ENVIRONMENTAL NOISE IMPACT ASSESSMENT

OF

SAND AND LIMESTONE EXTRACTIONS

AT

LOT 9003 MATHER DRIVE NEERABUP

18 June 2020

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Environmental Noise Impact Assessment

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EXECUTIVE SUMMARY

Acoustic Engineering Solutions (AES) has been commissioned by Urban Resources Pty Ltd to undertake an environmental noise impact assessment for the proposed sand and limestone extractions at Lot 9003 Mather Drive Neerabup. The aim of this assessment is to determine whether or not the noise emissions from the proposed operations would comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

An acoustic model is created, and eight worst-case operational scenarios are modelled to represent the proposed worst-case mining activities at different stages. The proposed operations are incorporated with the following noise control measures:

- The fixed plant operates at the pit floor.
- The east parts of stages 1, 2 and 5 have shallow sand deposit. For these areas, the crusher plant will not operate.
- For stage 1, the proposed topsoil bund on the southern boundary should be built at least 3m high in the west part and 3.5m in the east part.
- When mined in the eastern (one third) part of stage 1, the screening plant should be located at locations at least 100m away from the southern pit edge and 170m from the eastern pit edge (the vegetation strip).
- For the eastern (one third) part of stage 2, mining should start from west toward east. The screening plant should be located at no more than 30m behind sand face.
- For stages 3 and 4, mining should start at the middle of the pit. When mined toward east, both the crushing plant and the screening plant should be located at no more than 40m behind sand face. When mined toward west, the crushers and the screening plant should be located at no more than 70m behind sand face.
- For stage 5, it should be mined from south toward north. The crushers and the screening plant should be located at no more than 35m behind sand face. When mined close to the west pit edge, the crushers and the screening plant should also be located at no more than 70m behind the west sand face. When mined in the east part (more than 180m from the east pit edge), the crushers and the screening plant should also be located at no more than 35m behind the east sand face.

The subject site is located within the Neerabup Industrial Area. Four point receivers are selected to represent the closest workshop/office areas in the neighbouring industrial premises. Noise levels are predicted for the worst-case meteorological conditions. The predicted worst-case noise levels are adjusted for their potential tonality according to the Regulations, and then assessed against the assigned noise levels set by the Regulations. The compliance assessment concludes that full compliance is achieved for the proposed sand and limestone extractions of stages 1 to 5.

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1.0 INTRODUCTION

Urban Resources Pty Ltd (Urban Resources) proposes the sand and limestone extractions at Lot 9003 Mather Drive Neerabup. Acoustic Engineering Solutions (AES) has been commissioned by Urban Resources to undertake the environmental noise impact assessment of the proposed operations. The objective of this assessment is to determine whether or not the noise emissions from the proposed operations would comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

The subject site is located within the Neerabup Industrial Area, as shown in Figure 1 in APPENDIX A. The extraction activities are proposed in five stages as shown in Figure 2. A 20 metre vegetation strip is reserved on the boundary shown as green in Figure 2 and 2-metre high topsoil bunds are proposed on the 20 metre vegetation strips.

The extractions will operate the following two fixed plant onsite:

- The screening plant:
  - A Finlay 683 screen; and
  - Terex FM120 plant; and
  - A 100kva Generator.
- The crushing plant:
  - A Mcloskey J50 jaw crusher; and
  - A Kleenman Evo1100 Jaw crusher; and
  - A Finlay 693 screen; and
  - Edge 24 metre stockpiling conveyor.

The fixed plant will operate at the finished levels.

The mobile equipment on site will include a Cat D10R Dozer, two Komatsu 470 Front End Loaders, a Cat 740 watercart and a Volvo 48T Excavator.

The operation hours are proposed between 6am and 6pm on Monday to Saturday excluding public holidays.

2.0 NOISE CRITERIA

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".

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)[1]		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
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	60 + Influencing factor
	1900 to 2200 hours all days	40 + Influencing factor	50 + Influencing factor	60 + 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

For highly noise sensitive premises, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on road classification and land use zonings within circles of 100 metres and 450 metres radius from the noise receiver locations.

[1] Assigned level L_{A1} is the A-weighted noise level not to be exceeded for 1% of a delegated assessment period.
Assigned level L_{A10} is the A-weighted noise level not to be exceeded for 10% of a delegated assessment period.
Assigned level L_{Amax} is the A-weighted noise level not to be exceeded at any time.

2.1 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

2.2 INFLUENCING FACTORS

The subject site is located within the Neerabup Industrial Area. Residential premises are more than 1km away from the site boundaries.

Four point receivers R1 to R4 are selected at the neighbouring industrial premises, as shown in Figure 3 in APPENDIX A. No calculation of influencing factors is required for the selected industrial receivers.

3.0 NOISE MODELLING

3.1 METHODOLOGY

An acoustic model is developed using SoundPlan v8.0 program, and the CONCAWE[2,3] prediction algorithms are selected for this study. The acoustic model is used to predict worst-case noise levels at point receivers and generate worst-case noise contours for the areas surrounding the subject site.

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

3.2 INPUT DATA

3.2.1 Topography

The ground contours for the pits, subject site and surrounding area are provided by Urban Resources in AUTO-CAD dxf format. These ground contours were amended to incorporate details of mining pits and topsoil bunds at different stages.

The ground is assumed to be absorptive for the subject site and bushlands, and to have an average absorptive coefficient of 0.6 for industrial areas.

Existing buildings and sheds in neighbouring industrial premises are digitised into the acoustic model. No boundary fences are considered.

3.2.2 Noise Sensitive Premises

Four (4) point receivers are selected at the workshop/office areas of the neighbouring industrial premises, as shown in Figure 3 in APPENDIX A.

R1: represents a future industrial site.

R2: represents Wesbeam.

R3: represents Neerabup Power Station.

R4: represents Arise Racing Pty Ltd.

[2] 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.

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

3.2.3 Source Sound Power Levels

Table 3-1 presents the overall source sound power levels, which are calculated from the information provided by Urban Resources. The sound power spectrum shapes are obtained from the AES database for similar equipment.

Table 3-1: Sound power levels

Equipment	Overall Sound Power Level in dB(A)
Finlay 683 Screen	114
Finlay 693 Screen	115
Edge 24m Slewing Stacker RTS 80	109
Terex FM120 Plant	107
100 KVA Generator	101
McCloskey J50 Jaw Crusher	115
Kleenman Evo1100 Jaw Crusher	116
Cat D10R Dozer	109
Komatsu 470 Front End Loader	108
Cat 740 Watercart	107
Volvo 48T Excavators	99

3.3 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[4] are assumed, as shown in Table 3-2.

[4] 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.

