



MIDDLEMOUNT COAL MINE

SOUTHERN EXTENSION PROJECT Original EPBC Referral Submission 18/03/2021 (EPBC 2021/8920)

EVA Appendix F Noise Assessment



MIDDLEMOUNT SOUTHERN EXTENSION PROJECT

Noise Impact Assessment

19 November 2020

Middlemount Coal Pty Ltd

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Supplementary professional advice should be sought in respect of these issues.

Executive summary

Renzo Tonin & Associates was engaged to prepare a noise impact assessment for the proposed Middlemount Coal Mine Southern Extension Project (the Project). This report identifies and addresses the following items:

- Nearest residential neighbours potentially affected by operational noise;
- Existing noise environment at the nearest receptors;
- Applicable noise criteria at the nearest receptors;
- Types of mining activities and locations during key stages of mining operations;
- Predicted noise levels at the identified receptors; and
- Recommendations for suitable noise control measures.

Middlemount Coal Pty Ltd (MCPL) operates the Middlemount Coal Mine located approximately 7 kilometres (km) to the south-west of the Middlemount township within the Isaac Regional Local Government Area, Queensland. The surrounding topography is relatively flat with the exception of a ridge rising between the site location and the township of Middlemount. Mining and processing activities will be undertaken within the existing Mining Leases (ML) 70379, ML 70417 and ML 700014 and operated in accordance with Environmental Authority EPML 00716913.

Two operational scenarios have been selected for the purpose of noise modelling, which are representative of operations in the selected years, 2037 and 2043. These scenarios were selected in consideration of the scale of mining operations in each year of the Project, number of major mobile equipment and proximity of operations to sensitive receivers. Fleet locations showing the haul truck and excavator/shovel locations were provided for the selected years by MCPL.

The noise criteria for the Project are consistent with those adopted for the Western Extension Project Noise Assessment and were selected based on the relevant legislation and guidelines, as well as background noise monitoring data. A computer model was prepared for the Project using CadnaA software. Operational noise levels were predicted with the use of maximum mining fleet and disturbance footprint (nominal Years 2037 and 2043) at each of the identified noise sensitive receptors.

Two weather scenarios were considered in the modelling, namely neutral weather and adverse weather conditions (Stability Class F). Under neutral weather conditions, operational noise levels for Years 2037 and 2043 scenarios were determined to satisfy the Project noise criteria for daytime, evening and night time periods at a majority of the nearest noise sensitive receptors. One exception is the nearest receiver "Tralee 2", located approximately 1.9 km from the proposed open cut pit extension, with possible noise exceedances up to 5dBA for modelling Year 2043. Note, the predicted noise levels are lower than previously approved at the Middlemount Coal Mine. Material impacts would be avoided at "Tralee 2" with the continued implementation of simple operational modifications (e.g. the use of particularly noisy equipment may be limited) as required (e.g. consistent with the approved Middlemount Coal Mine).

Under adverse weather conditions (i.e. a temperature inversion), operational noise levels for Years 2037 and 2043 scenarios were determined to satisfy the Project noise criteria for daytime, evening and night time periods at a majority of the nearest noise sensitive receptors. One exception is the nearest receiver "Tralee 2", with possible noise exceedances up to 7dBA for modelling Year 2037 and 8dBA for modelling Year 2043 (corresponding with noise predictions of 37dBA to 38dBA under adverse weather conditions, respectively).

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1 Introduction

Renzo Tonin & Associates was engaged to prepare a noise impact assessment for the proposed Middlemount Coal Mine Southern Extension Project (the Project). This report identifies and addresses the following items:

- nearest residential neighbours potentially affected by operational noise;
- existing noise environment at the nearest receptors;
- applicable noise criteria at the nearest receptors;
- types of mining activities and locations during key stages of mining operations;
- predicted noise levels at the identified receptors; and
- recommendations for suitable noise control measures.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project & Site Description

2.1 Site Location

Middlemount Coal Pty Ltd (MCPL) owns and operates the Middlemount Coal Mine, an existing open cut coal mine located approximately 90 kilometres (km) north-east of Emerald and approximately 3km to the south-west of the Middlemount Township, Queensland (Figure 1). The surrounding topography is relatively flat with the exception of a ridge rising between the site location and the township of Middlemount.

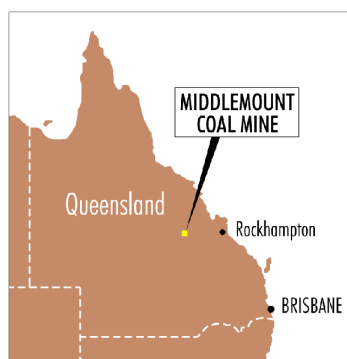
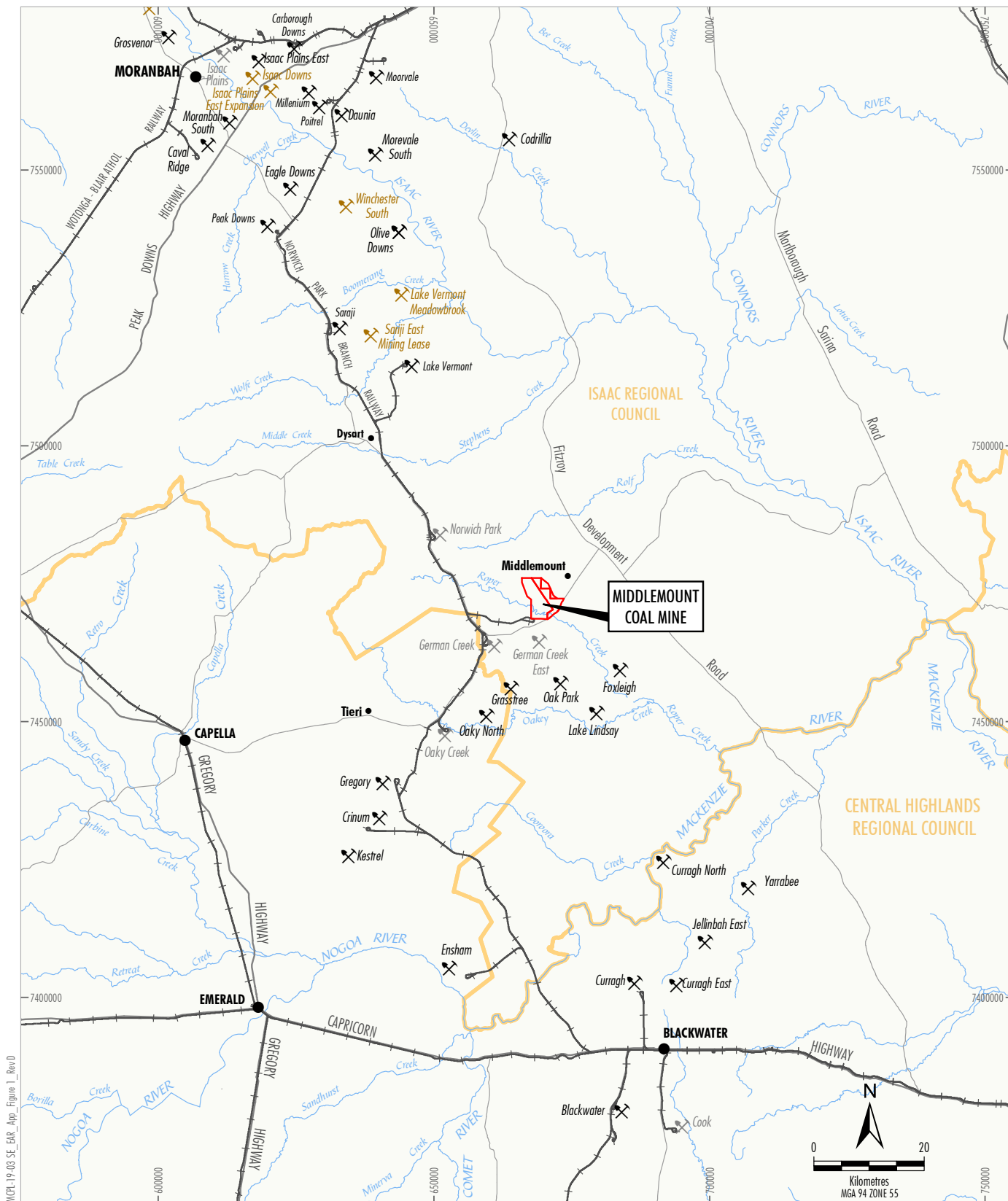
Mining and processing activities are currently undertaken within the existing Mining Leases (ML) 70379, ML 70417 and ML 700014 and operated in accordance with Environmental Authority EPML00716913.

2.2 Project Description

MCPL proposes to seek Queensland Government and Commonwealth Government (if required) approval for the Project. The main components of the Project would be:

