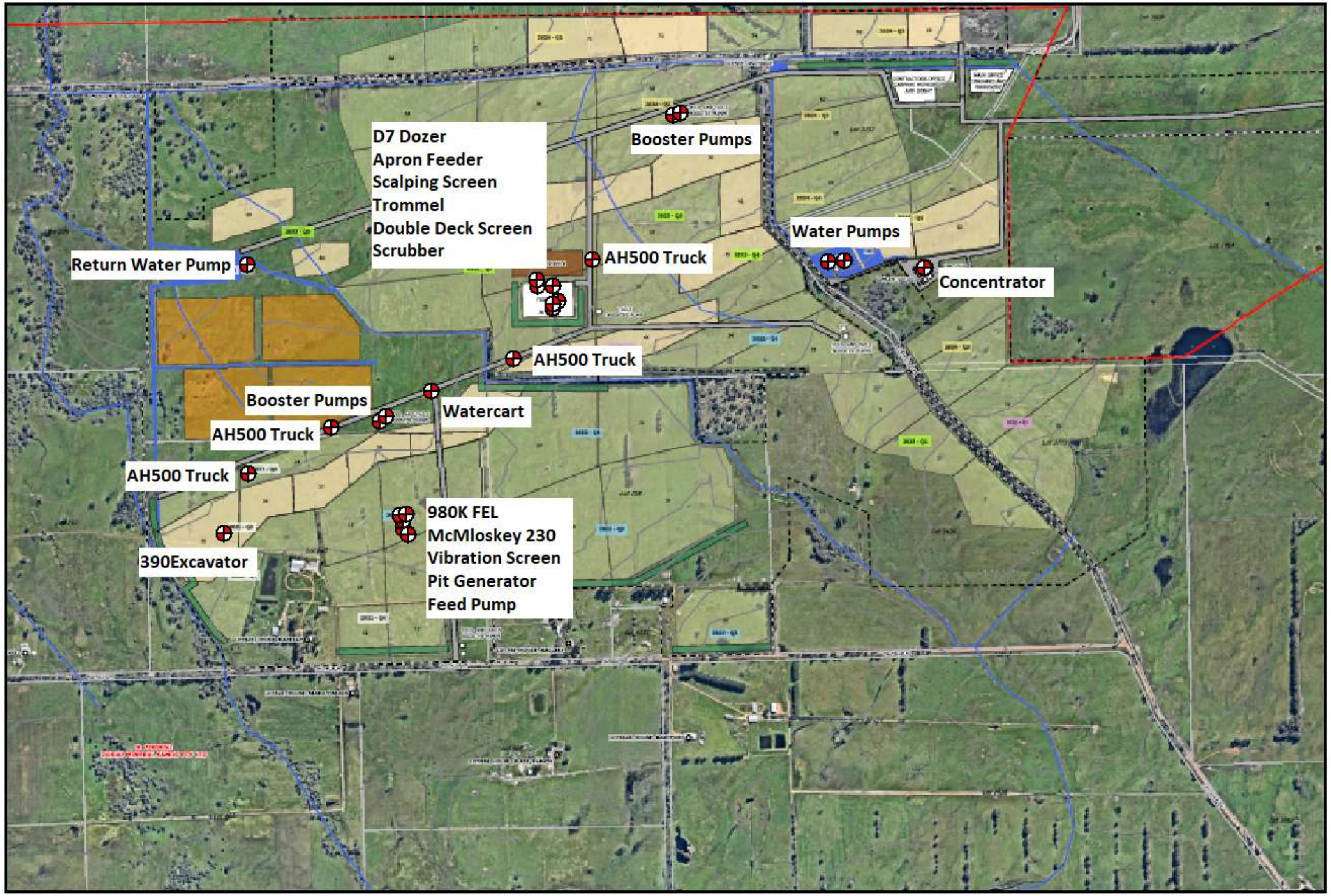

Figure 4: Assumed noise source locations for scenario 2 – Mining at Q3 2021.

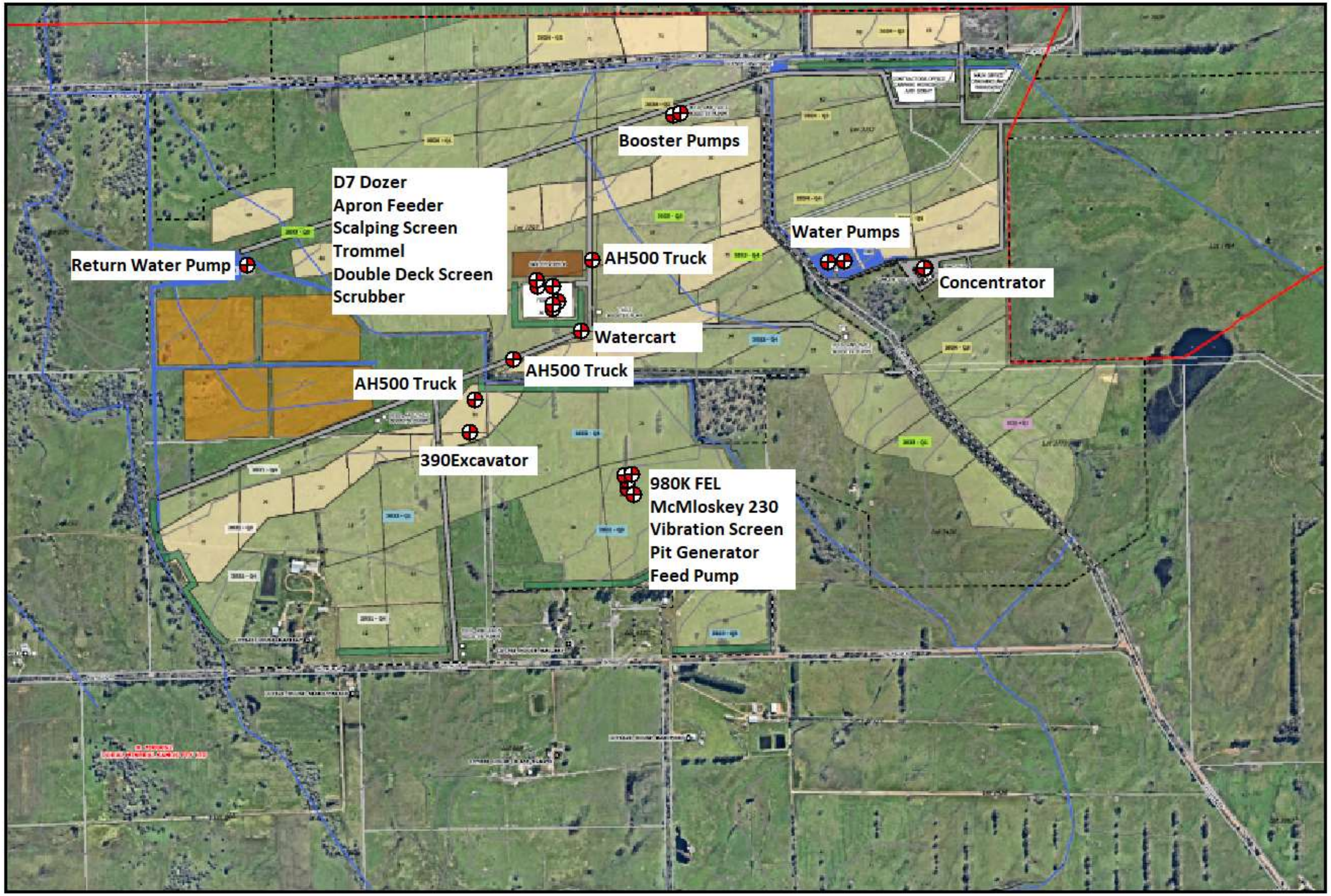

Figure 5: Assumed noise source locations for scenario 3 – Mining at Q2 2022.