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

3.4 NOISE MODELLING SCENARIOS

Urban Resources advised that:

- The sand and limestone extractions are progressed in five stages.
- The operation hours are between 6am and 6pm on Monday to Saturday excluding public holidays.
- A 20 metre vegetation strip is reserved on the boundary shown as thick green lines in Figure 2 in APPENDIX A and 2m high topsoil bunds (shown as yellow lines) will be built inside the vegetation strip.
- The extraction depth ranges from 2m to 10m.
- The fixed plant operates at the pit floor.
- The following fixed plant and mobile equipment will operate on site:
  - The screening plant; and
  - The crushing plant; and
  - Mobile equipment of a Cat D10R Dozer, two Komatsu 470 Front End Loaders, a Cat 740 watercart and a Volvo 48T Excavator.
- The east parts of stages 1 and 2 have shallow sand deposit. For both of the stages (1 and 2) the crusher will only be used in the western third of the area. The eastern side will only have the screening plant being used.

Based on the provided information, the following operational scenarios are modelled to represent the worst-case operational activities:

Scenario 1: represents the worst-case operations at the western part of stage 1.

Scenario 2: represents the worst-case operations at the eastern part of stage 1.

Scenario 3: represents the worst-case operations at the eastern part of stage 2.

Scenario 4: represents the worst-case operations at the south-eastern part of stage 3.

Scenario 5: represents the worst-case operations at the south-western part of stage 3.

Scenario 6: represents the worst-case operations at the south-eastern part of stage 4.

Scenario 7: represents the worst-case operations at the north-western part of stage 5.

Scenario 8: represents the worst-case operations at the north-eastern part of stage 5.

All items of the mobile equipment are assumed to operate at the same level as the fixed plant for scenarios 1 to 3 but at middle levels of the sand layers for the other scenarios.

3.4.1 Noise Control and Recommendations

Urban Resources wants to find the conditions for compliant operations. To do so, several modelling exercises were undertaken for each of stages 1 to 5.

Preliminary modelling results indicate that full compliance is achieved for the proposed activities without any restrictions on the locations of the crushers and the screening plant at:

- The western (two third) part of stage 2.
- The north-eastern part of stage 4.
- The southern middle part of stage 5.

To achieve full compliance for the operations on the other stages/areas, the following noise control measures are recommended:

- For stage 1 (scenarios 1 and 2), the proposed topsoil bund on the southern vegetation strip needs to be increased to 3m high in the west part and 3.5m in the east part, as shown in Figure 2 in APPENDIX A.
- For scenario 2, the screening plant should be located at locations at least 100m away from the southern pit edge and 170m from the eastern pit edge.
- For the eastern (one third) part of stage 2, mining should start from west toward east. The screening plant should be located at no more than 30m behind sand face.
- For stage 3, mining should start at the middle of the pit. When mined toward east (scenario 4), the crushers and the screening plant should be located at no more than 40m behind sand face. When mined toward west (scenario 5), the crushers and the screening plant should be located at no more than 70m behind sand face.
- For stage 4, mining should start at the middle of the pit. When mined toward west, the crushers and the screening plant should be located at no more than 70m behind sand face. When mined toward south-east (scenario 6), the crushers and the screening plant should be located at no more than 40m behind sand face.
- For stage 5, it should be mined from south toward north. The crushers and the screening plant should be located at no more than 35m behind sand face. When mined close to the west pit edge, the crushers and the screening plant should also be located at no more than 70m behind the west sand face. When mined in the east part (more than 180m from the east pit edge), the crushers and the screening plant should be located at no more than 35m behind the east sand face.
  In the east part (within 180m from the east pit edge) of stage 5, the sand deposit is shallow. Similar to the east parts of stages 1 and 2, the crusher should not operate. Only the screening plant operates with the mobile equipment.

4.0 MODELLING RESULTS

4.1 POINT CALCULATIONS

Table 4-1 presents the predicted worst-case noise levels in dB(A) at the selected receivers for the worst-case operational scenarios incorporated with the recommended noise control measures stated in section 3.4.1. The predicted day and night-time noise levels are similar with differences of less than 0.4 dB. The highest noise level of 58.1 dB(A) is predicted at R2 for scenario 2.

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

Receivers	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Day-time Noise Levels in dB(A)								
R1	26.9	38.1	35.1	48.6	47.5	34.9	27.0	27.8
R2	50.3	58.1	49.4	33.9	41.8	27.3	31.1	46.9
R3	44.7	48.9	46.4	29.3	37.2	23.1	41.0	49.6
R4	45.5	37.2	38.5	41.0	40.8	47.2	48.0	40.9
Night-time Noise Levels in dB(A)								
R1	26.9	38.3	35.5	48.2	47.4	34.7	27.3	28.2
R2	50.3	57.9	49.4	34.1	42.0	27.4	31.5	47.0
R3	44.9	48.8	46.4	29.6	37.6	23.3	41.3	49.6
R4	45.6	37.4	38.7	41.3	41.1	47.3	47.9	41.1

4.2 NOISE CONTOURS

Figure 4 to Figure 11 in APPENDIX B present the worst-case day-time noise level contours at 1.5m above the ground. These noise contours represent the worst-case day-time noise propagation envelopes, i.e., worst-case propagation in all directions simultaneously.

Table 4-1 indicates the predicted day and night-time noise levels are very similar. Therefore, the noise contours in Figure 4 to Figure 11 in APPENDIX B also represent the worst-case night-time (6am to 7am) noise propagation envelopes at 1.5m above the ground.

Figure 4 to Figure 11 indicate that all of the 60 dB(A) noise contours are kept within the site boundaries. This means that if the noise control measures stated in section 3.4.1 are implemented, the noise level at any locations of any neighbouring industrial premises is below 60 dB(A).

5.0 COMPLIANCE ASSESSMENT

5.1 ADJUSTED NOISE LEVELS

The noises emitted from the proposed fixed plant and mobile equipment are expected to exhibit tonality. According to Table 2-2, the predicted noise levels shown in Table 4-1 should be adjusted by adding 5 dB.

Table 5-1 presents the adjusted worst-case noise levels in dB(A). The adjusted noise levels are below 63.1 dB(A).