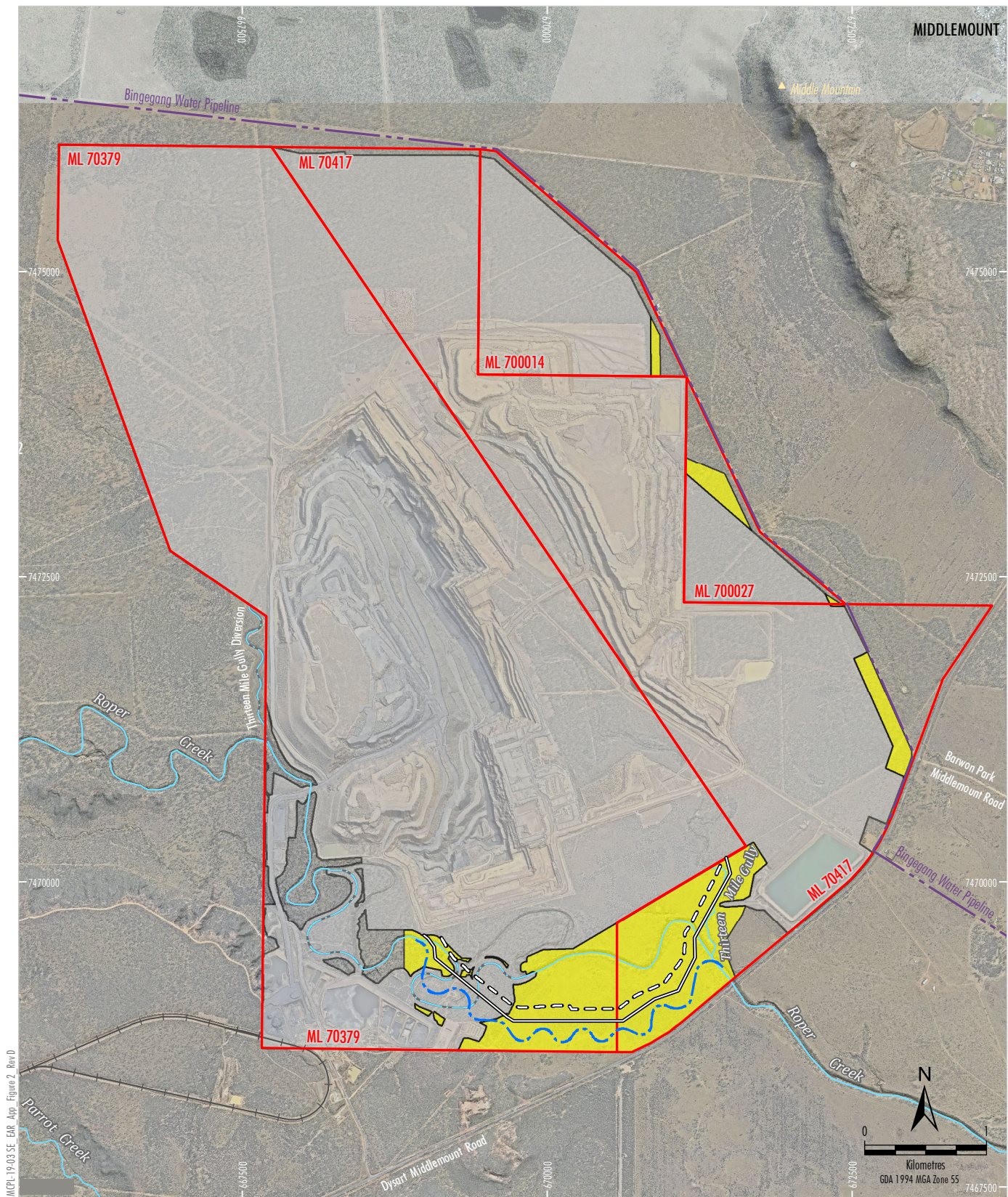
- extension of the open cut pit to the south within ML 70379;
- continued extraction of ROM coal up to approximately 5.7 million tonnes per annum using conventional open cut mining equipment;
- placement of waste rock in existing emplacements, expanded emplacements (Eastern Dump) and within the mined-out void;
- minor extensions to waste rock emplacement footprint;
- progressive development of sediment dams, pipelines and other water management equipment and structures;
- re-positioning of the approved southern flood levee and water management infrastructure;
- realignment of the approved (but not yet constructed) eastern diversion of Roper Creek inside the ML;
- progressive development of new haul roads and internal roads;
- continued development of soil stockpiles, laydown areas and borrow areas;
- continued use of existing and approved supporting mine infrastructure;
- extension of the approved mine life by approximately seven years (to 2044); and
- a change to the final landform for the end of the mine life.

The approximate extent of the proposed additional disturbance is shown on Figure 2.



SOUTHERN EXTENSION PROJECT Regional Location

Figure 1



- LEGEND**
- Mining Lease Boundary (ML)
 - Middlemount Rail Spur and Loop
 - Approved Disturbance Footprint
 - Approved Diversion
 - Realigned Diversion
 - Realigned Levee
 - Open Cut Pit Extension
 - Approximate Extent of Additional Disturbance


SOUTHERN EXTENSION PROJECT
 Conceptual Southern Extension Project
 Footprint

Figure 2

3 Noise Criteria

The relevant legislation and guidelines used to determine the Project noise criteria include the following:

- Environmental Authority EPML00716913 [Reference 1];
- Environmental Protection (Noise) Policy 2019 [Reference 2];
- Ecoaccess Guideline - Planning for Noise Control [Reference 3];
- Ecoaccess Draft Guideline Assessment of Low-frequency Noise [Reference 4]; and
- Model Mining Conditions Guideline (MMCG) (Department of Environment and Heritage Protection [DEHP], 2017a) [Reference 5].

3.1 Background Noise Monitoring

Background noise monitoring was conducted in March 2010 as part of the previous Environmental Impact Statement (EIS) noise impact assessment [Reference 7]. Monitoring consisted of attended and unattended noise monitoring at three locations around the Middlemount Coal Mine. The following three (3) locations were selected:

Site 1 - MAC Middlemount Village – (Easting: 55K 674101 Northing: 7475776)

Site 2 – Foxleigh property – (Easting: 55K 676259 Northing: 7475164)

Site 3 – Kokane property – (Easting: 55K 658113 Northing: 7479906)

Additional background noise monitoring was conducted in August 2013 as part of an independent report [Reference 8] commissioned by Middlemount Coal Mine. Monitoring consisted of attended and unattended noise monitoring at four (4) locations around the Project site. The following four locations were selected:

ML1 - MAC Camp – (Easting: 55K 674101 Northing: 7475776)

ML2 - 143 Centenary Drive North, Middlemount – (Easting: 55K 673724 Northing: 7477379)

ML3 - Foxleigh Residence (vacant) – (Easting: 55K 676259 Northing: 7475164)

ML4 - Hazelbrae Property – (Easting: 55K 668038 Northing: 7483466)

Table 1 presents a comparison of noise monitoring conducted in March 2010 and additional monitoring conducted in August 2013.

Table 1: Comparison of Background Noise Monitoring Results (March 2010 vs August 2013)

Monitoring Location	Month & Year	Sound Pressure Level (dBA)								
		LA10, 15min			LAeq, 1 hr			Rating Background Level (RBL)		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Site 1 MAC Camp	March 2010	52	51	51	50	48	48	42	44	40
ML1 MAC Camp	August 2013 audit	63	51	59	47	42	47	31	33	29
ML2: 143 Centenary Drive North	August 2013 audit	61	55	56	47	42	40	33	27	20*
Site 2 – Foxleigh property	March 2010	43	48	43	41	45	41	33	36	33
ML3: Foxleigh Residence (vacant)	August 2013 audit	52	48	53	41	37	41	28	27	23*
Site 3 – Kokane property	March 2010	42	51	44	41	50	43	30	36	31
ML4: Hazelbrae Property	August 2013 audit	43	37	36	46	39	39	27	31	30

Note: dBA – A-weighted decibels.

*Where RBL is less than 25dBA, the RBL is set to 25dBA.

Table 1 shows the Rating Background Levels or RBLs for August 2013 audit were lower than the March 2010 data. Only two sites can make a direct comparison between the data, namely Site 1 / ML1 and Site2 / ML3. For Site 1 /ML1 MAC Camp the RBLs have reduced by around 11dBA during the day, evening and night time periods. For Site 2 / ML3 Foxleigh property the RBLs have reduced by around 5dBA to 10dBA during the day, evening and night time periods. There is no commentary in the March 2013 audit report explaining the reason for any differences between the March 2010 and August 2013 data at the same sites. The cumulative noise (summarised as L_{eq}) was fairly similar at both sites. The March 2013 is considered typical of many rural environments and conservative in nature. This report therefore uses the more conservative March 2013 audit noise data for assessment purposes.

3.2 Summary of Noise Criteria

Table 2 presents the conditions in Environmental Authority EPML00716913 [Reference 1] relating to noise.

Table 2: Environmental Authority Conditions Relating to Noise

D1	Subject to conditions D2 and D3 noise from the mining activity must not cause an environmental nuisance at any noise sensitive or commercial place.																															
D2	When requested by the administering authority, noise monitoring must be undertaken `within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring. Monitoring must include: a) LAeq, adj, 15 mins (external); b) LA1, adj, 15 mins (internal – or a measured external noise level and calculation of corresponding internal noise level); c) The level and frequency of occurrence of impulsive or tonal noise; d) Atmospheric conditions including wind speed and direction; e) Effects due to extraneous factors such as traffic noise; and f) Location date and time of recording.																															
D3	If the environmental authority holder can provide evidence through monitoring that the limits defined in Table D1: Noise Limits, are not being exceeded then the holder is not in breach of Condition D1.																															
D4	If monitoring indicates the noise component from the Project exceeds the limits in Table D1: Noise Limits, then the environmental authority holder must: a) address the complaint including the use of appropriate dispute resolution if required; and b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance. Table D1: Noise Limits <table><tr><th rowspan="2">Noise level dB(A)</th><th colspan="3">Monday to Sunday (including public holidays)</th></tr><tr><th>7am – 6pm</th><th>6pm – 10pm</th><th>10pm – 7am</th></tr><tr><td colspan="4">Noise measured at a ‘sensitive place’ expressed as:</td></tr><tr><td>LAeq, adj 15 mins*</td><td>RBL + 5</td><td>RBL + 5</td><td>RBL + 5</td></tr><tr><td>LA1, adj, 15 mins**</td><td>40</td><td>40</td><td>40</td></tr><tr><td colspan="4">Noise measured at a ‘commercial place’ expressed as:</td></tr><tr><td>LAeq, adj 15 mins*</td><td>RBL + 10</td><td>RBL + 10</td><td>RBL + 10</td></tr><tr><td>LA1, adj, 15 mins**</td><td>45</td><td>45</td><td>45</td></tr></table> NOTE: *External noise limit ** Internal noise limit RBL means Rating Background Level as defined in the administering authority’s Guideline, Planning for Noise Control	Noise level dB(A)	Monday to Sunday (including public holidays)			7am – 6pm	6pm – 10pm	10pm – 7am	Noise measured at a ‘sensitive place’ expressed as:				LAeq, adj 15 mins*	RBL + 5	RBL + 5	RBL + 5	LA1, adj, 15 mins**	40	40	40	Noise measured at a ‘commercial place’ expressed as:				LAeq, adj 15 mins*	RBL + 10	RBL + 10	RBL + 10	LA1, adj, 15 mins**	45	45	45
Noise level dB(A)	Monday to Sunday (including public holidays)																															
	7am – 6pm	6pm – 10pm	10pm – 7am																													
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LAeq, adj 15 mins*	RBL + 10	RBL + 10	RBL + 10																													
LA1, adj, 15 mins**	45	45	45																													
D5	The method of measurement of noise monitoring must comply with the current edition of the administering authority’s Noise Measurement Manual.																															