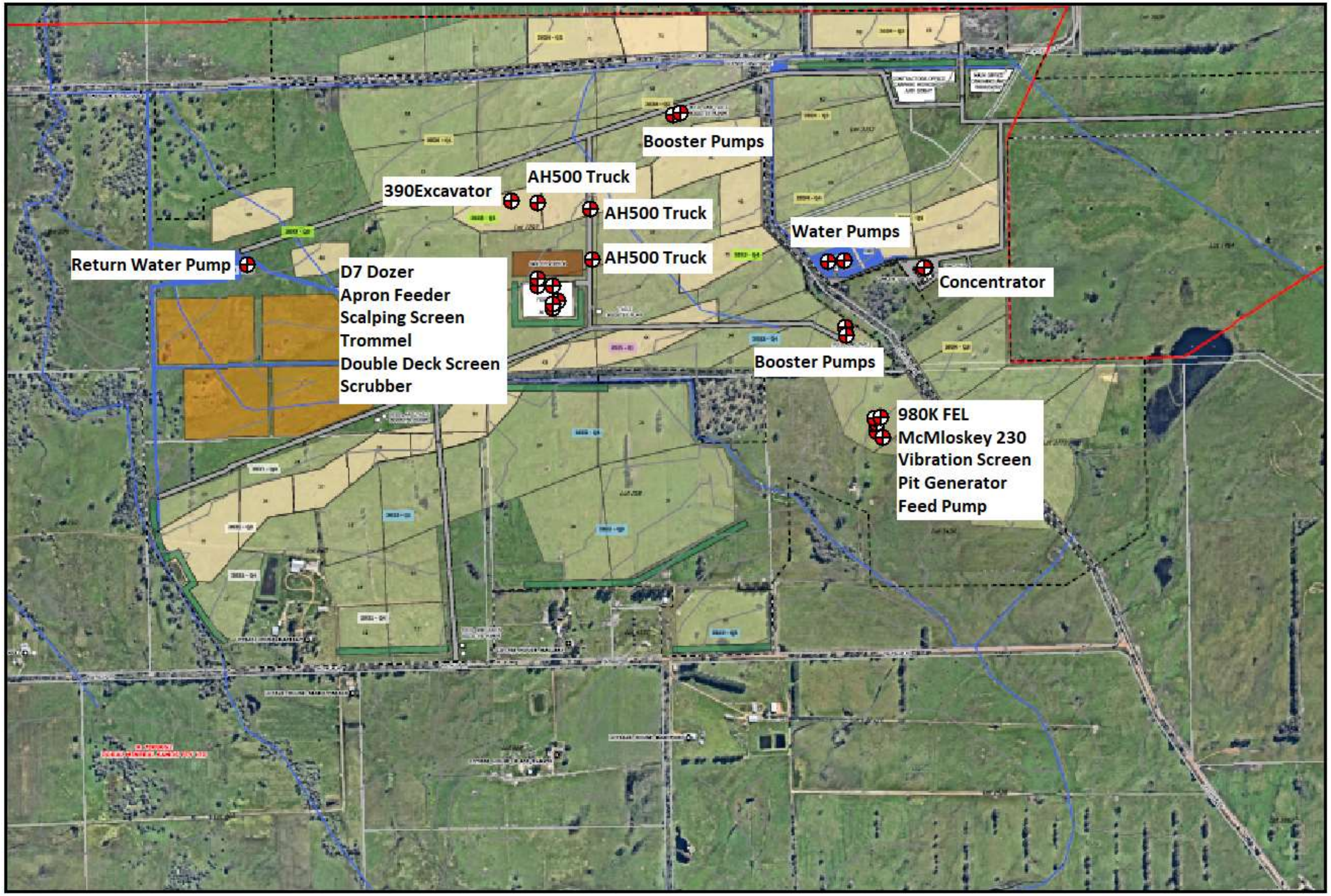

Figure 6: Assumed noise source locations for scenario 4 – Mining at Q1 2023.

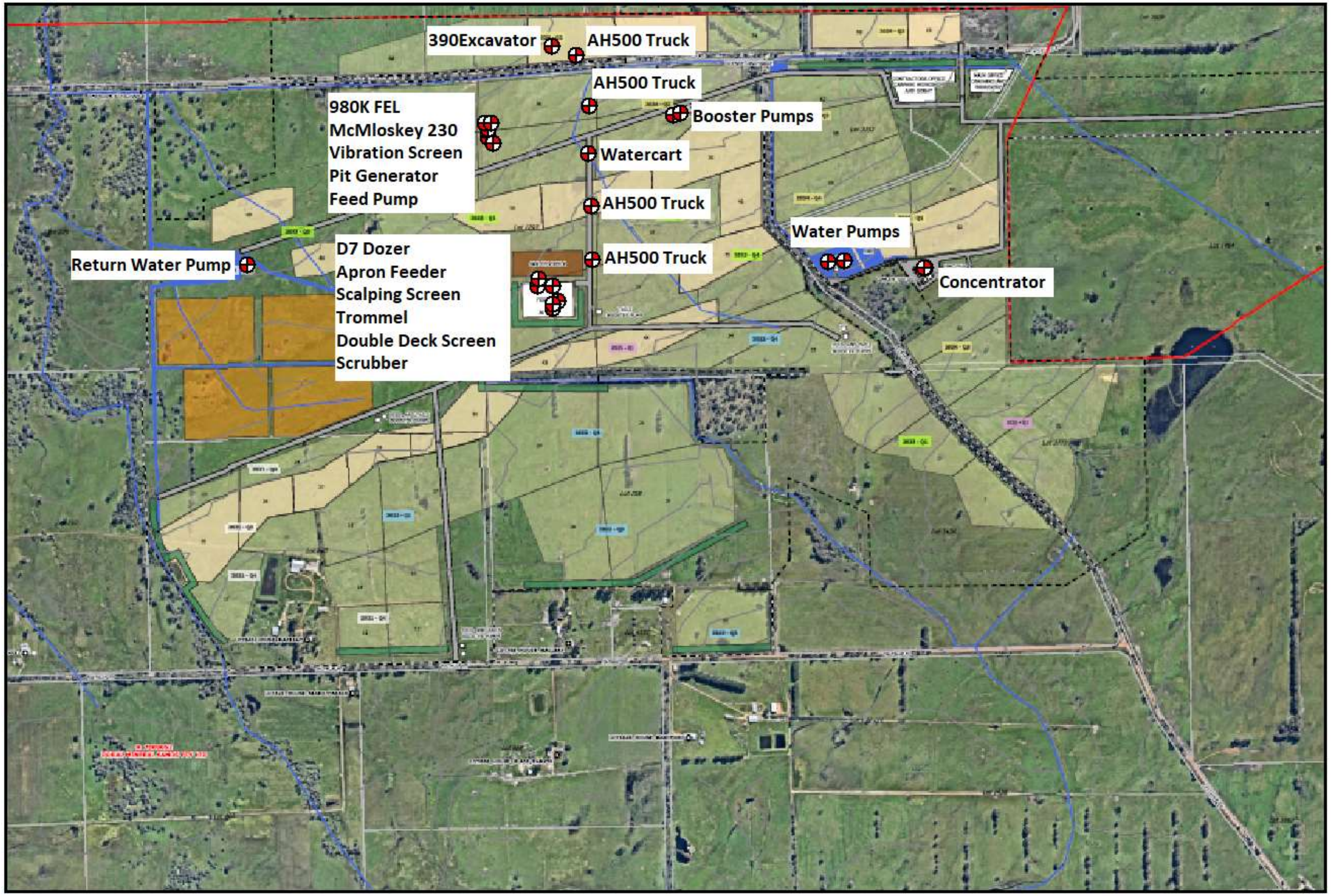

Figure 7: Assumed noise source locations for scenario 5 – Mining at Q2 2024.

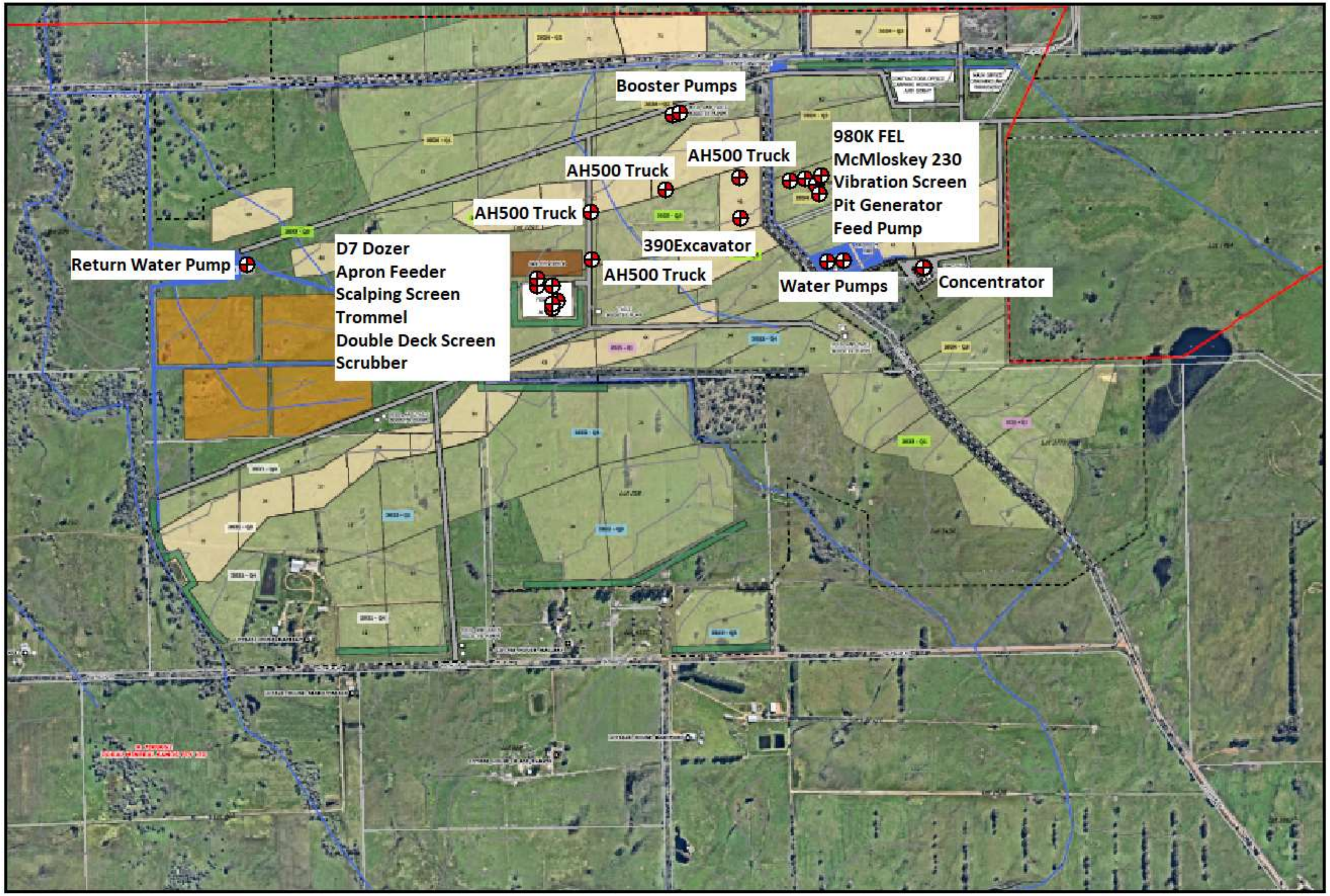

Figure 8: Assumed noise source locations for scenario 6 – Mining at Q4 2024.