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

Receivers	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Adjusted Day-time Noise Levels in dB(A)								
R1	31.9	43.1	40.1	53.6	52.5	39.9	32.0	32.8
R2	55.3	63.1	54.4	38.9	46.8	32.3	36.1	51.9
R3	49.7	53.9	51.4	34.3	42.2	28.1	46.0	54.6
R4	50.5	42.2	43.5	46.0	45.8	52.2	53.0	45.9
Adjusted Night-time Noise Levels in dB(A)								
R1	31.9	43.3	40.5	53.2	52.4	39.7	32.3	33.2
R2	55.3	62.9	54.4	39.1	47.0	32.4	36.5	52.0
R3	49.9	53.8	51.4	34.6	42.6	28.3	46.3	54.6
R4	50.6	42.4	43.7	46.3	46.1	52.3	52.9	46.1

5.2 COMPLIANCE ASSESSMENT

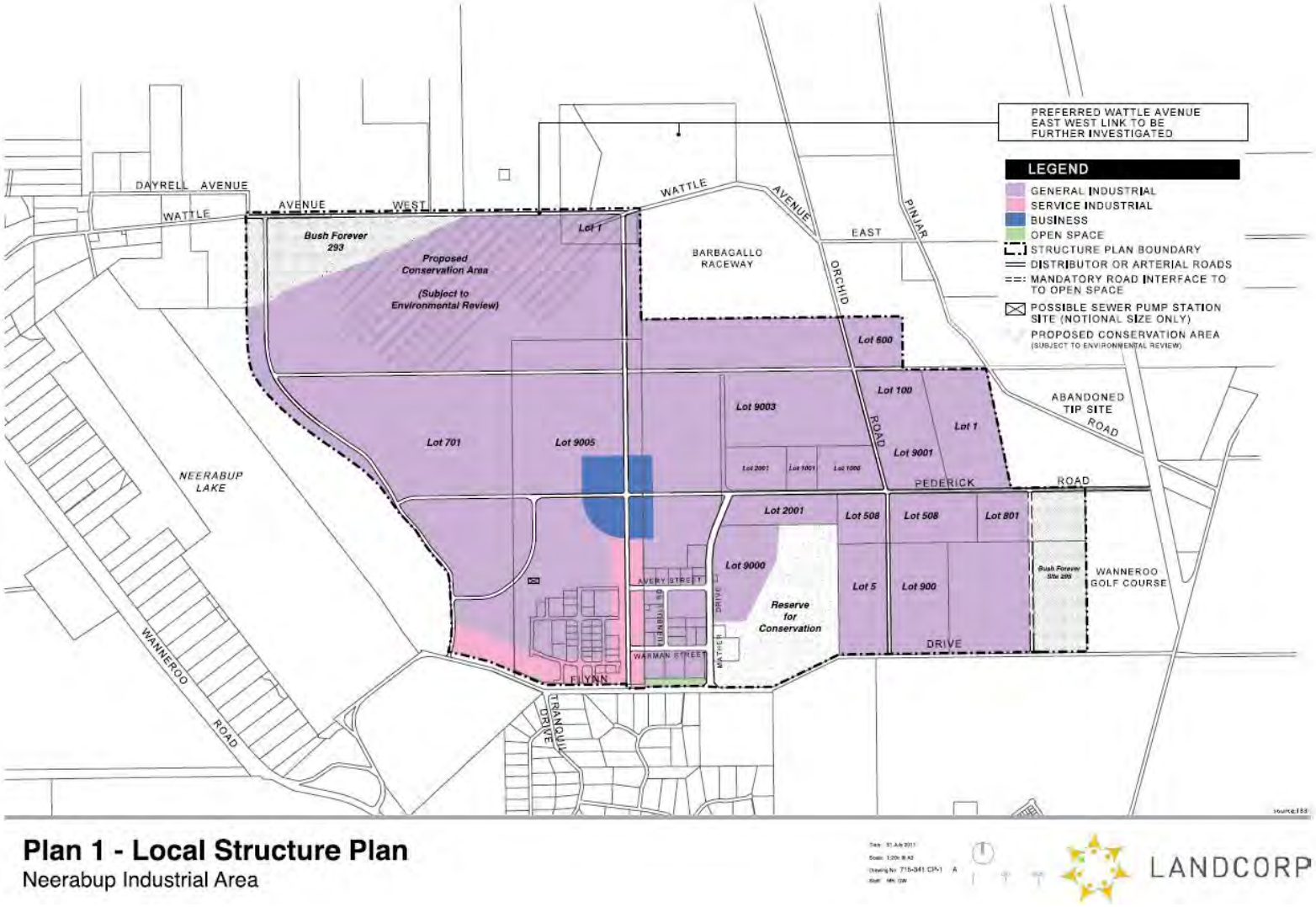
All activities proposed in this project will be undertaken during the night (between 6am and 7am) and day (between 7am and 6pm) on Monday to Saturday excluding public holidays. As shown in Table 2-1, the assigned noise level for industrial premises is 65 dB(A) for both the day and the night.

Table 5-1 indicates that all of the adjusted noise levels are below the assigned noise level of 65 dB(A). This indicates that compliance is achieved at all of the selected receivers for all of the worst-case operational scenarios.

Noise contours in APPENDIX B, which do not include the 5dB tonality adjustment, shows that the noise contours of 60dB(A) (corresponding to the adjusted noise level of 65 dB(A)) and above are kept within the site boundaries for all of the operational scenarios. This means that the adjusted noise level at any locations of any neighbouring industrial premises is below the assigned noise level of 65 dB(A) for all stages. Compliance is achieved at the boundaries of the neighbouring industrial premises.

Both the point modelling results and the noise contours domestrate that full compliance is achieved for all of the proposed operations (of stages 1 to 5).

APPENDIX A PLANS AND MAPS



Plan 1 - Local Structure Plan
Neerabup Industrial Area

LANDCORP

Figure 1: Local structural plan.