The noise criteria for the Project are consistent with those adopted for the Western Extension Project Noise Assessment, and were selected based on the relevant legislation and guidelines, and the background noise monitoring data presented in Section 3.1.

Table 3 presents the Project noise criteria based on RBL results from March 2010 and August 2013.

Table 3: Project Noise Criteria for Residential Receivers based on RBL Results (March 2010 vs August 2013)

Location	RBL (March 2010) (dBA)			RBL (August 2013) (dBA)			Project Criteria (dBA)		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Site 1 / ML1 MAC Village	42	44	40	31	33	29	31 + 5 = 36	33 + 5 = 38	29 + 5 = 34
Site 2 / ML3 Foxleigh	33	36	33	28	27	25	33	32	30
Site 3 – Kokane	30	36	31	-	-	-	35	41	36
ML2 (Centenary Drive North	-	-	-	33	27	25	38	32	30
ML4 Hazelbrae	-	-	-	27	31	30	32	36	35

We note the Planning for Noise Control document [Reference 3] nominates the following for areas with low RBLs:

It may not be possible to maintain background levels in very rural areas below 25dBA as developments occur. In such cases a threshold background level of 25dBA is to be used.

In direct comparison the more recent MMCG (DEHP, 2017a) document [Reference 5] nominates the following for areas with low RBLs:

In the event that measured background ($L_{A90, adj, 15 mins}$) is less than 30 dBA, then 30 dBA can be substituted for the measured background level.

For this extension project we have adopted the more conservative approach using the RBL data from August 2013 audit and minimum background noise levels of 25dBA as per the Planning for Noise Control document [Reference 3].

Table 4 presents the Project noise criteria for non-residential noise sensitive receivers based on Environmental Protection (Noise) Policy 2019 [Reference 2].

Table 4: Noise Criteria for Non-Residential Sensitive Receivers

Location	Period	Sound Pressure Level (dBA)		
		Planning for Noise Control	EPP Noise Policy (outdoor)	Project Noise Criteria
Schools	Operating Hours	45	[Indoor 35 + 5 =] 40*	40
Community Buildings [#]	Operating Hours	50	[Indoor 45 + 5 =] 50**	50
Parks [^]	Daytime	35	[31 + 5 =] 36 (Amenity based on RBL + 5 at Site 1 in August 2013 Audit)	36

-
- * EPP (Noise) 2019 nominates 35dBA indoors for educational institutions and 55dBA for outdoor school playgrounds. Assuming a conservative noise reduction of 5dBA from indoor to outdoor provides an outdoor noise target, just outside a fully open classroom window. The 5dBA noise reduction conversion factor is based on wide open windows shown in Table 7, page 7 Ecoaccess Guideline - Planning for Noise Control [Reference 3].
- # Assumed equivalent to commercial or retail receiver.
- ** EPP (Noise) 2019 nominates 45dBA indoors for commercial and retail receivers. Assuming a conservative noise reduction of 5dBA from indoor to outdoor provides an outdoor noise target, just outside a fully open commercial or retail window.
- ^ Park or garden that is open to the public for use other than sport or organised entertainment. EPP (Noise) 2019 nominates 'the level of noise that preserves the amenity of the existing park or garden'. We also note EPP (Noise) 2019 nominates 55dBA for school or playground (outdoors) when the children usually play outside. For sporting venues such as Norm Blanch Oval we have nominated a conservative criteria of 50dBA during daytime, evening and night periods.
-

3.3 Noise Sensitive Receivers

The nearest noise sensitive receivers potentially affected by noise emissions from mining operations are listed in Table 5 below. The noise sensitive receivers were identified and provided by MCPL. All of the noise sensitive receivers have been previously assessed as part of the Middlemount Coal Mine Western Extension Project. Appendix D shows the location of the noise sensitive receivers. It is noted the Project would not decrease the distance between mining activities and the nearest sensitive receiver - "Tralee 2" is located approximately 1.25km to the south-east of the approved East Dump, and approximately 1.9km from the proposed open cut pit extension.

Further, it is noted that the Tralee 2 dwelling is located on mine-owned land (owned by Foxleigh Land Pty Ltd), and was first identified during the preparation of the Middlemount Coal Mine Western Extension Project. Specifically, Tralee 2 was constructed subsequent to the approval of the Middlemount Coal Mine Stage 2 EIS, after the occupants were relocated due to operations at the Foxleigh Coal Mine. Further discussion of the approved and predicted noise levels at Tralee 2 are provided in Section 5.

Table 5: Noise Sensitive Receivers & Project Criteria

Receiver ID	Receiver	UTM Coordinates (Zone 55)		Project Noise Criteria (outdoors) dBA			Project Criteria based on?	Representative Receiver Point (described in Stage 2 EIS)
		Easting	Northing	Day	Evening	Night		
SR075	Accommodation Village 1	673899	7475861	36	38	34	RBL at ML1 (August 2013 audit)	SR075
SR074	Accommodation Village 2	673860	7476113	36	38	34	RBL at ML1 (August 2013 audit)	SR074
SR410	Accommodation Village 3	674176	7476028	36	38	34	RBL at ML1 (August 2013 audit)	SR410
SR411	Accommodation Village 4	674171	7475738	36	38	34	RBL at ML1 (August 2013 audit)	SR411
SR278-SR303	Alfred Quinn Drive Residences	673820	7476596	36	38	34	RBL at ML1 (August 2013 audit)	SR288
SR619-SR725	Centenary Drive South Residences	675007	7475610	36	38	34	RBL at ML1 (August 2013 audit)	SR725
SR069	Industrial Estate	673599	7475840	50	50	50	EPP Noise (2019)	SR075
SR409	Middlemount Community School	674416	7476301	40	40	40	EPP Noise (2019)	SR409
SR060	Norm Blanche Oval	673473	7476213	50	50	50	EPP Noise (2019)	SR060

Receiver ID	Receiver	UTM Coordinates (Zone 55)		Project Noise Criteria (outdoors) dBA			Project Criteria based on?	Representative Receiver Point (described in Stage 2 EIS)
		Easting	Northing	Day	Evening	Night		
SR057	Treatment Plant	673263	7475790	50	50	50	EPP Noise (2019)	SR060
Gundabah	Gundabah	663948	7480703	32	36	35	RBL at ML4 (August 2013 audit)	New receiver
Hazelbrae	Hazelbrae	668048	7483433	32	36	35	RBL at ML4 (August 2013 audit)	New receiver
Campion	John Frederick Campion	676961	7475599	33	32	30	RBL at ML3 (August 2013 audit)	New receiver
Foxleigh	Foxleigh	681585	7470645	33	32	30	RBL at ML3 (August 2013 audit)	New receiver
Tralee	Tralee	681123	7467485	33	32	30	RBL at ML3 (August 2013 audit)	New receiver
Tralee 2	Tralee 2	673175	7469070	33	32	30	RBL at ML3 (August 2013 audit)	New receiver

4 Noise Impact Assessment

4.1 Calculation Methodology

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 2020 175.5000) noise prediction computer program. CadnaA is an internationally recognised environmental noise prediction computer program (which is also recognised by the Queensland Government) that can be used to model transportation noise, construction noise and general industry noise. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models take into account:

- location of noise sources and receiver locations;
- height of sources and receivers;
- separation distances between sources and receivers;
- ground type between sources and receivers;
- attenuation from barriers (natural and purpose built); and
- meteorological effects.

All predictions have been conducted in accordance with International Standard ISO 9613 (1996) *Acoustics – Attenuation of sound propagation outdoors* [Reference 6].

A number of 3D models were created for the site location and surrounding area using terrain contours at 2 metres (m) intervals and more detailed on-site terrain elevations (1m intervals) as provided by MCPL. All noise receivers were modelled as 2m above ground level and noise sources were modelled as point sources 2m above ground level.

4.2 Meteorological Effects

Certain meteorological conditions may increase noise levels by focusing sound-wave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level) and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receiver.

Temperature inversions occurring within the lowest 50m to 100m of atmosphere can affect noise levels measured on the ground. Temperature inversions are most commonly caused by radiative cooling of the ground at night leading to cooling of air in contact with the ground. This is especially prevalent on cloudless nights with little wind. Air that is somewhat removed from contact with the ground will not cool as much, resulting in warmer air aloft than near to the ground.

Similarly, when significant wind exists, the conditions can significantly affect noise levels at receptor points downwind of a noise source. This will depend, however, on the particular direction and velocity of the wind at that time. It should also be noted that although wind can raise noise emission levels as perceived from a downstream assessment point, background noise also tends to increase as a result of increased wind activity. This often causes masking of potential increases in intrusive noise.

4.2.1 Wind Effects

Gradient wind differs from the drainage-flow wind associated with temperature inversions. Drainage-flow wind is the localised drainage of cold air under the influence of the local topography, and travels in one direction only (direction of decreasing altitude). Gradient wind is the regional wind determined by synoptic factors (high and low-pressure systems) and may originate from any direction.

Unlike temperature inversions, gradient winds may cause impacts during any assessment period (day, evening or night), and not just the night period.

The Ecoaccess Guideline: Planning for Noise Control 2004 guideline [Department of Natural Resources and Mines] [Reference 3] specifies that the prevailing and worst-case meteorological conditions (wind, temperature, humidity and temperature inversions) at the planned and receiver locations must be determined. Noise levels are calculated at the noise sensitive places for a range of typical operating scenarios and conditions that are representative of the proposed facility, including worst case meteorological conditions.

An Air Quality Assessment was prepared by Katestone Environmental Pty Ltd (June 2020) [Reference 9] for the Project. Appendix G of this report presents wind rose extracts from the Katestone Environmental Pty Ltd report.