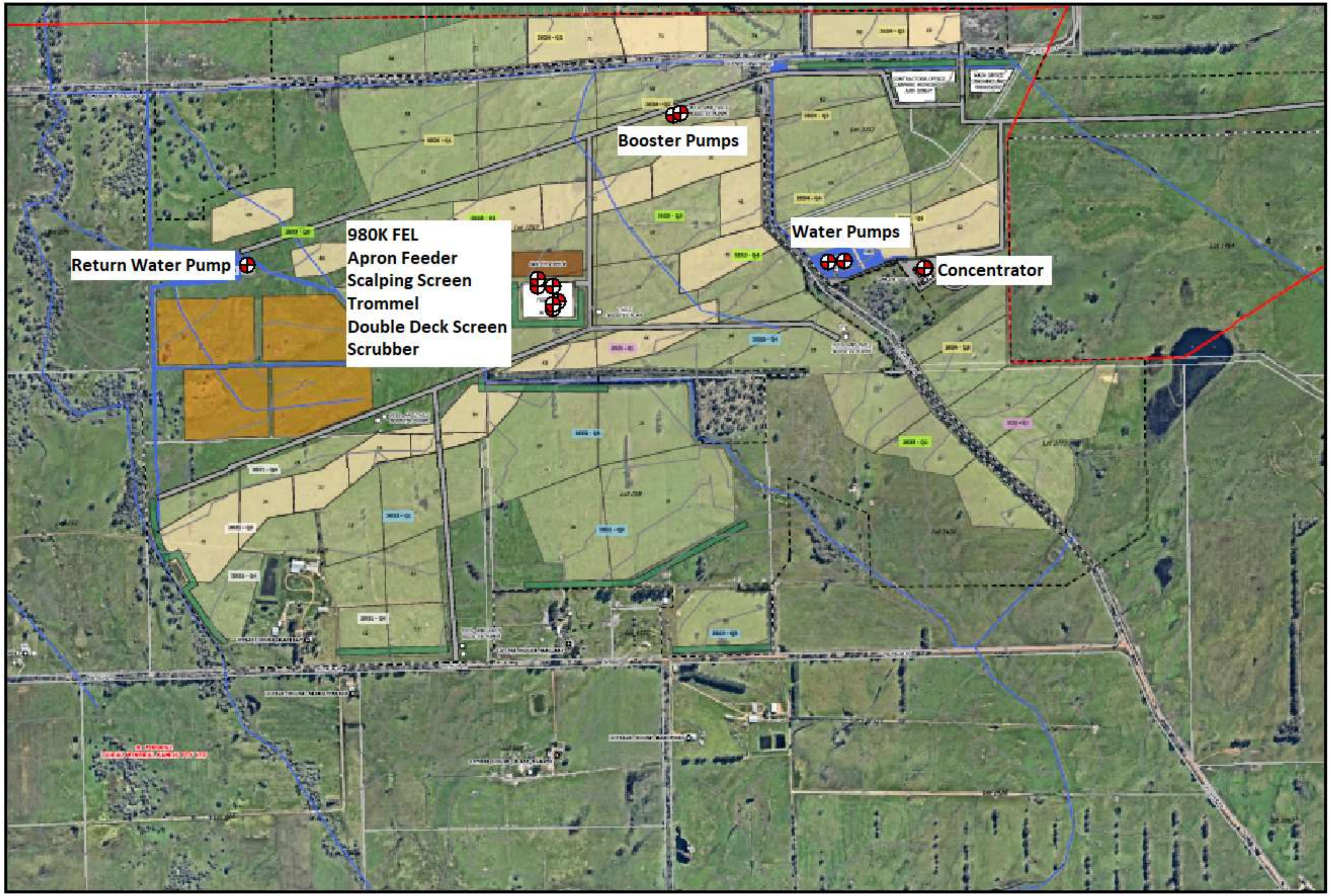

Figure 9: Assumed noise source locations for scenario 7 – Night Mining.

APPENDIX C POINT MODELLING RESULTS

Table C1: Predicted worst-case day-time noise levels in dB(A) for scenario 1.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 1								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	24.3	15.3	14.3	14.4	18.5	26.4	26.4	26.4	20.6
R2	23.6	15.9	15.4	15.5	21.5	27.7	27.7	27.7	21.8
R3	22.5	22.2	22.9	30.3	34.1	34.2	34.0	29.5	28.8
R4	30.4	34.3	36.4	40.8	41.5	40.8	39.7	32.6	36.7
R5	16.7	26.2	28.2	28.2	28.2	20.4	15.8	15.8	22.4
R6	26.7	26.7	26.7	20.9	14.4	14.2	14.7	22.5	20.9
R7	29.5	29.5	29.4	23.1	16.9	16.8	17.4	26.1	23.8
R8	33.3	33.5	33.4	32.0	22.1	20.5	20.6	25.0	27.8
R9	33.9	34.0	34.0	31.1	22.0	21.0	21.2	27.6	28.4
R10	35.2	35.3	35.3	32.7	23.5	22.3	22.5	28.7	29.8
R11	35.9	36.1	36.0	33.1	24.2	23.2	23.5	30.1	30.6
R12	32.1	32.1	30.9	21.2	19.2	19.2	23.1	31.8	26.5
R13	42.6	42.5	41.2	34.3	29.5	29.6	34.4	40.8	37.4
R14	41.2	41.1	39.7	30.2	27.8	28.1	34.2	40.8	35.9
R15	42.5	41.0	34.4	30.0	29.5	33.9	41.3	42.5	37.4
R16	39.0	38.5	31.8	26.6	26.2	28.4	37.4	38.9	33.9
R17	37.8	36.1	29.6	25.1	24.9	30.1	37.1	37.8	32.4
R18	22.6	17.8	11.0	10.7	11.1	19.2	22.5	22.4	16.6

Table C2: Predicted worst-case day-time noise levels in dB(A) for scenario 2.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 2								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	20.5	12.7	12.2	12.3	18.1	24.6	24.6	24.6	18.7
R2	19.5	13.5	13.3	13.7	21.2	25.7	25.7	25.8	19.9
R3	18.4	17.8	18.3	25.3	30.2	30.2	30.2	26.2	24.7
R4	27.8	28.4	32.5	39.2	39.6	39.5	38.2	29.4	34.8
R5	15.3	24.1	27.1	27.1	27.2	20.9	14.8	14.6	21.3
R6	28.3	28.3	28.3	22.8	15.8	15.6	15.8	22.7	22.4
R7	31.4	31.4	31.3	25.2	18.8	18.6	19.1	27.0	25.6
R8	34.5	35.2	35.2	34.7	25.2	22.8	22.8	24.9	29.8
R9	35.9	36.2	36.2	34.6	25.4	23.9	23.9	27.7	30.9
R10	37.3	37.7	37.7	36.6	27.4	25.6	25.6	28.7	32.6
R11	38.4	38.8	38.8	37.2	28.4	26.9	26.9	30.5	33.7
R12	34.4	34.4	33.0	23.3	21.8	21.9	26.2	34.2	28.8
R13	47.9	47.6	46.3	41.3	37.9	39.4	43.3	46.3	43.8
R14	45.6	45.3	43.9	35.7	34.4	35.5	40.2	45.2	41.0
R15	44.2	41.2	35.7	33.0	33.6	40.6	43.6	44.4	39.7
R16	40.9	39.4	32.5	28.9	28.8	32.9	39.8	40.9	35.9
R17	39.1	36.4	29.4	26.9	27.4	34.3	38.8	39.2	34.0
R18	22.4	14.6	10.0	9.9	10.7	20.6	22.1	22.1	16.2