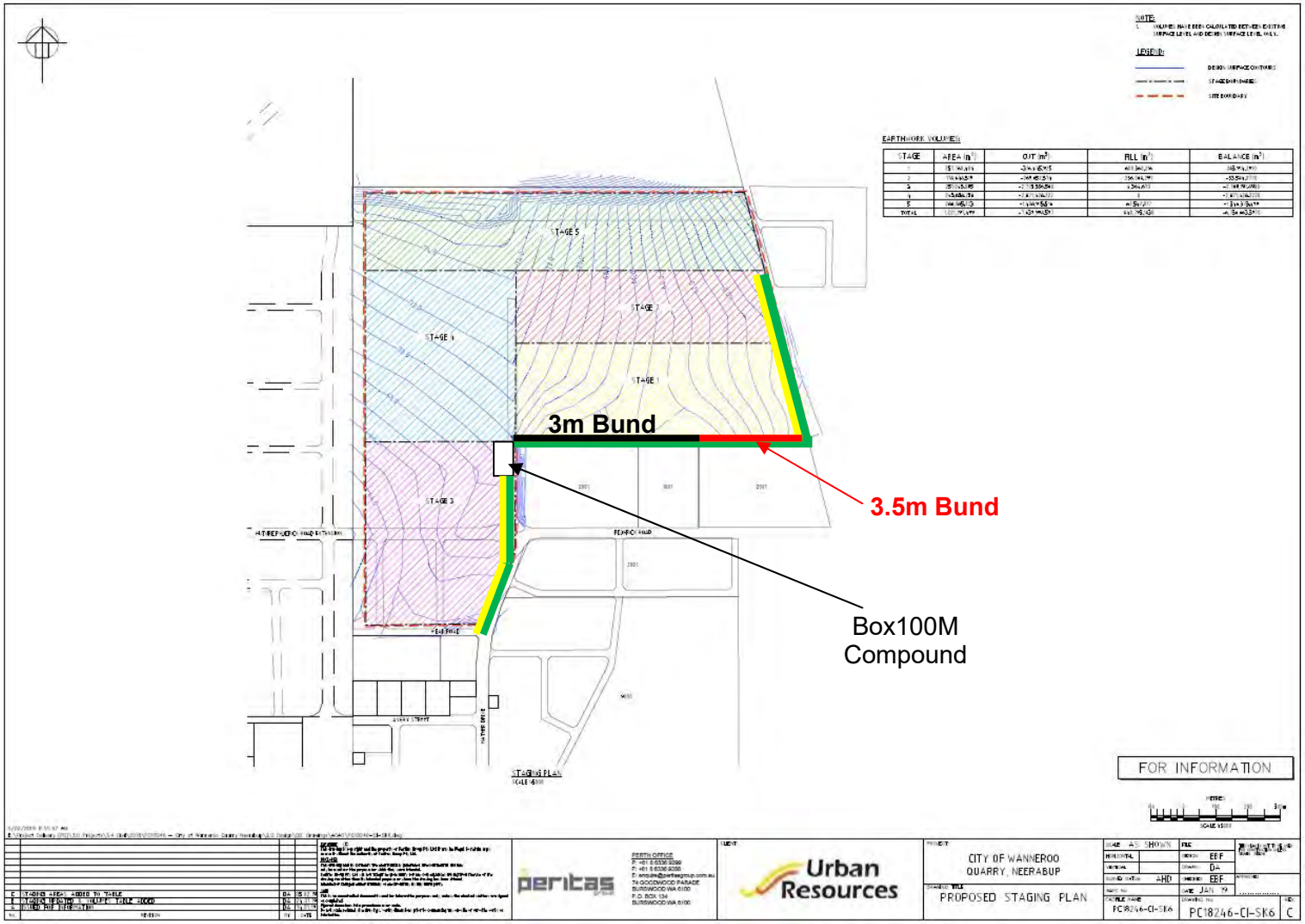


Figure 2: Proposed mining stage plan.

Figure 3: Selected point receivers.

APPENDIX B NOISE CONTOURS

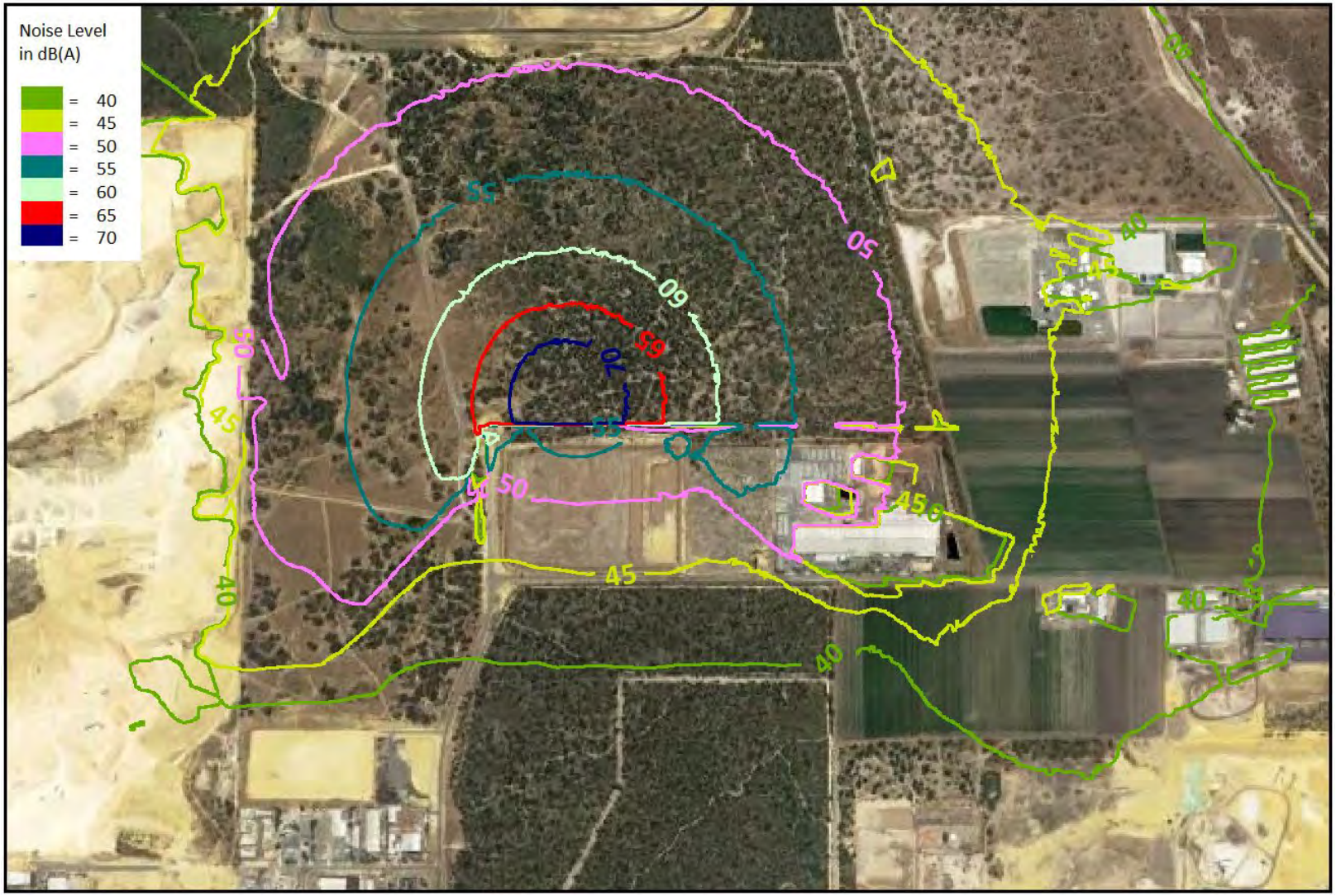


Figure 4: Worst-case noise contours for scenario 1 – mining at the western part of stage 1 pit.