Our analysis of the wind roses concluded that wind effects were not a particular feature of the area blowing from the mine to the nearest receivers. That is, wind is not considered to be a feature where source to receiver wind speeds (at 10m height) of 3m/s or below occur for 30% of the time or more in any assessment period (day, evening, night) in any season as outlined in the Planning for Noise Control guideline [Reference 3]. For the Project, we have therefore not used the default wind effects parameter of 3m/s towards the receivers.

4.2.2 Temperature Inversions

An occurrence of 30% of the total night time period during winter (June, July and August) is selected by the Planning for Noise Control guideline [Reference 3] as representing a significant noise impact warranting further assessment.

For Middlemount Coal Mine we have used the default inversion parameters for modelling purposes:

- non-arid areas (annual average rainfall greater than 500 millimetres);
- moderate (F-class stability category) inversions; and
- 3°/100m temperature inversion strength for all receivers plus a 2m/s source to receiver component drainage flow wind speed for those receivers where applicable.

4.3 Operational Noise Levels

4.3.1 Noise Modelling Years

Two operational scenarios have been selected for noise modelling purposes, years 2037 and 2043. These scenarios were selected in consideration of the scale of mining operations in each year of the Project, number of major mobile equipment and proximity of operations to sensitive receivers. Fleet locations showing the haul truck and excavator/shovel locations were provided for the selected years by MCPL.

It is noted the Project would not increase the maximum mining fleet assessed as part of the Middlemount Coal Mine Western Extension Project.

4.3.2 Fleet Locations & Numbers

Appendix C presents the proposed fleet locations in Year 2037 and Year 2043.

Table 6 presents fleet numbers for Project Year 2037 and Year 2043.

Table 6: Fleet Numbers Project Years 2037 and 2043

Plant Type	Fleet	Equipment Descriptor	Southern Extension Project Year 2037*	Southern Extension Project Year 2043
Fixed Plant	CHPP	CHPP		
Mobile Plant	D1	D10 dozer	6 (7)	5
Mobile Plant	D2	D11 dozer	4 (5)	3
Mobile Plant	Dozer Mining	D11 dozer	6	6
Mobile Plant	WD	CAT84G wheel dozer	2	2
Mobile Plant	Drill	Drill	3	2
Mobile Plant	FEL	CAT992 front end loader	2	2
Mobile Plant	Excavators	9400 Excavator	4	3

Plant Type	Fleet	Equipment Descriptor	Southern Extension Project Year 2037*	Southern Extension Project Year 2043
Mobile Plant	Excavators	R996B Excavator	4 (5)	3
Mobile Plant	Excavators	EX1900 Excavator	1	1
Haul Route	G	CAT24M grader	3 (4)	3
Haul Route	G	CAT16H Grader	4 (6)	5
Haul Route	WC	CAT777 water cart	5 (6)	5
Haul Route	T1_coal	CAT789 190T truck	24 (30)	27
Haul Route	T3	CAT5300 300T truck	29 (35)	27

Note: * fleet numbers for Year 2036 have been adopted for the Year 2037 assessment, and are shown in brackets where they differ from 2037. This is considered a slightly more conservative approach.

4.3.3 Haul Routes

Table 7 presents haul route fleet numbers for Project Year 2037.

Table 7: Haul Route Fleet Numbers for Project Year 2037

Plant Item	C1	C2	W1	W2	W3	W4	W5	W6
T1_Coal (CAT 789 190 t truck)	14	16	-	-	-	-	-	-
T3 (300 t truck)	-	-	6	6	6	6	6	5
CAT 24M grader	1	1	1	1	-	-	-	
CAT 16H grader	-	-	1	1	1	1	1	1
CAT 777 water cart	1	1	1	1	0.5	0.5	0.5	0.5

Table 8 presents haul route fleet number for Project Year 2043.

Table 8: Haul route fleet numbers for Project Year 2043

Plant Item	C1	C2	W1	W2	W3	W4
T1_Coal (CAT 789 190 t truck)	13	14	-	-	-	-
T3 (300 t truck)	-	-	9	4	8	6
CAT 24M grader	1	1	1	-	-	-
CAT 16H grader	-	1	1	1	1	1
CAT 777 water cart	1	1	1	1	0.5	0.5

4.3.4 Sound Power Levels

Noise data for the excavators, front end loaders and trucks in the proposed fleet was sourced from the Stage 2 EIS [Reference 1] prepared by Parsons Brinckerhoff.

Table 9 presents noise data as an overall sound power level (in dBA) and octave band frequency data (in dBZ). This noise data applies to unmitigated trucks (i.e. standard trucks with no additional noise control treatment or hush kits applied).

Table 9: Sound Power Levels for Proposed Mining Fleet (Unmitigated Plant Items)

Fleet	Equipment Descriptor	Overall dBA	Octave band centre frequency – Hz (dBZ)								
			31.5	63	125	250	500	1k	2k	4k	8k
CHPP	CHPP	123	-	117	117	119	118	117	117	115	112
D1	D10 dozer	116	107	111	117	113	114	112	108	102	97
D2	D11 dozer	108	109	110	108	110	104	102	100	95	88
WD	CAT84G wheel dozer	127	122	121	130	120	120	123	122	114	109
Drill	Drill	126	-	117	124	116	114	113	113	108	104
FEL	CAT 992 front end loader	112	102	106	121	104	106	108	103	97	89
G1	CAT 24M grader	121	99	102	118	113	112	110	107	101	95
G2	CAT 16H grader	113	101	102	111	104	109	110	105	100	100
WC	CAT 777 water cart	112	113	118	116	112	109	106	104	97	90
E1	9400 Excavator	126	120	128	122	117	117	120	120	118	111
E2	R996B Excavator	126	120	128	122	117	117	120	120	118	111
E3	EX1900 Excavator	126	120	128	122	117	117	120	120	118	111
T1_Coal	CAT789 190 t truck	118	119	125	125	120	116	111	108	102	97
T3	CAT5300 300t truck	121	122	128	128	123	119	114	111	105	100

4.4 Predicted Operational Noise Levels

Predicted operational noise levels at each noise sensitive receiver are presented in Tables 10 and 11 for Years 2037 and 2043, respectively. Noise levels have been predicted and presented for both neutral weather (i.e. no wind) and adverse weather conditions.

Noise contour maps are also presented in Appendix E.

Table 10 shows operational noise levels for Year 2037 under neutral and adverse weather conditions are predicted to comply with the Project noise criteria for daytime, evening and night-time periods. The exception is the nearest receiver "Tralee 2" with a possible noise exceedance up to 7dBA under adverse weather conditions. This assumes the worst-case scenario with all plant operating simultaneously. Noise exceedances from plant items are discussed further in Section 5.

Table 11 shows operational noise levels for Year 2043 under neutral and adverse weather conditions are predicted to comply with the Project noise criteria for daytime, evening and night-time periods. The exception is the nearest receiver "Tralee 2" with a possible noise exceedance of up to 5dBA under neutral weather conditions and up to 8dBA under adverse weather conditions. This assumes the worst-case scenario with all plant operating simultaneously. Noise exceedances from plant items are discussed further in Section 5.

Table 10: Predicted Total Noise Levels Project Year 2037 – Neutral & Adverse Weather Conditions

Receiver ID	Receiver	Year 2037 - Neutral Weather	Year 2037 - Adverse Weather	Project Noise Criteria dBA (LA _{eq} , 15 min)			Compliance?		
				Day	Evening	Night	Day	Evening	Night
SR075	Accommodation Village 1	24	31	36	38	34	Yes	Yes	Yes
SR074	Accommodation Village 2	24	31	36	38	34	Yes	Yes	Yes
SR410	Accommodation Village 3	24	31	36	38	34	Yes	Yes	Yes
SR411	Accommodation Village 4	24	31	36	38	34	Yes	Yes	Yes
SR278-SR303	Alfred Quinn Drive Residences	23	30	36	38	34	Yes	Yes	Yes
SR619-SR725	Centenary Drive South Residences	24	31	36	38	34	Yes	Yes	Yes
SR069	Industrial Estate	24	31	50	50	50	Yes	-	-
SR409	Middlemount Community School	23	30	40	40	40	Yes	-	-
SR060	Norm Blanche Oval	24	31	50	50	50	Yes	-	-
SR057	Treatment Plant	24	31	50	50	50	Yes	-	-
Gundabah	Gundabah	23	30	32	36	35	Yes	Yes	Yes
Hazelbrae	Hazelbrae	20	26	32	36	35	Yes	Yes	Yes
Campion	John Frederick Campion	22	28	33	32	30	Yes	Yes	Yes
Foxleigh	Foxleigh	17	23	33	32	30	Yes	Yes	Yes
Tralee	Tralee	15	21	33	32	30	Yes	Yes	Yes
Tralee 2	Tralee 2	30	37	33	32	30	No	No	No

Table 11: Predicted Total Noise Levels for Project Year 2043 – Neutral & Adverse Weather Conditions

Receiver ID	Receiver	Year 2043 - Neutral Weather	Year 2043 - Adverse Weather	Project Noise Criteria dBA (LA _{eq} , 15 min)			Compliance?		
				Day	Evening	Night	Day	Evening	Night
SR075	Accommodation Village 1	24	31	36	38	34	Yes	Yes	Yes
SR074	Accommodation Village 2	24	30	36	38	34	Yes	Yes	Yes
SR410	Accommodation Village 3	23	30	36	38	34	Yes	Yes	Yes
SR411	Accommodation Village 4	24	31	36	38	34	Yes	Yes	Yes
SR278-SR303	Alfred Quinn Drive Residences	23	30	36	38	34	Yes	Yes	Yes
SR619-SR725	Centenary Drive South Residences	23	30	36	38	34	Yes	Yes	Yes
SR069	Industrial Estate	24	31	50	50	50	Yes	-	-
SR409	Middlemount Community School	23	30	40	40	40	Yes	-	-
SR060	Norm Blanche Oval	24	30	50	50	50	Yes	-	-
SR057	Treatment Plant	24	31	50	50	50	Yes	-	-
Gundabah	Gundabah	17	24	32	36	35	Yes	Yes	Yes
Hazelbrae	Hazelbrae	16	22	32	36	35	Yes	Yes	Yes
Campion	John Frederick Campion	21	27	33	32	30	Yes	Yes	Yes
Foxleigh	Foxleigh	16	22	33	32	30	Yes	Yes	Yes
Tralee	Tralee	16	22	33	32	30	Yes	Yes	Yes
Tralee 2	Tralee 2	35	38	33	32	30	No	No	No

5 Discussion on Noise Exceedances

The previous report section identified the nearest noise sensitive receiver "Tralee 2" as possible noise exceedances up to 7dBA under adverse weather conditions in Year 2037, and 5dBA under neutral and up to 8dBA under adverse weather conditions in Year 2043.