Table C3: Predicted worst-case day-time noise levels in dB(A) for scenario 3.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 3								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	21.1	13.3	12.9	13.0	19.0	25.4	25.3	25.4	19.5
R2	20.0	14.1	13.9	14.4	22.3	26.5	26.5	26.5	20.6
R3	18.7	18.2	18.7	26.1	30.6	30.7	30.6	26.1	25.1
R4	27.6	28.3	32.9	39.1	39.4	39.2	37.5	28.8	34.6
R5	13.2	23.5	24.6	24.6	24.6	15.6	12.0	12.0	18.7
R6	25.4	25.4	25.4	21.4	13.2	12.7	12.8	18.5	19.4
R7	28.1	28.1	28.1	23.8	15.9	15.4	15.6	21.8	22.3
R8	30.0	30.5	30.5	30.3	20.4	18.0	18.0	20.2	24.8
R9	31.1	31.3	31.3	30.4	20.5	18.9	18.9	22.0	25.7
R10	31.9	32.3	32.3	31.6	21.7	19.8	19.8	22.6	26.7
R11	32.7	33.0	33.0	32.1	22.4	20.7	20.7	23.7	27.5
R12	31.6	31.6	31.4	22.2	18.9	18.9	20.7	30.6	25.9
R13	40.2	40.4	40.2	36.1	29.0	28.4	29.2	36.8	35.4
R14	39.7	39.8	39.5	33.9	28.1	27.8	29.1	37.8	34.7
R15	45.8	45.7	43.9	36.2	34.9	35.2	40.1	45.4	41.3
R16	40.6	40.5	38.0	29.5	28.6	28.8	34.8	40.4	35.6
R17	41.0	40.6	32.6	29.1	29.0	30.7	39.9	41.0	36.1
R18	22.9	15.3	10.4	10.3	11.0	20.0	22.7	22.7	16.8

Table C4: Predicted worst-case day-time noise levels in dB(A) for scenario 4.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 4								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	22.3	14.5	14.0	14.2	20.4	26.6	26.6	26.6	20.8
R2	21.0	15.3	15.1	15.7	24.2	27.7	27.7	27.6	21.9
R3	19.6	19.1	20.1	28.6	31.5	31.6	31.5	26.9	26.1
R4	28.9	29.6	34.8	40.2	40.5	40.4	38.3	30.0	35.7
R5	13.4	24.2	24.4	24.4	24.5	14.8	11.9	11.9	18.6
R6	23.4	23.3	23.4	19.4	11.2	10.8	11.0	17.2	17.4
R7	25.9	25.9	25.9	21.6	13.6	13.3	13.6	20.6	20.0
R8	28.0	28.2	28.2	27.5	17.6	15.9	15.9	19.0	22.6
R9	28.7	28.7	28.7	26.6	17.5	16.3	16.3	20.7	23.1
R10	29.5	29.7	29.7	27.8	18.7	17.3	17.4	21.5	24.1
R11	30.1	30.3	30.3	28.1	19.3	18.1	18.1	22.6	24.8
R12	29.1	29.1	29.0	20.7	16.5	16.4	18.2	28.1	23.3
R13	36.6	36.6	36.4	30.8	24.9	24.5	25.7	34.3	31.5
R14	36.1	36.2	35.8	29.8	24.1	23.8	25.6	35.0	30.9
R15	39.7	39.7	36.7	33.0	28.2	28.3	34.5	38.6	34.9
R16	36.7	36.6	33.8	27.9	24.4	24.5	30.4	35.6	31.4
R17	37.7	37.6	34.9	27.5	25.3	26.3	34.3	37.1	32.5
R18	23.2	17.1	10.9	10.7	11.0	18.2	23.2	23.2	17.3

Table C5: Predicted worst-case day-time noise levels in dB(A) for scenario 5.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 5								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	23.6	13.9	13.0	13.0	17.1	25.5	25.4	25.4	19.5
R2	22.6	14.7	14.2	14.3	20.0	26.7	26.7	26.7	20.8
R3	22.0	20.5	20.8	26.1	32.7	32.9	32.9	31.4	27.4
R4	40.9	40.9	42.0	48.0	49.8	49.9	49.4	44.5	46.1
R5	17.0	27.5	27.7	27.7	27.6	17.3	15.0	15.0	21.8
R6	24.0	24.0	24.0	17.6	11.5	11.4	11.7	19.2	18.0
R7	26.4	26.4	26.5	19.5	13.7	13.6	14.2	22.5	20.5
R8	29.3	29.3	29.3	27.5	17.8	16.6	16.6	21.0	23.6
R9	29.9	29.9	29.9	26.4	18.0	17.3	17.4	23.2	24.2
R10	30.7	30.8	30.8	27.7	19.0	18.2	18.3	23.8	25.1
R11	31.3	31.4	31.4	27.8	19.5	18.8	19.0	25.0	25.8
R12	29.5	29.5	29.4	19.1	16.9	16.9	19.1	29.4	23.8
R13	37.1	37.1	36.8	28.9	24.8	24.8	26.2	35.5	31.8
R14	36.6	36.6	36.1	26.9	24.0	24.0	26.2	36.1	31.2
R15	39.5	39.4	34.2	27.8	27.4	27.8	35.1	39.4	34.4
R16	36.3	36.2	31.2	24.3	23.8	24.1	31.1	36.2	30.9
R17	36.4	36.1	28.6	24.2	24.0	25.6	35.1	36.4	31.1
R18	21.8	15.6	9.7	9.6	9.9	17.1	21.8	21.7	15.8

Table C6: Predicted worst-case day-time noise levels in dB(A) for scenario 6.

Closest Residences	Worst-case Day-time Noise Levels in dB(A) for Scenario 6								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	24.6	14.9	13.9	13.9	17.9	26.4	26.4	26.4	20.6
R2	23.4	15.7	15.3	15.4	21.1	27.7	27.7	27.7	22.0
R3	22.5	22.0	22.3	29.0	34.3	34.4	34.4	30.1	29.0
R4	31.8	34.7	40.7	43.3	43.4	42.5	38.9	32.3	38.6
R5	13.9	24.8	24.8	24.8	24.9	14.6	12.2	12.2	18.9
R6	23.2	23.1	23.1	17.9	10.9	10.6	10.7	16.8	17.2
R7	25.7	25.7	25.7	20.0	13.2	13.0	13.3	20.1	19.8
R8	27.7	27.7	27.7	27.4	16.8	15.3	15.3	18.0	22.0
R9	28.3	28.3	28.3	26.5	16.8	15.7	15.7	19.9	22.6
R10	29.1	29.2	29.2	27.8	18.0	16.8	16.8	20.5	23.6
R11	29.8	29.9	29.9	28.0	18.5	17.4	17.4	21.6	24.3
R12	29.1	29.1	29.0	19.2	16.5	16.5	18.3	28.7	23.3
R13	36.4	36.4	36.2	29.3	24.1	24.0	25.0	33.7	31.1
R14	36.2	36.2	35.9	27.5	23.8	23.8	25.5	35.1	30.9
R15	39.5	39.4	35.9	28.4	27.5	27.8	34.3	39.3	34.4
R16	36.3	36.2	33.0	24.8	23.9	24.1	30.2	36.1	30.9
R17	36.8	36.5	31.4	25.0	24.6	25.8	34.4	36.7	31.5
R18	22.7	17.5	10.6	10.3	10.6	17.3	22.7	22.7	16.7

Table C7: Predicted worst-case night-time noise levels in dB(A) for scenario 7.

Closest Residences	Worst-case Night-time Noise Levels in dB(A) for Scenario 6								
	N	NE	E	SE	S	SW	W	NW	Calm
R1	21.4	14.1	11.6	12.9	19.5	21.3	21.3	21.3	21.4
R2	22.5	14.8	12.9	14.7	22.5	22.6	22.6	22.6	22.6
R3	20.7	18.9	21.0	27.1	28.2	28.2	28.2	27.0	27.9
R4	29.0	30.9	34.5	37.1	37.1	37.0	36.4	31.5	36.5
R5	15.7	22.3	22.2	22.2	22.2	18.1	13.2	12.6	22.3
R6	19.0	19.0	19.0	19.2	11.2	9.1	10.9	18.8	19.3
R7	21.7	21.7	21.7	21.4	13.8	11.9	13.8	21.5	21.7
R8	24.9	24.9	24.9	24.9	18.9	15.7	16.2	20.4	24.7
R9	25.1	25.1	25.1	25.0	18.6	15.9	16.8	22.1	24.9
R10	26.1	26.1	26.1	26.0	19.8	17.0	17.8	22.7	25.8
R11	26.7	26.7	26.7	26.5	20.3	17.6	18.5	23.7	26.4
R12	25.0	25.0	25.0	20.2	16.0	15.8	19.2	25.0	24.8
R13	33.2	33.2	33.2	30.9	25.7	24.5	27.0	32.8	32.7
R14	32.5	32.5	32.5	28.7	24.5	24.0	27.1	32.4	32.0
R15	35.8	35.8	34.7	29.7	27.5	29.3	35.0	35.8	35.2
R16	32.3	32.3	31.7	25.8	23.5	25.2	31.5	32.3	31.8
R17	32.5	32.5	29.3	25.0	23.9	26.7	32.0	32.5	32.0
R18	17.5	16.8	9.3	7.6	9.6	17.4	17.5	17.5	17.5