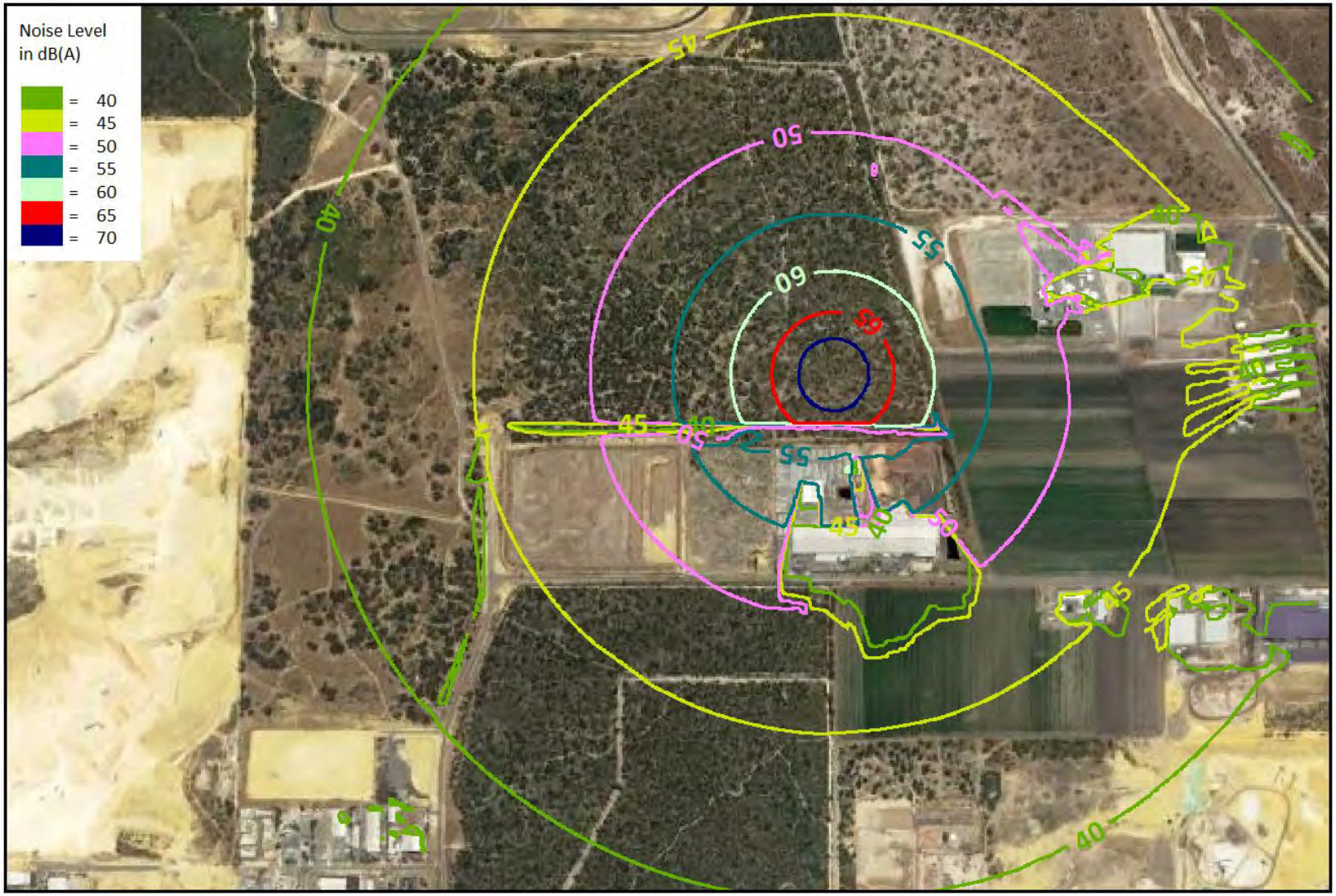


Figure 5: Worst-case noise contours for scenario 2 – mining at the eastern part of stage 1 pit.

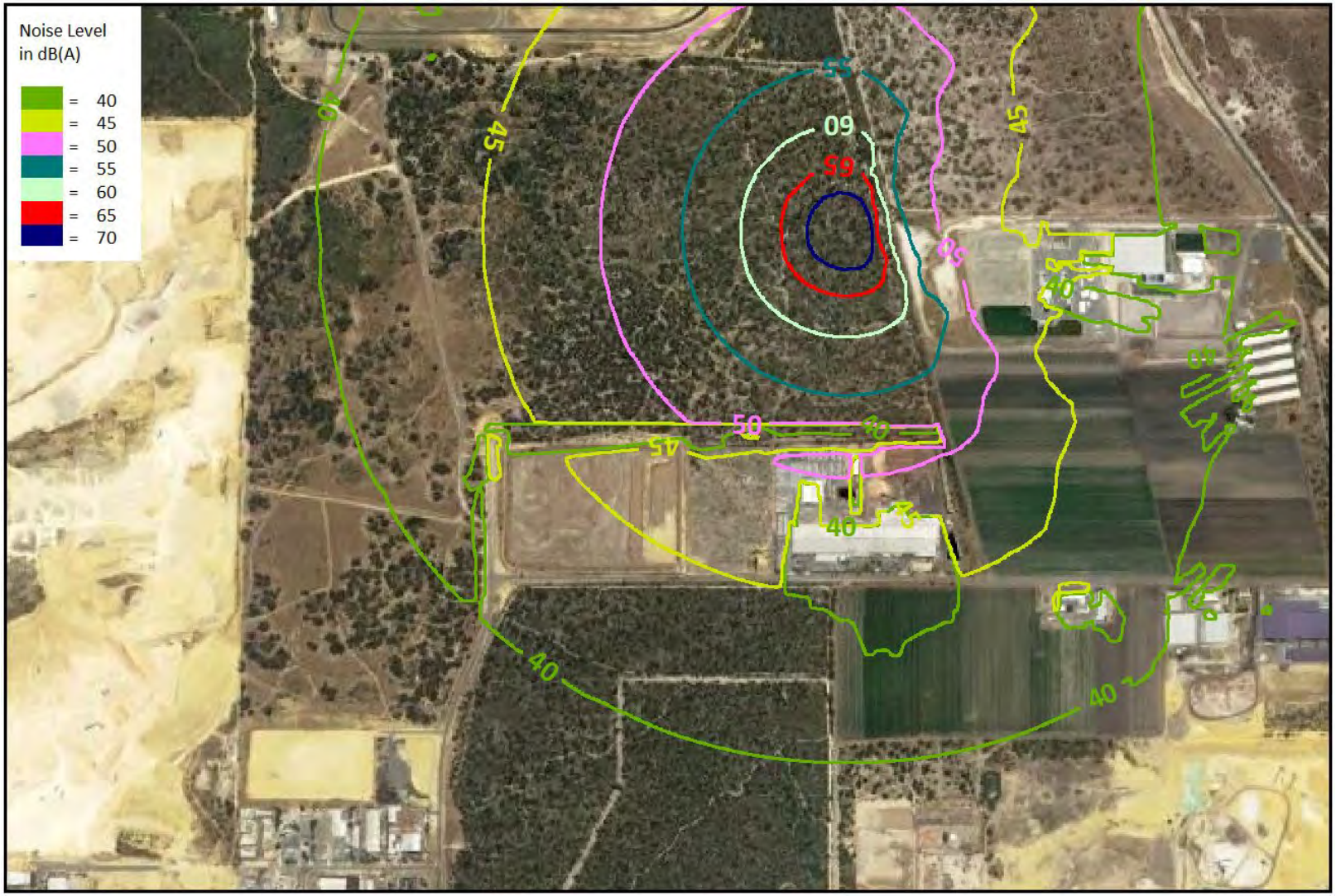


Figure 6: Worst-case noise contours for scenario 3 – mining at the eastern part of stage 2 pit.