Our review of the EIS document [Reference 1] shows a number of noise contour maps based on the Projected Stage 2 operation. Contours maps for Year 7, Year 14 and Year 22 of the mine have been extracted and presented in Appendix F of this report. Appendix F of this report also shows an indicative location of the nearest noise sensitive receiver "Tralee 2".

A comparison of the noise contour maps (C-4, C-5 and C-6) and location of Tralee 2 shows previously predicted and approved operational noise levels in the range of 40dBA to 44dBA at Tralee 2 (Appendix F). Similarly, a comparison of the contour maps (D-4, D-5 and D-6) and location of Tralee 2 shows operations noise levels with some mitigation applied in the range of 37dBA to 40dBA at Tralee 2 (Appendix F).

In summary, the contour maps in the EIS document [Reference 1] predict noise levels ranging from 37dBA to 44dBA at Tralee 2 depending on the year and mitigation control (Appendix F). In comparison, noise predictions at Tralee 2 for the Southern Extension Project indicate lower noise levels around 30dBA to 35dBA under neutral weather and 37dBA to 38dBA under adverse weather conditions. That is, the noise levels predicted at Tralee 2 in the Stage 2 EIS, which are greater than those predicted for the Project, were approved prior to the construction of the Tralee 2 dwelling.

Predictions assume the worst-case scenario with all plant operating simultaneously. One exception is topsoil management plant, which would generally not be operated at night and are therefore assumed to not be operational during adverse (i.e. temperature inversion) conditions.

It should be noted the maximum predicted noise level at Tralee 2 for the Project, 38dBA, is consistent with the maximum noise level predicted at this receiver in the Middlemount Coal Mine Western Extension Project. This result is due to the following:

- the Project would not increase the maximum mining fleet assessed as part of the Middlemount Coal Mine Western Extension Project (Section 4.3.2);
- the Project would not decrease the distance between mining activities and Tralee 2 (Section 3.3); and
- when mining activities are proposed to be undertaken closest to Tralee 2, they would be reducing in scale overall as production ramps down.

Material impacts would be avoided at Tralee 2 with the continued implementation of simple operational modifications (e.g. the use of particularly noisy equipment may be limited) as required (e.g. consistent with the approved Middlemount Coal Mine).

In the event of a noise-related complaint, Environmental Authority Conditions D1 to D5 (Table 2) will be investigated. That is, noise monitoring would be conducted to validate the model predictions and inform the implementation of noise mitigation measures, if required, where Project noise criteria are exceeded. In this instance, noise mitigation measures would be investigated in consultation with the noise sensitive receptor and could include modification of mine operations or at-receiver mitigation measures.

6 Conclusion

Renzo Tonin & Associates has completed a noise impact assessment for the Project.

Under neutral and adverse weather conditions (i.e. a temperature inversion), operational noise levels for the Years 2037 and 2043 scenarios were determined to satisfy the Project noise criteria for daytime, evening and night-time periods at a majority of the nearest noise sensitive receivers. The exception is the nearest receiver "Tralee 2", located approximately 1.9km from the proposed open cut pit extension, with possible noise exceedances up to 7dBA for modelling Year 2037 and 8dBA for modelling Year 2043.

The maximum predicted noise level, however, is consistent with the maximum noise level predictions for the approved Middlemount Coal Mine Western Extension Project. This result is due to the following:

- the Project would not increase the maximum mining fleet assessed as part of the Middlemount Coal Mine Western Extension Project;
- the Project would not decrease the distance between mining activities and Tralee 2; and
- when mining activities are proposed to be undertaken closest to Tralee 2, they would be reducing in scale overall as production ramps down.

Material impacts would be avoided at Tralee 2 with the continued implementation of simple operational modifications (e.g. the use of particularly noisy equipment may be limited) as required (e.g. consistent with the approved Middlemount Coal Mine).

In the event of a noise-related complaint, noise monitoring would be conducted to validate the model predictions and inform the implementation of noise mitigation measures, if required, where Project noise criteria are exceeded. In this instance, noise mitigation measures would be investigated in consultation with the sensitive receptor and could include modification of mine operations or at-receiver mitigation measures.

References

1. Environmental Authority EPML 00716913 (effective 26 February 2020);
2. Environmental Protection (Noise) Policy 2019;
3. Ecoaccess Guideline - Planning for Noise Control;
4. Ecoaccess Draft Guideline Assessment of Low-frequency Noise;
5. Model Mining Conditions Guideline (Department of Environment and Heritage Protection, 2017a);
6. Internal Standard ISO 9613 (1996) *Acoustics – Attenuation of sound propagation outdoors*;
7. Parsons Brinckerhoff (2010) Middlemount Coal Project, Stage 2 Noise Assessment Technical Report;
8. Noise Monitoring Report Middlemount Coal Pty Ltd Dysart/Middlemount Road Middlemount QLD 4746 [Report 2546-1 R2 dated 29 January 2013 and prepared by NMS; and
9. Middlemount Coal Mine – Southern Extension Project Air Quality and Greenhouse Gas Assessment dated June 2020 [Reference D19032-7] and prepared by Katestone Environmental Pty Ltd.

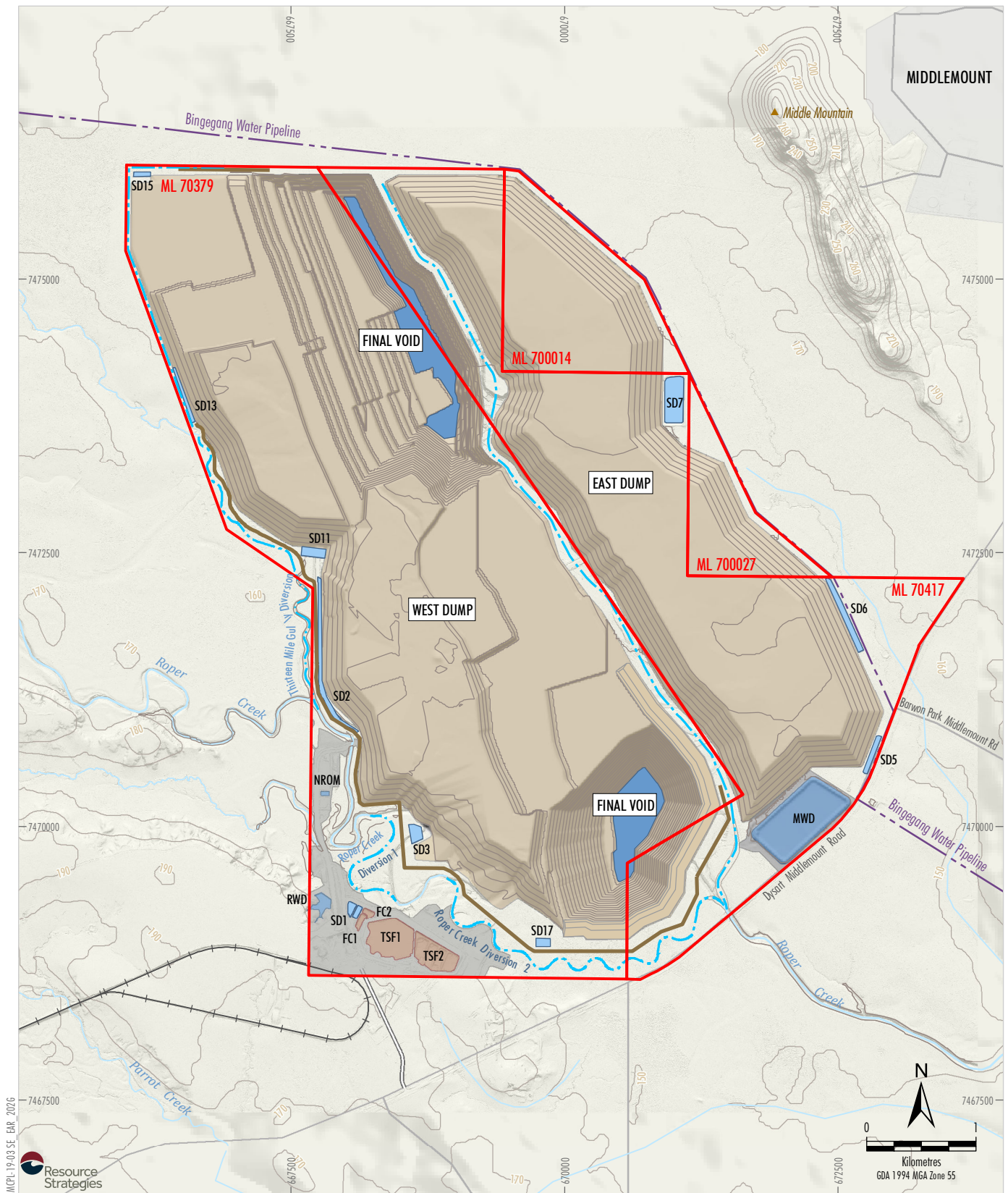
APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