APPENDIX D NOISE CONTOURS

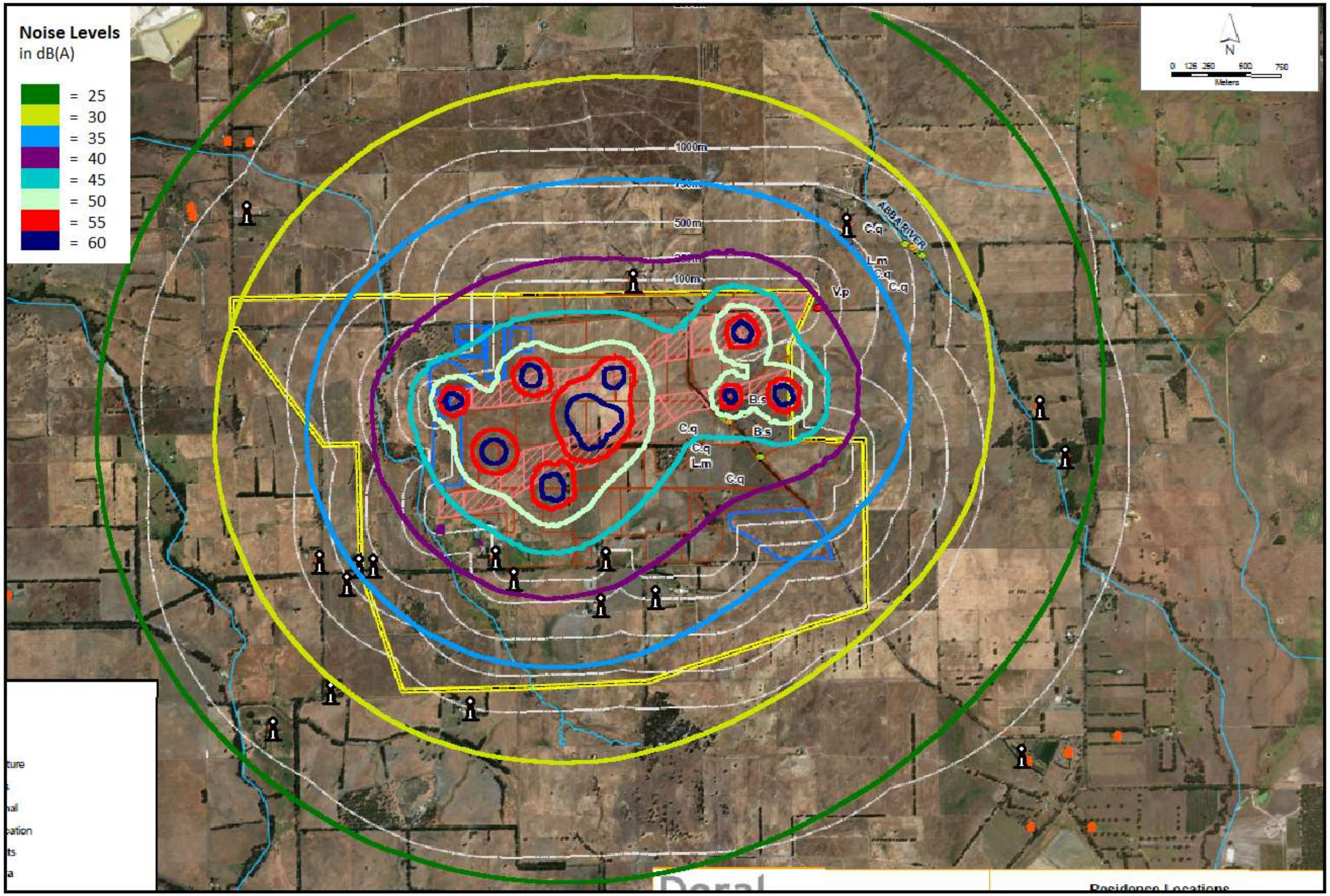

Figure 10: Worst-case day-time noise contours for scenario 1.

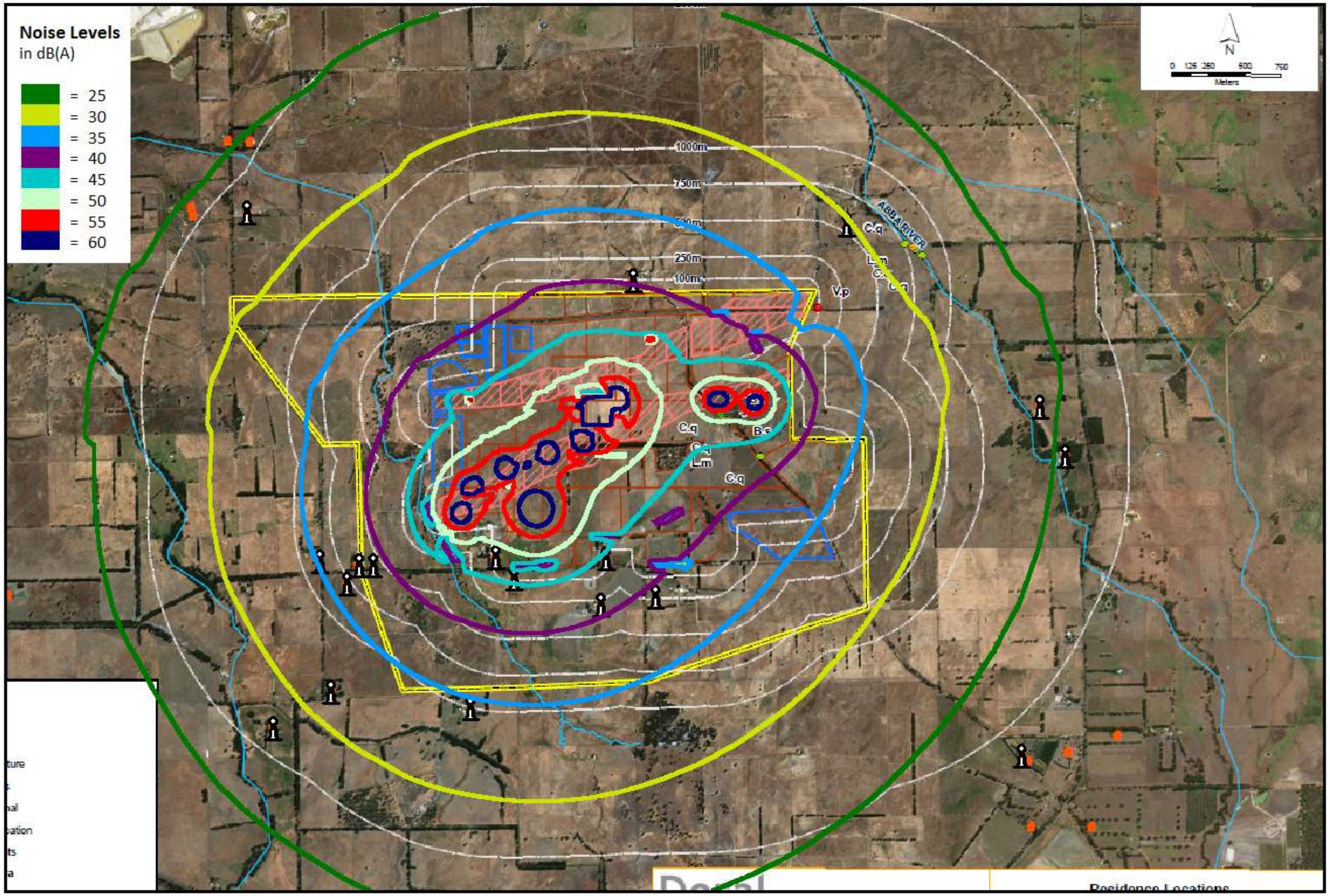

Figure 11: Worst-case day-time noise contours for scenario 2.