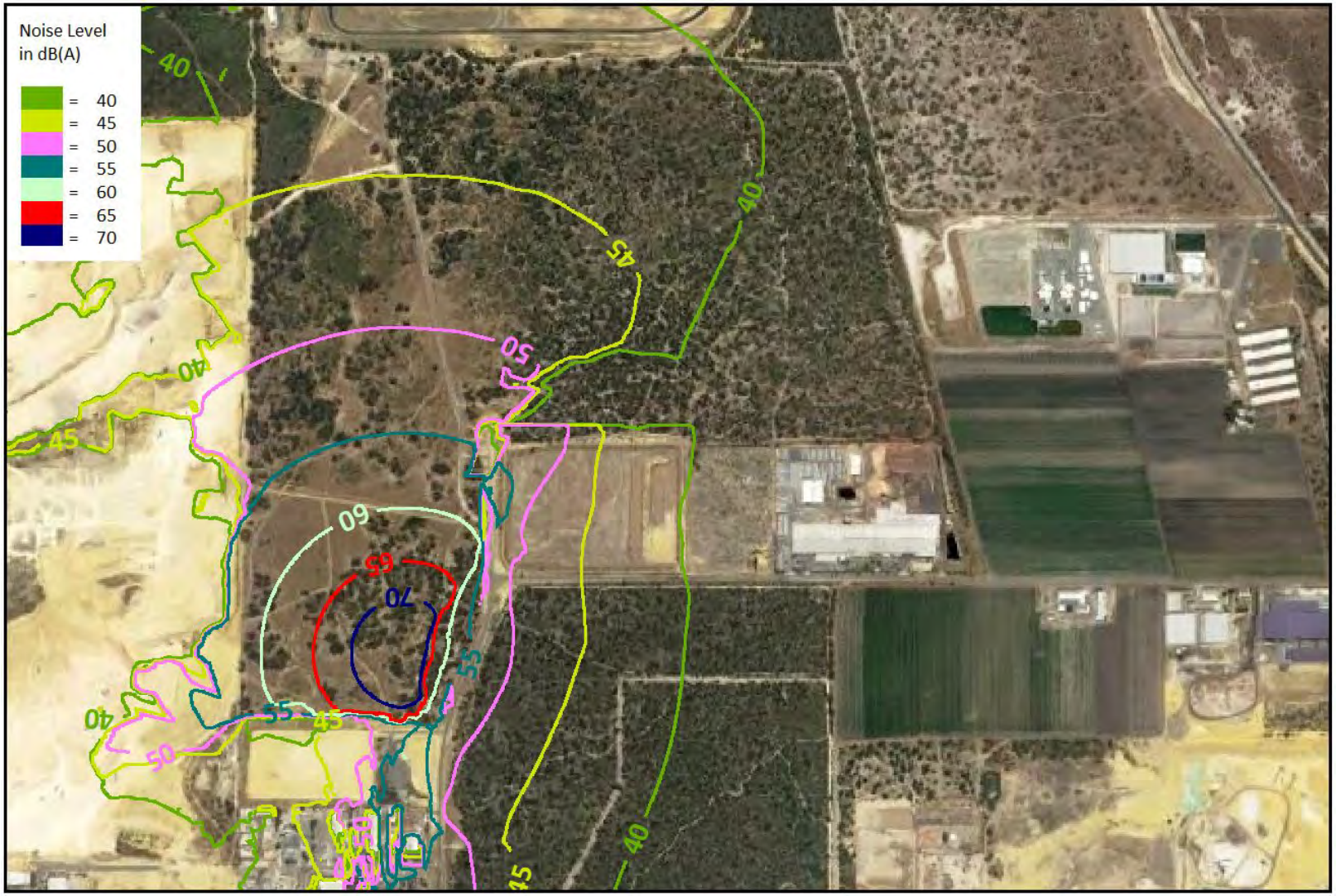


Figure 7: Worst-case noise contours for scenario 4 – mining at the south-eastern part of stage 3 pit.