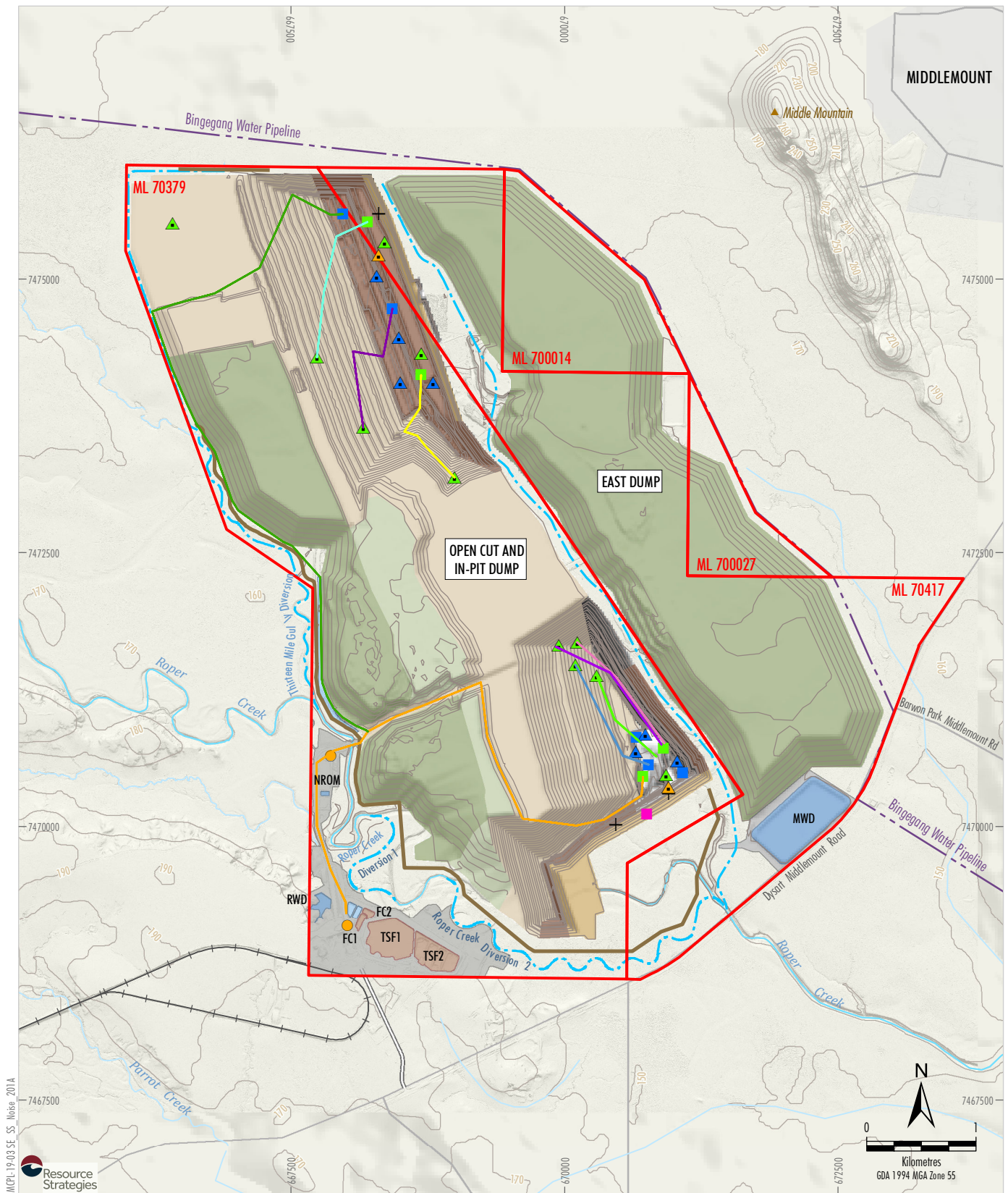
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.

L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L _{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B **Project General Arrangement**



APPENDIX C Fleet Locations

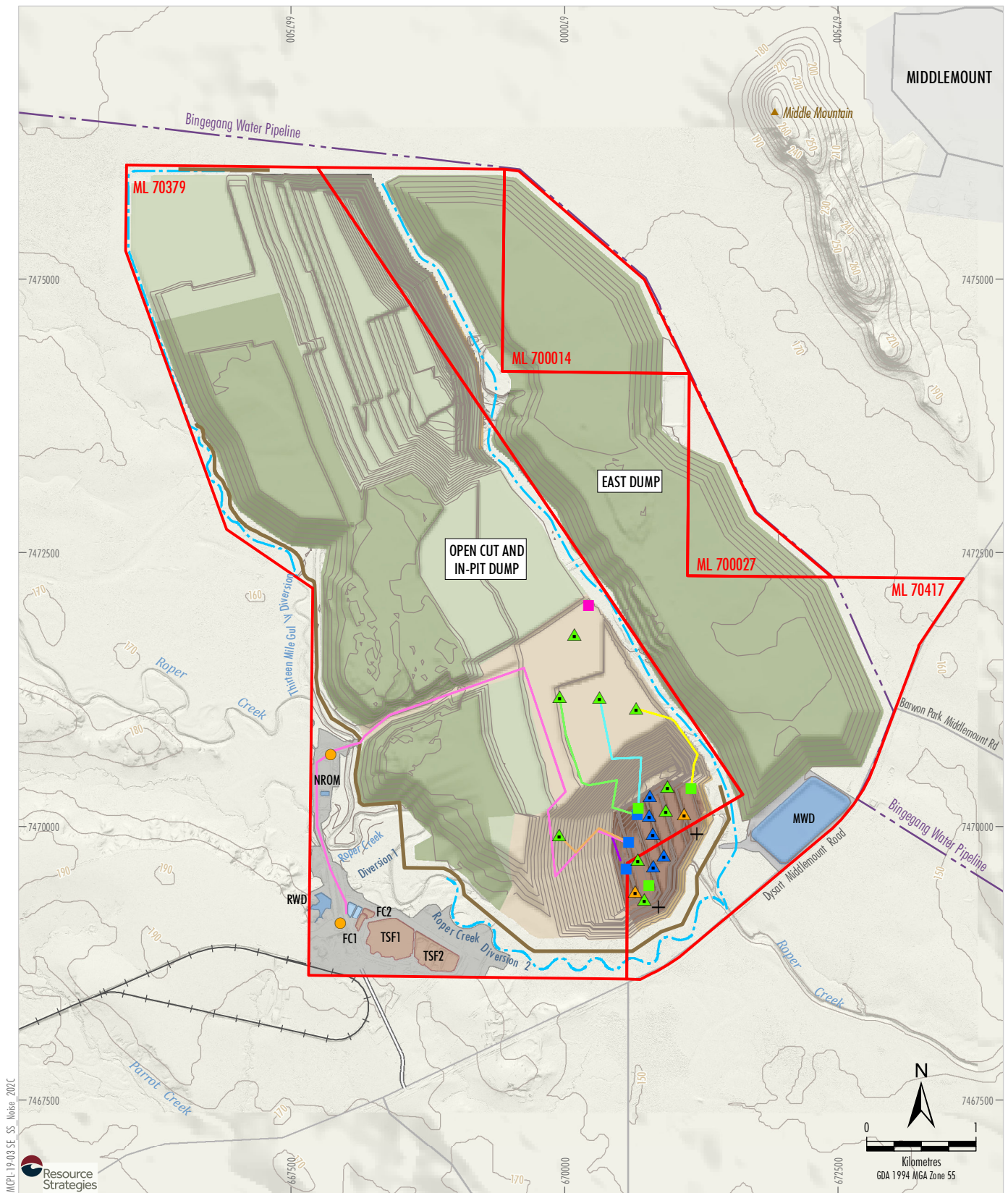


LEGEND

- | | | |
|--------------------------------|---------------|--------------------------|
| Topsoil Stripped | Coal Route 1 | 84G Wheel Dozer |
| Active Open Cut Mining Area | Coal Route 2 | CAT 922 Front End Loader |
| Active Waste Rock Emplacement | Waste Route 1 | D10 Dozer |
| Initial Rehabilitation | Waste Route 2 | D11 Dozer |
| Established Rehabilitation | Waste Route 3 | Drill |
| Mine Infrastructure Area | Waste Route 4 | EX1900 Excavator |
| Tailings Storage Facility | Waste Route 5 | EX9400 Excavator |
| Sediment Dam | Waste Route 6 | R966B Excavator |
| Water Storage | Waste Route 7 | |
| Diversion Structure | | |
| Levee | | |
| Mine Access Road | | |
| Middlemount Rail Spur and Loop | | |



SOUTHERN EXTENSION PROJECT
Conceptual General Arrangement
Year 17 (2037)