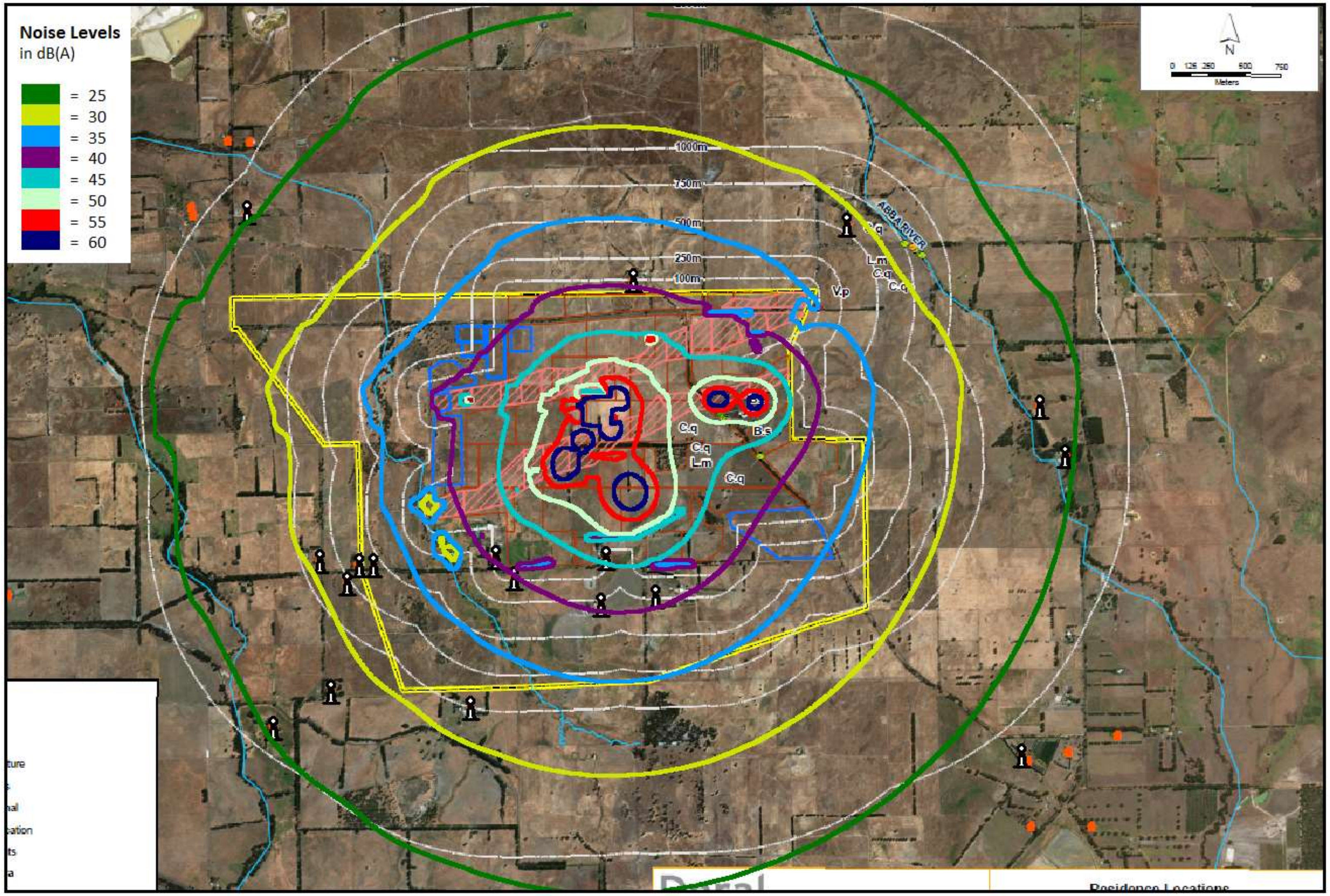

Figure 12: Worst-case day-time noise contours for scenario 3.

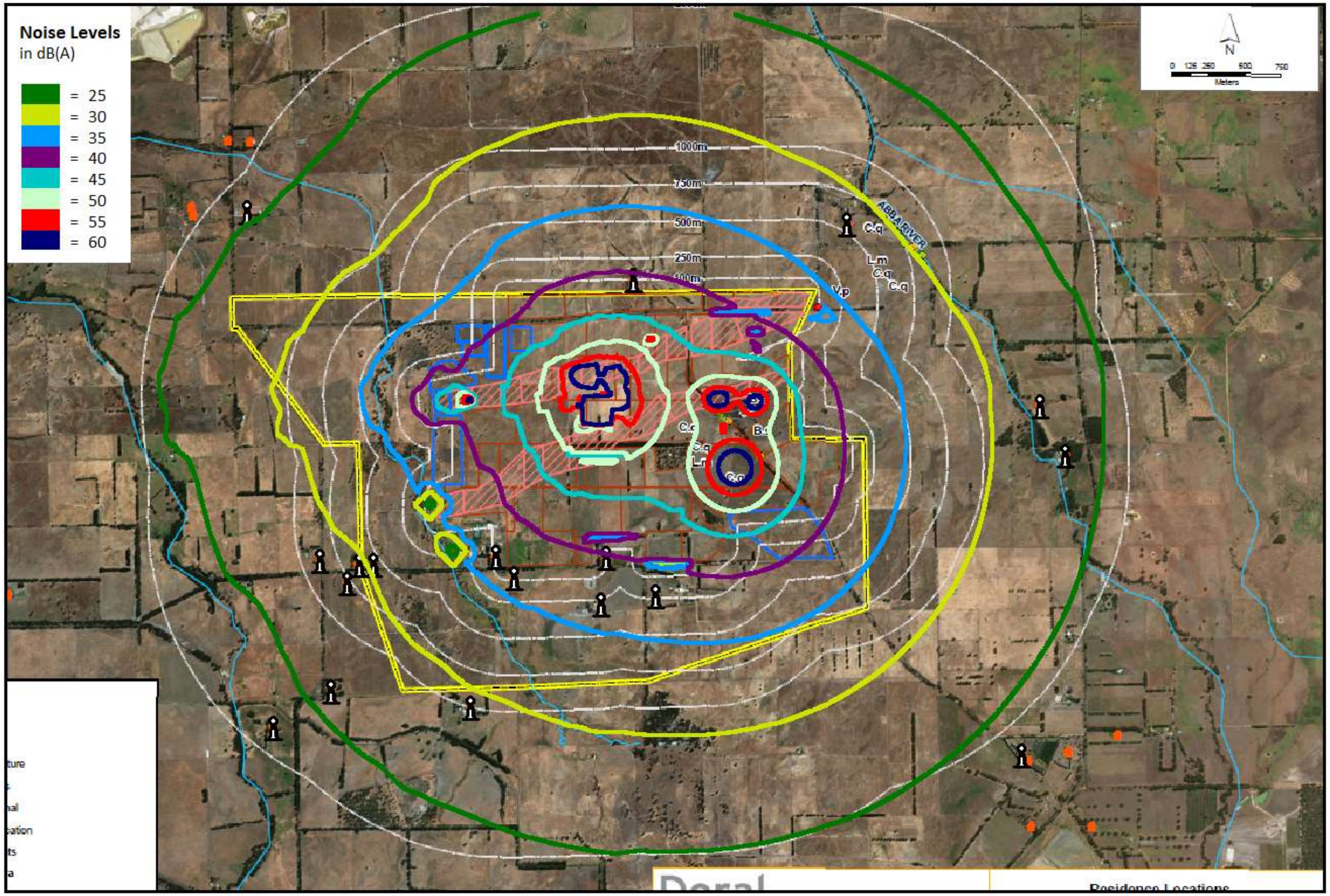

Figure 13: Worst-case day-time noise contours for scenario 4.

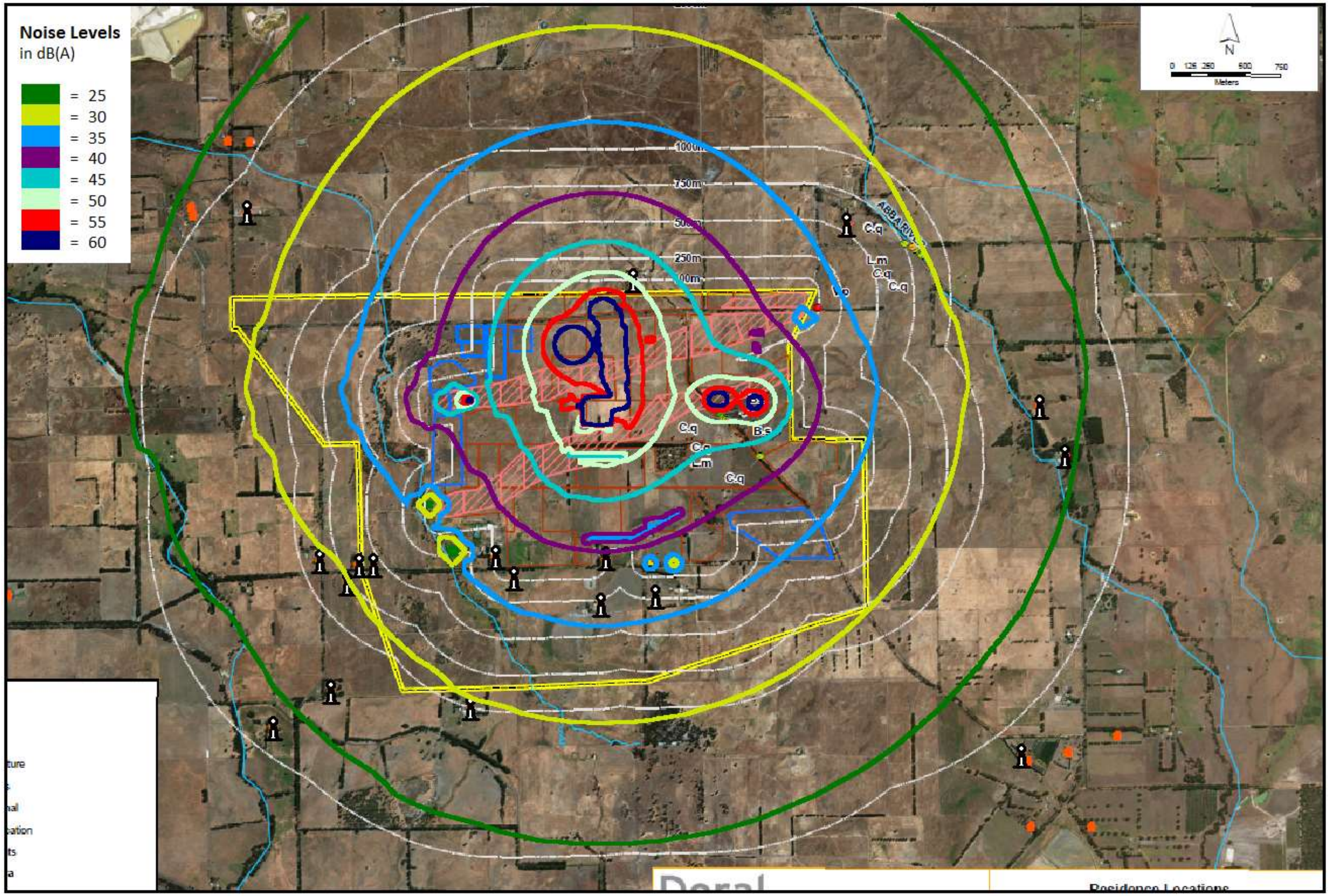

Figure 14: Worst-case day-time noise contours for scenario 5.