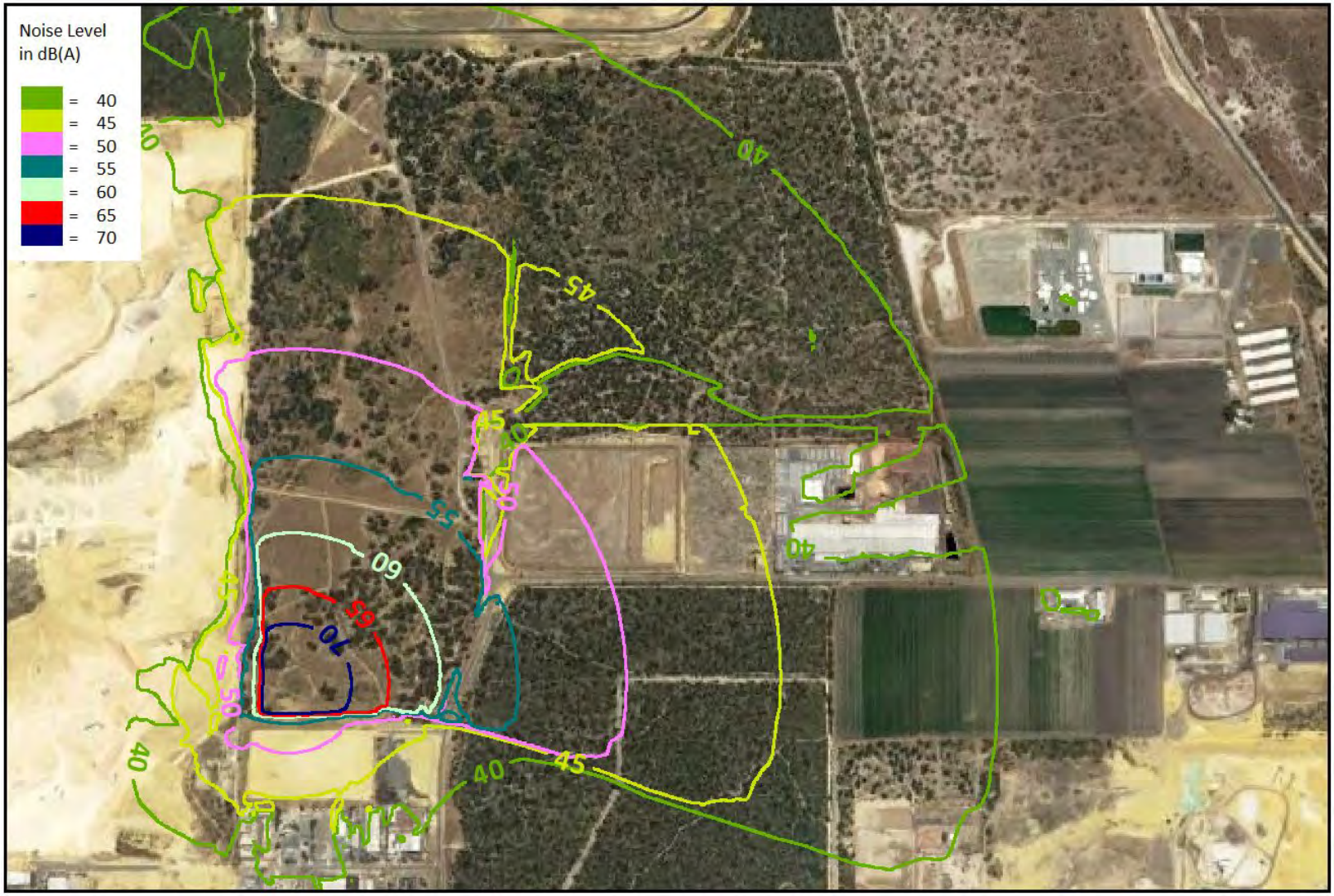


Figure 8: Worst-case noise contours for scenario 5 – mining at the south-western part of stage 3 pit.

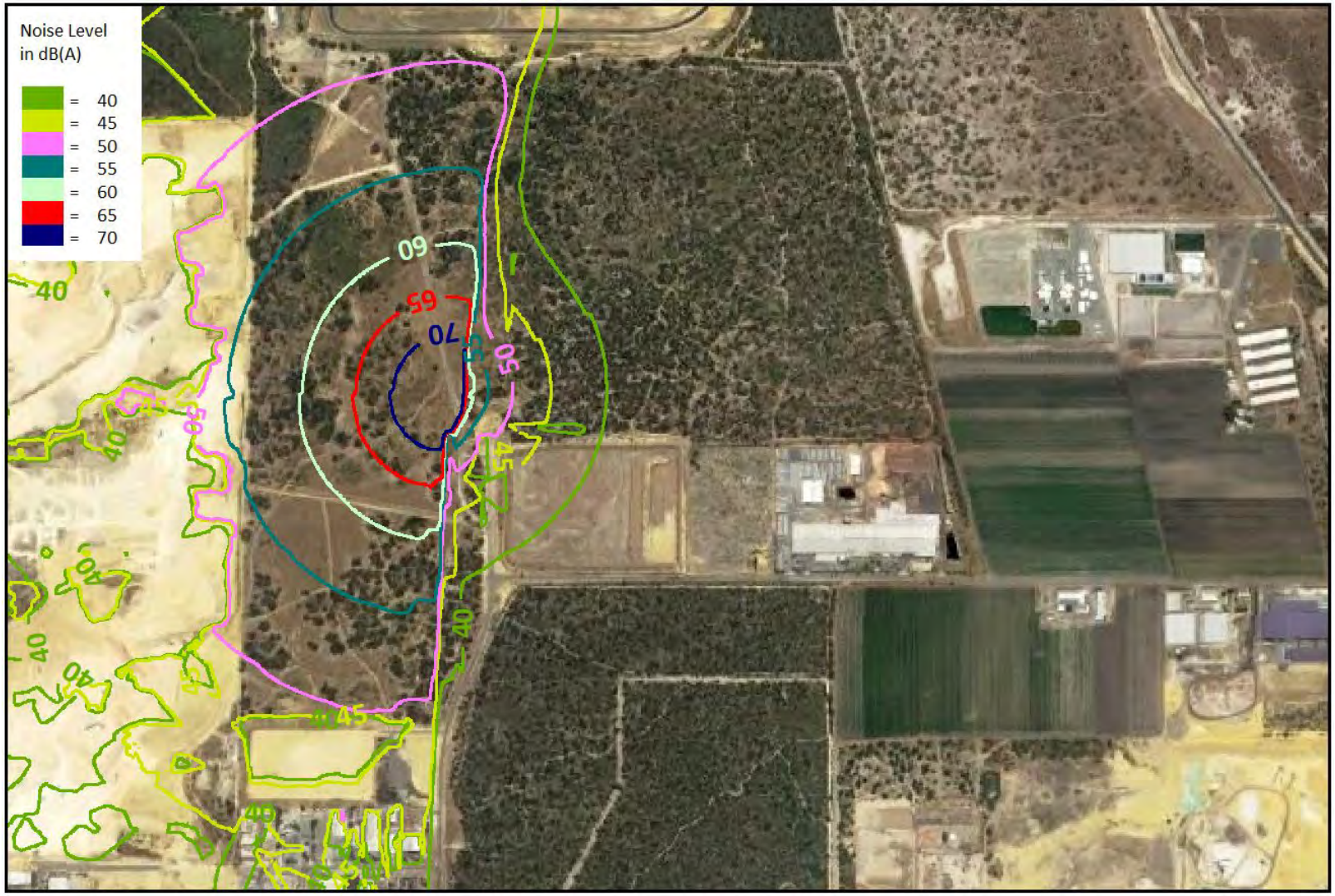


Figure 9: Worst-case noise contours for scenario 6 – mining at the south-eastern part of stage 4 pit.