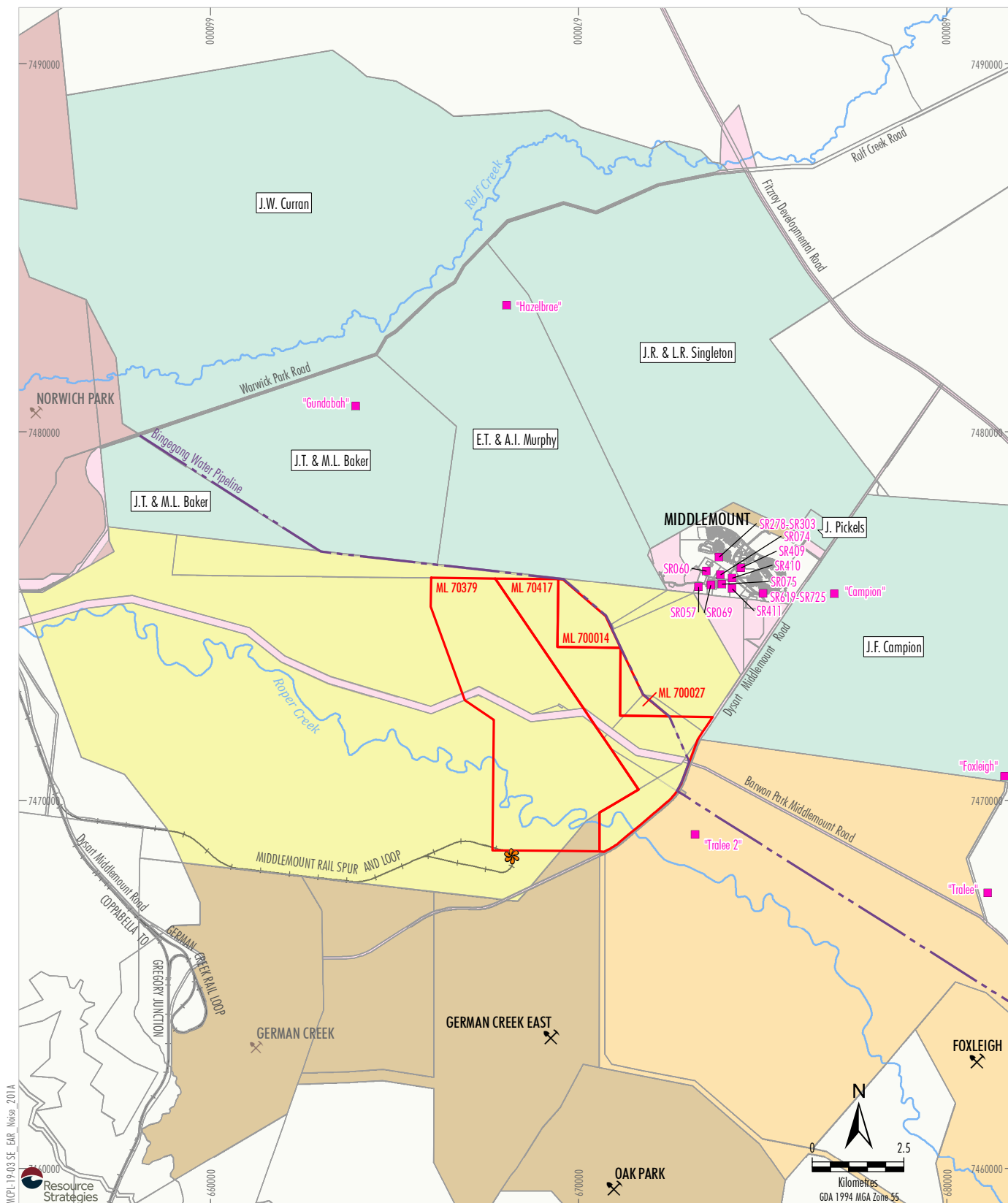
LEGEND			
 	Mining Lease Boundary (ML)	—	Coal Route 1
 	Topsoil Stripped	—	Coal Route 2
 	Active Open Cut Mining Area	—	Waste Route 1
 	Active Waste Rock Emplacement	—	Waste Route 2
 	Initial Rehabilitation	—	Waste Route 3
 	Established Rehabilitation	—	Waste Route 4
 	Mine Infrastructure Area	▲	84G Wheel Dozer
 	Tailings Storage Facility	●	CAT 922 Front End Loader
 	Sediment Dam	▲	D10 Dozer
 	Water Storage	▲	D11 Dozer
---	Diversion Structure	+	Drill
---	Levee	■	EX1900 Excavator
---	Mine Access Road	■	EX9400 Excavator
+ +	Middlemount Rail Spur and Loop	■	R966B Excavator

SOUTHERN EXTENSION PROJECT

Conceptual General Arrangement

Year 23 (2043)

APPENDIX D **Noise Sensitive Receiver Locations**



Source: MCPL (2020); AGE (2018); The State of Queensland (2020)

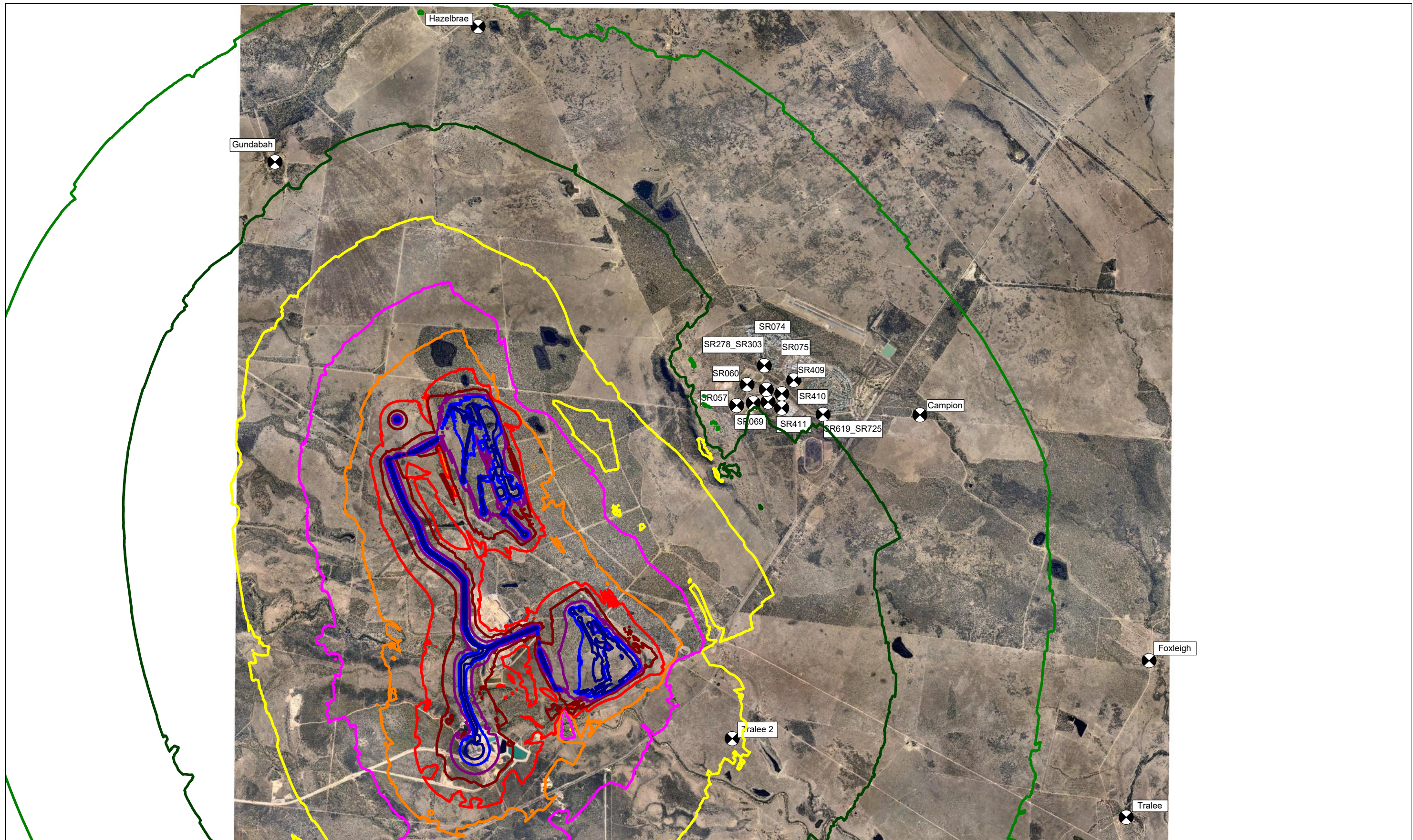
- LEGEND**
- Middlemount Coal Mining Lease Boundary (ML)
 - Cadastral Boundary
 - Railway
 - ✂ Active Coal Mine
 - ✂ Inactive Coal Mine
 - LANDHOLDER**
 - Middlemount Coal Owned Land
 - Anglo Coal (Capcoal Management) Pty Limited
 - BHP Coal Pty Ltd; QCT Mining Pty Ltd; Mitsubishi Development Pty Ltd; QCT Investment Pty Ltd; BHP Queensland Coal Investments Pty Ltd; Umal Consolidated Pty Ltd; QCT Resources Pty Limited
 - Foxleigh Land Pty Ltd
 - Crown Land
 - Relevant Private Landholder
 - Owner not Referenced

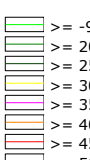
- ✂ Meteorological Station
- Sensitive Receiver
- SENSITIVE PLACES**
- | Receiver | Location |
|-------------|----------------------------------|
| SR075 | Accommodation Village 1 |
| SR074 | Accommodation Village 2 |
| SR410 | Accommodation Village 3 |
| SR411 | Accommodation Village 4 |
| SR278-SR303 | Alfred Quinn Drive Residences |
| SR619-SR725 | Centenary Drive South Residences |
| SR069 | Industrial Estate |
| SR409 | Middlemount Community School |
| SR060 | Norm Blache Oval |
| SR057 | Treatment Plant |