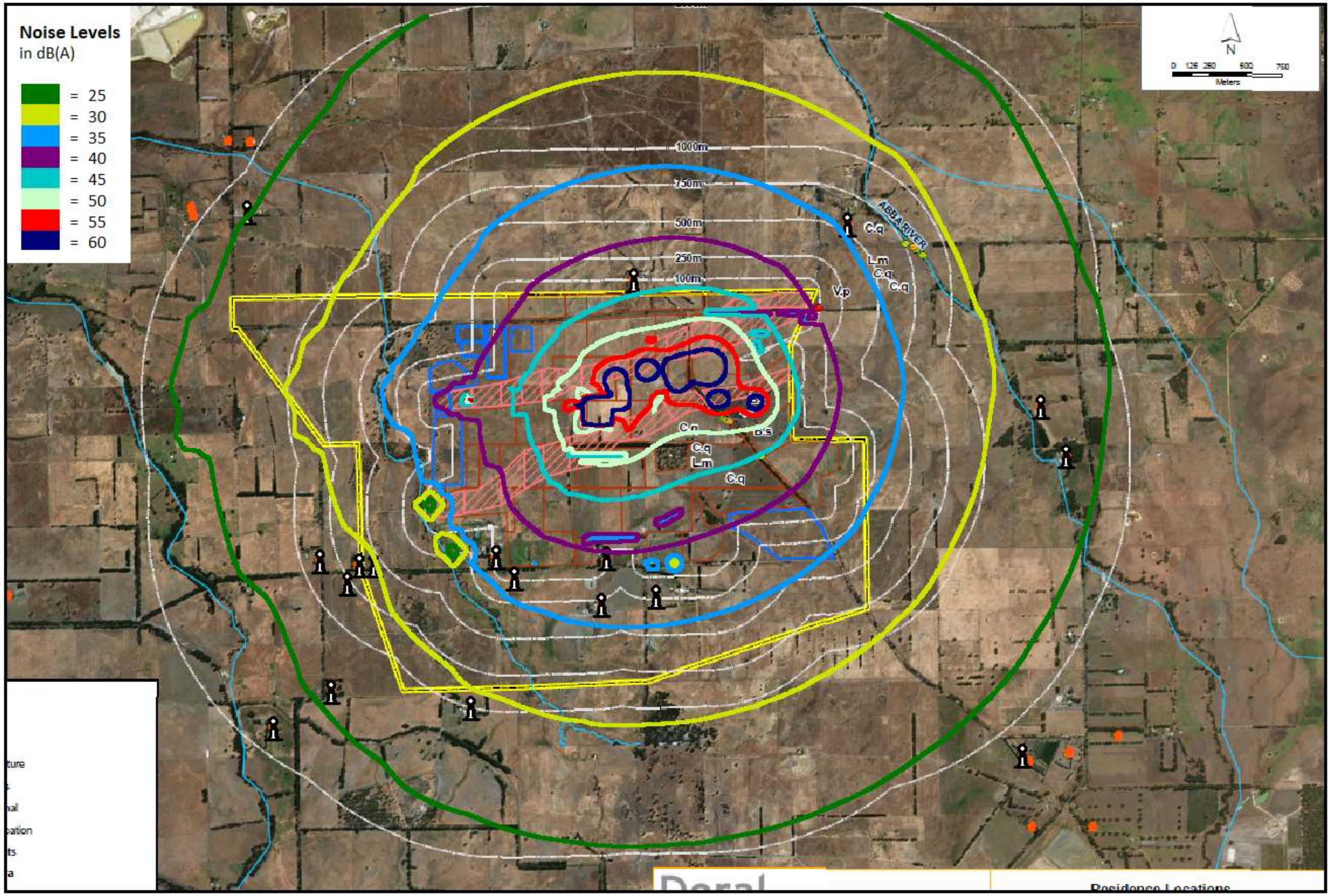

Figure 15: Worst-case day-time noise contours for scenario 6.

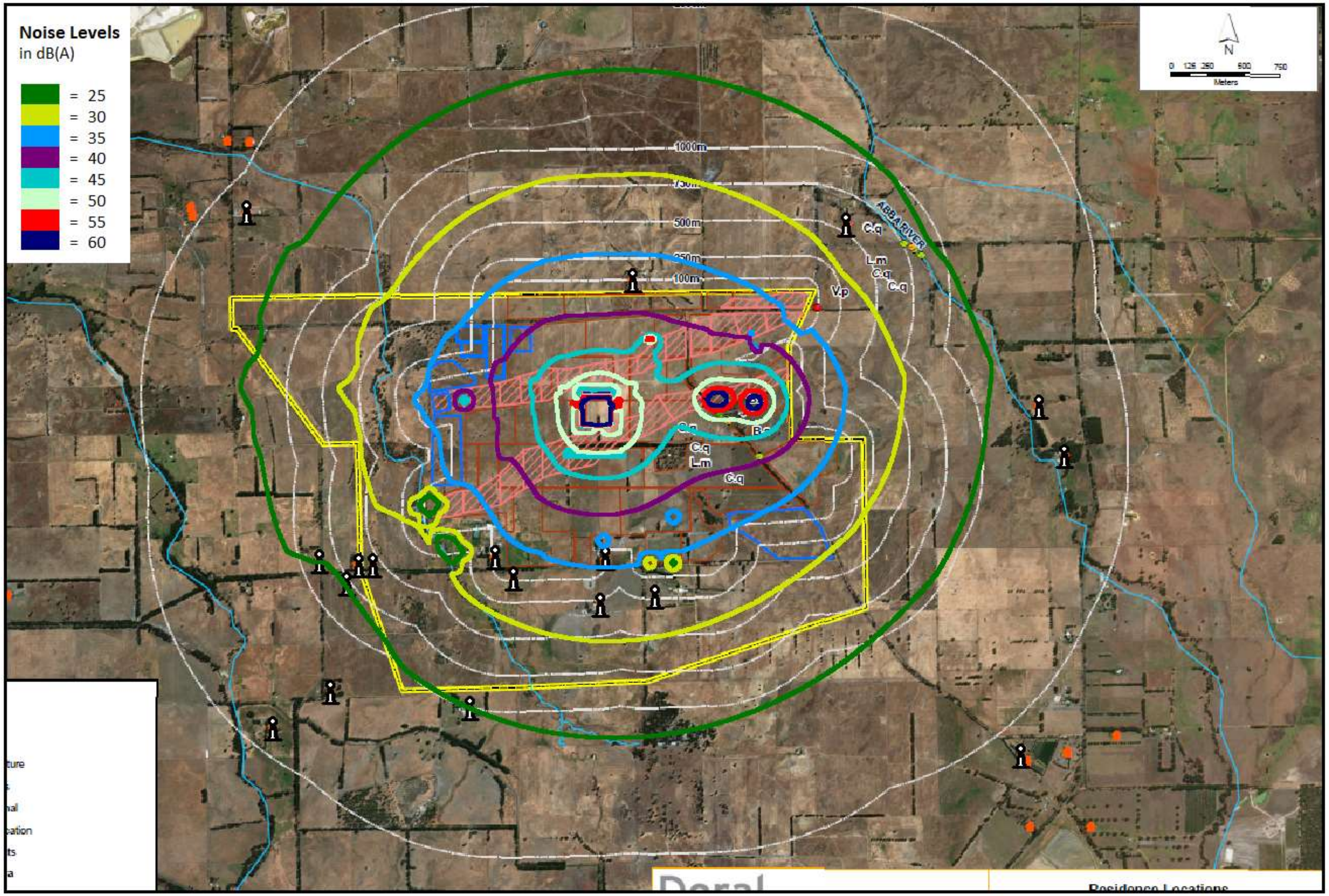

Figure 16: Worst-case night-time noise contours for scenario 7.