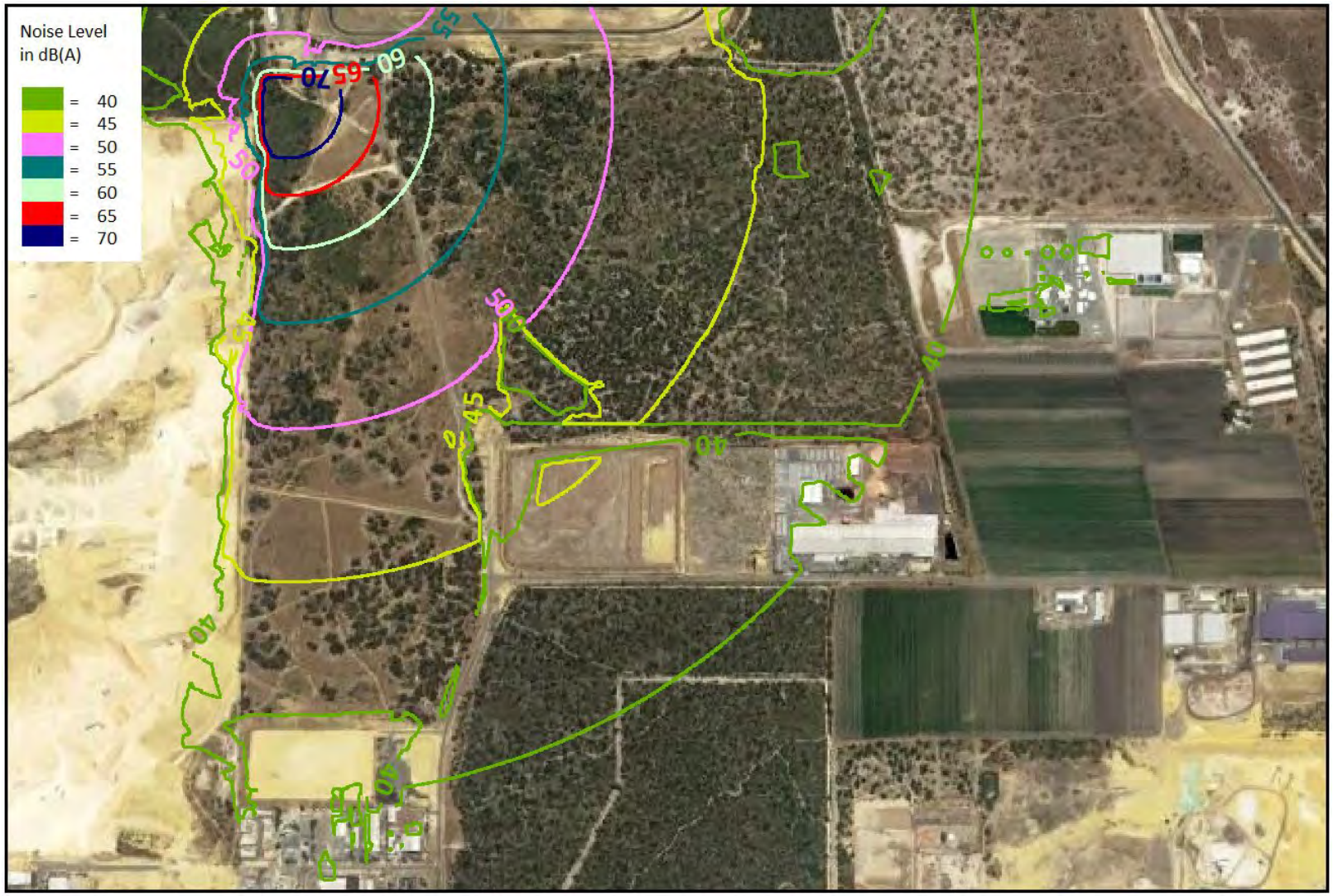


Figure 10: Worst-case noise contours for scenario 7 – mining at the north-western part of stage 5 pit.

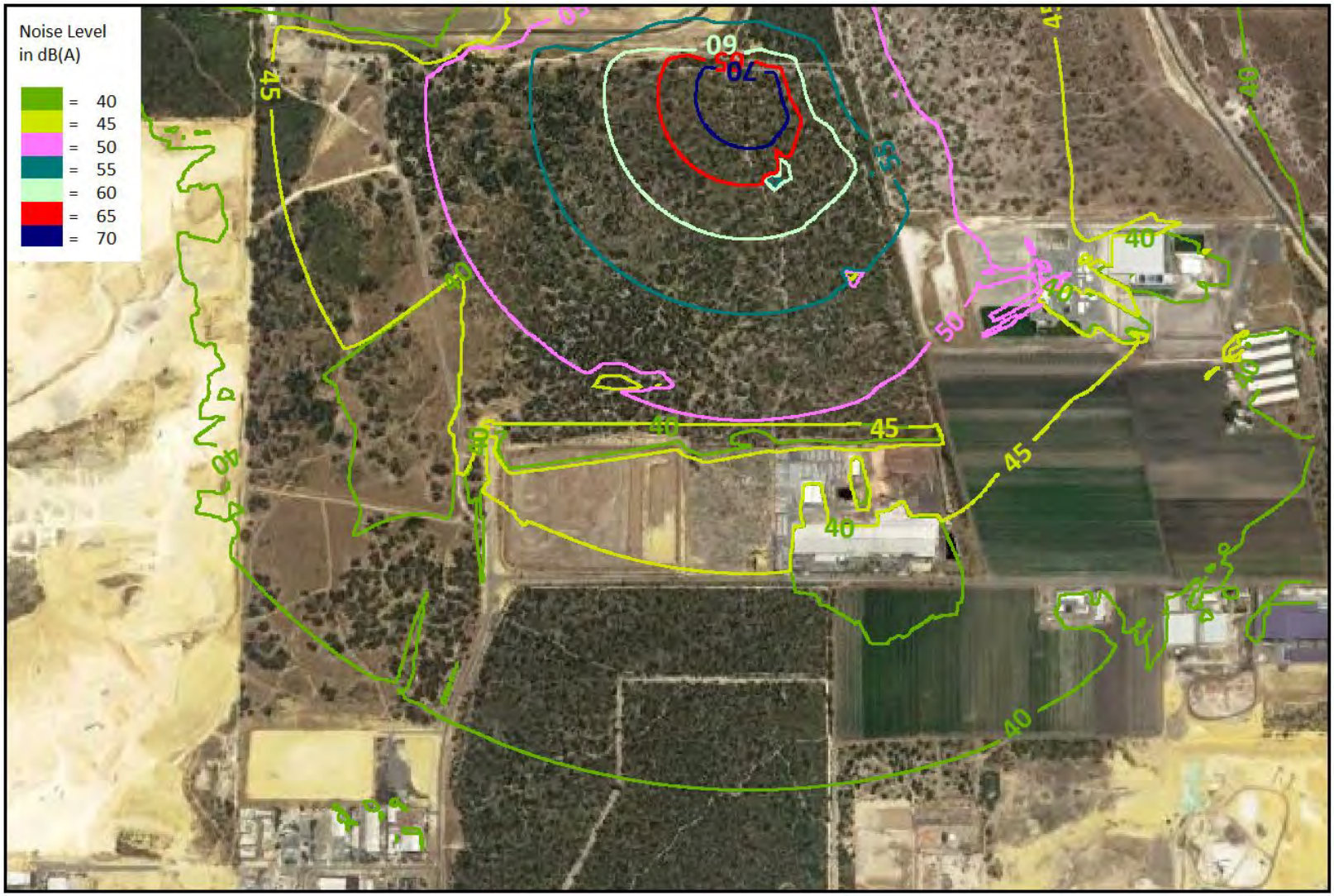


Figure 11: Worst-case noise contours for scenario 8 – mining at the north-eastern part of stage 5 pit.