APPENDIX E TONALITY ANALYSIS

Table E1: Tonality assessment for scenario 1.

Scenario 1 – Day-time Construction				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
R4	Hitachi AH500 Trucks	39.2	No	Hitachi AH500 and Dozers are the dominant noise sources. They generate similar levels. Any tonal noise components will be masked.
	Dozers	36.6		
	Watercart	30.1		
R10	Dozers	32.4	Yes	Dozers are the most dominant source and radiate tonal components.
	Grader	28.5		
	Hitachi AH500 Trucks	26.9		
R11	Dozers	33.1	Yes	Dozers are the most dominant source and radiate tonal components.
	Grader	29.1		
	Hitachi AH500 Trucks	27.5		
R13	Grader	38.7	No	Dozers and Grader are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	Dozers	38.5		
	Hitachi AH500 Trucks	32.3		
R14	Grader	37.6	No	Grader and Dozers are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	Dozers	36.6		
	Hitachi AH500 Trucks	31.6		
R15	Grader	39.0	No	Grader and Dozers are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	Dozers	36.6		
	Watercart	33.6		
R16	Grader	35.0	No	Grader and Dozers are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	Dozers	33.6		
	Watercart	29.6		
R17	Dozers	32.5	No	Multiple dominant sources generate similar levels. Any tonal noise components of individual sources will be masked.
	Grader	32.5		
	Hitachi AH500 Trucks	31.8		

Table E2: Tonality assessment for scenario 2.

Scenario 2 – Day-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
R4	Hitachi AH500 Trucks	34.4	No	Multiple dominant sources generate similar levels. Any tonal noise components of individual sources will be masked.
	Vibration Screens	34.3		
	Scrubber	31.4		
R8	Hitachi AH500 Trucks	30.8	No	Hitachi AH500 and Excavator are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	CAT390 Excavator	28.4		
	Vibration Screens	27.3		
R9	Hitachi AH500 Trucks	31.7	No	Hitachi AH500 and Excavator are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	CAT390 Excavator	29.8		
	Vibration Screens	28.4		
R10	Hitachi AH500 Trucks	33.3	No	Hitachi AH500 and Excavator are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	CAT390 Excavator	31.8		
	Vibration Screens	29.5		
R11	Hitachi AH500 Trucks	34.2	No	Hitachi AH500 and Excavator are the dominant sources and radiate similar levels. Their tonal noise components will be masked.
	CAT390 Excavator	33.2		
	Vibration Screens	30.4		
R13	Vibration Screens	41.9	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components from other sources will be masked.
	Hitachi AH500 Trucks	41.2		
	McCloskey R230	40.7		
R14	Vibration Screens	40.1	No	Screens are the most dominant source and do not radiate tonal components. Any tonal noise components from other sources will be masked.
	McCloskey R230	38.9		
	AH500 Trucks	38.4		
R15	Vibration Screens	39.1	No	Screens are the most dominant source and

Scenario 2 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
	McCloskey R230	37.1		do not radiate tonal components. Any tonal noise components from other sources will be masked.
	Hitachi AH500 Trucks	37.1		
R16	Vibration Screens	35.4	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components from other sources will be masked.
	Hitachi AH500 Trucks	34.2		
	McCloskey R230	33.5		
R17	Vibration Screens	33.2	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	32.8		
	McCloskey R230	30.3		

Table E3: Tonality assessment for scenario 3.

Scenario 3 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
R4	Vibration Screens	34.3	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	34.0		
	Scrubber	31.4		
R13	Hitachi AH500 Trucks	34.9	No	AH500 and Screens are the dominant sources and radiate similar levels, which are much lower than the overall level. Any tonal noise components will be masked.
	Vibration Screens	33.6		
	Dozer	30.9		
R14	Hitachi AH500 Trucks	34.5	No	AH500 and Screens are the dominant sources and radiate similar levels, which are much lower than the overall level. Any tonal noise components will be masked.
	Vibration Screens	33.5		
	Dozer	30.6		
R15	Vibration Screens	41.0	No	Screens and McCloskey radiate similar

Scenario 3 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
	McCloskey R230	39.4		levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	37.3		
R16	Vibration Screens	35.3	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	McCloskey R230	33.4		
	Hitachi AH500 Trucks	33.4		
R17	Vibration Screens	36.1	No	Screens and McCloskey are the dominant sources and radiate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	McCloskey R230	34.4		
	Hitachi AH500 Trucks	32.7		

Table E4: Tonality assessment for scenario 4.

Scenario 4 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
R4	Hitachi AH500 Trucks	36.7	No	AH500 and Screens are the dominant sources and radiate similar levels. Any tonal noise components will be masked.
	Vibration Screens	34.3		
	Scrubber	31.4		
R13	Vibration Screens	31.2	No	Multiple dominant sources generate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	31.1		
	Hitachi AH500 Trucks	28.4		
R14	Vibration Screens	30.7	No	Multiple dominant sources generate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	30.3		
	Hitachi AH500 Trucks	28.6		
R15	Vibration Screens	34.8	No	Screens and Dozer are the dominant sources

Scenario 4 – Day-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
	Dozer	33.3		and radiate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	31.7		
R16	Vibration Screens	31.5	No	Multiple dominant sources generate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	29.8		
	Hitachi AH500 Trucks	28.7		
R17	Vibration Screens	33.1	No	Screens are the dominant source, but do not radiate tonal components. Any tonal noise components will be masked.
	McCloskey R230	30.1		
	Hitachi AH500 Trucks	28.7		

Table E5: Tonality assessment for scenario 5.

Scenario 5 – Day-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
R4	Hitachi AH500 Trucks	47.6	Yes	AH500 is the most dominant sources, and radiates tonal components.
	CAT390 Excavator	41.5		
	Vibration Screens	39.1		
R13	Vibration Screens	31.5	No	Multiple dominant sources generate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	31.2		
	Hitachi AH500 Trucks	28.8		
R14	Vibration Screens	30.7	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	30.3		
	Hitachi AH500 Trucks	29.9		
R15	Vibration Screens	33.7	No	Multiple dominant sources generate similar

Scenario 5 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
	Dozer	33.0		levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	33.0		
R16	Vibration Screens	30.2	No	Multiple dominant sources generate similar levels. Screens are the most dominant source and do not radiate tonal components. Any tonal noise components will be masked.
	Dozer	30.1		
	Hitachi AH500 Trucks	29.8		
R17	Vibration Screens	30.1	No	Multiple dominant sources generate similar levels. Any tonal noise components will be masked.
	Hitachi AH500 Trucks	30.1		
	Dozer	29.9		

Table E6: Tonality assessment for scenario 6.

Scenario 6 – Day-time Mining Operations				
Receivers	Contributor	Level	Tonal	Comments
R4	Hitachi AH500 Trucks	39.3	No	AH500 and Screens are the dominant sources and radiate similar levels. Any tonal noise components will be masked.
	Vibration Screens	36.9		
	McCloskey R230	33.5		
R13	Vibration Screens	30.9	No	Multiple dominant sources generate similar levels. Any tonal noise components will be masked.
	Dozer	30.9		
	Hitachi AH500 Trucks	29.2		
R14	Vibration Screens	30.3	No	Multiple dominant sources generate similar levels. Any tonal noise components will be masked.
	Dozer	30.3		
	Hitachi AH500 Trucks	30.3		
R15	Vibration Screens	33.7	No	Multiple dominant sources generate similar

Scenario 6 – Day-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
	Hitachi AH500 Trucks	33.7		levels. Any tonal noise components will be masked.
	Dozer	33.0		
R16	Hitachi AH500 Trucks	30.7	No	Multiple dominant sources generate similar levels. Any tonal noise components will be masked.
	Vibration Screens	30.2		
	Dozer	29.8		
R17	Hitachi AH500 Trucks	31.2	No	Multiple dominant sources generate similar levels. Any tonal noise components will be masked.
	Vibration Screens	30.5		
	Dozer	29.9		

Table E7: Tonality assessment for scenario 7.

Scenario 7 – Night-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
R4	Screens	33.7	No	Screens and Scrubber are the dominant sources and radiate similar levels. Screens do not radiate tonal components. Any tonal noise components will be masked.
	Scrubber	31.7		
	Trommel	27.5		
R13	Screens	30.5	No	Screens are the most dominant sources and do not radiate tonal components.
	Apron Feeder	25.6		
	Trommel	24.4		
R14	Screens	29.8	No	Screens are the most dominant sources and do not radiate tonal components.
	Apron Feeder	24.9		
	Trommel	23.7		
R15	Screens	33.0	No	Screens are the most dominant sources and

Scenario 7 – Night-time Mining Operations				
Receivers	**Contributor**	**Level**	**Tonal**	**Comments**
	Apron Feeder	27.6		do not radiate tonal components.
	Trommel	27.3		
R16	Screens	29.4	No	Screens are the most dominant sources and do not radiate tonal components.
	Apron Feeder	24.3		
	Trommel	23.4		
R17	Screens	29.4	No	Screens are the most dominant sources and do not radiate tonal components.
	Apron Feeder	24.2		
	Trommel	23.5		