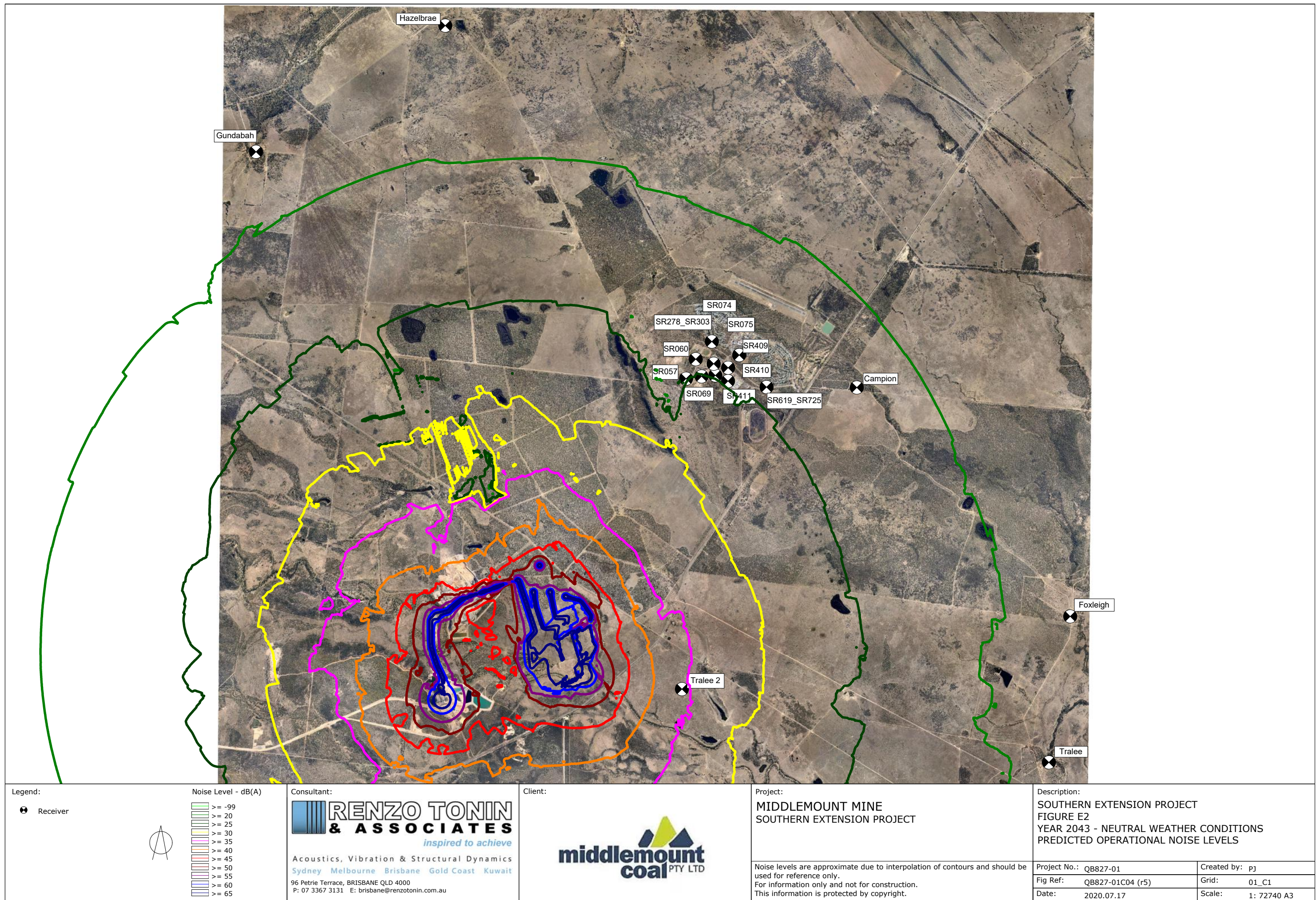


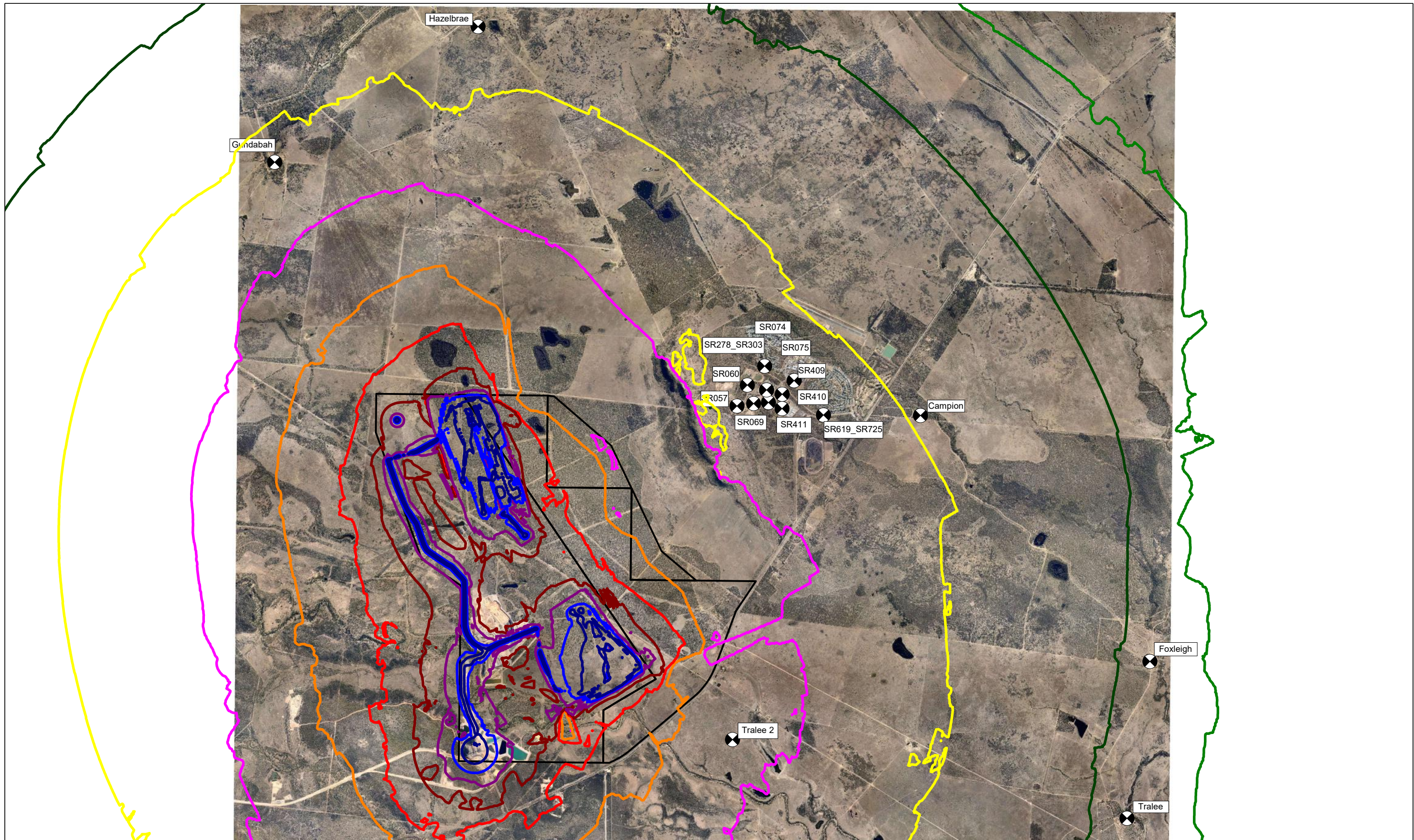
SOUTHERN EXTENSION PROJECT
Location of Sensitive Receptors

APPENDIX E Noise Contour Maps

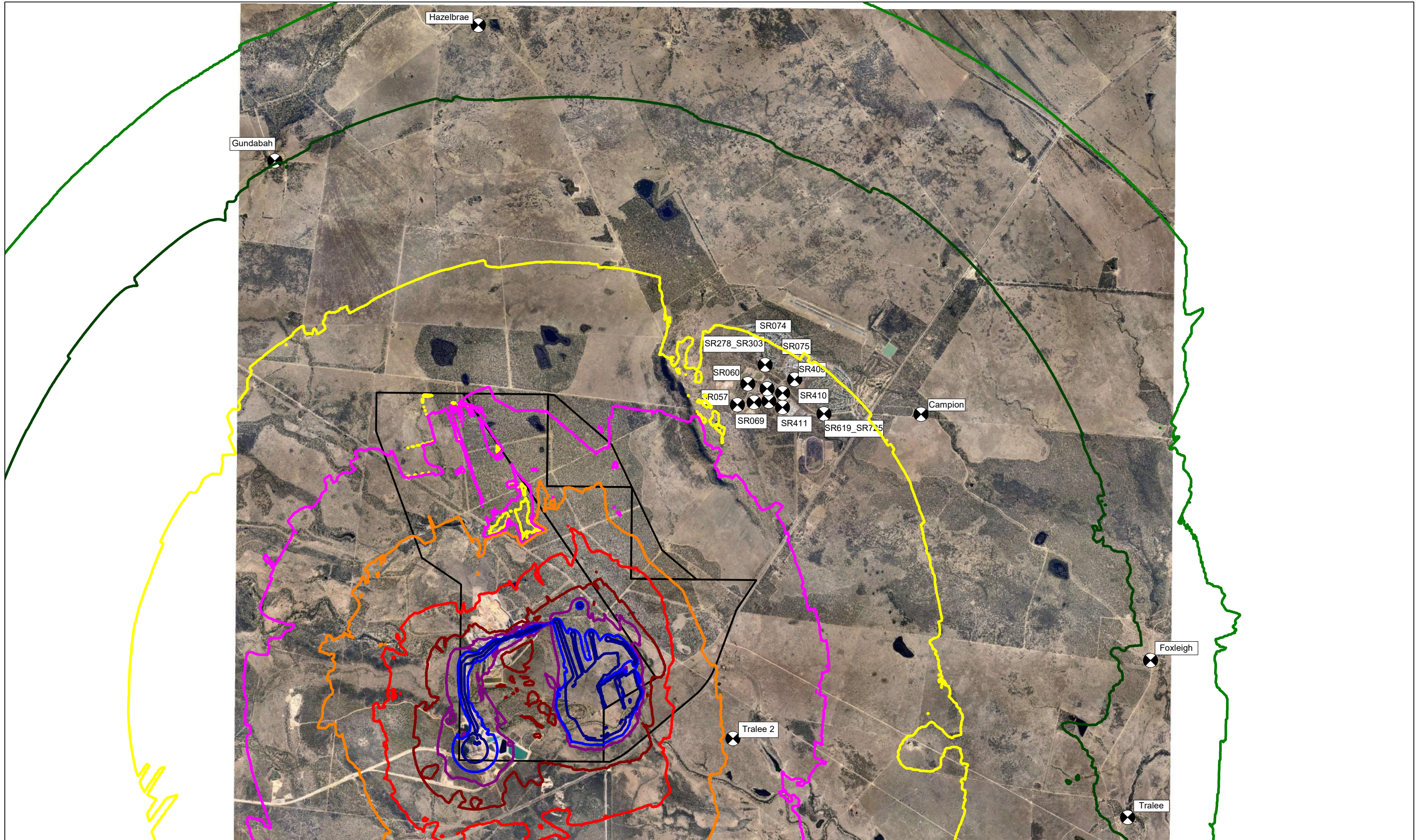


Legend:		Noise Level - dB(A)	Consultant:	Client:	Project:	Description:	
 Receiver		  >= -99 >= 20 >= 25 >= 30 >= 35 >= 40 >= 45 >= 50 >= 55 >= 60 >= 65	 Acoustics, Vibration & Structural Dynamics Sydney Melbourne Brisbane Gold Coast Kuwait 96 Petrie Terrace, BRISBANE QLD 4000 P: 07 3367 3131 E: brisbane@renzotonin.com.au		MIDDLEMOUNT MINE SOUTHERN EXTENSION PROJECT	SOUTHERN EXTENSION PROJECT FIGURE E1 YEAR 2037 - NEUTRAL WEATHER CONDITIONS PREDICTED OPERATIONAL NOISE LEVELS	
Noise levels are approximate due to interpolation of contours and should be used for reference only. For information only and not for construction. This information is protected by copyright.					Project No.: QB827-01		Created by: pj
					Fig Ref: QB827-01C03 (r5)		Grid: 01_C1
					Date: 2020.07.17		Scale: 1: 72740 A3





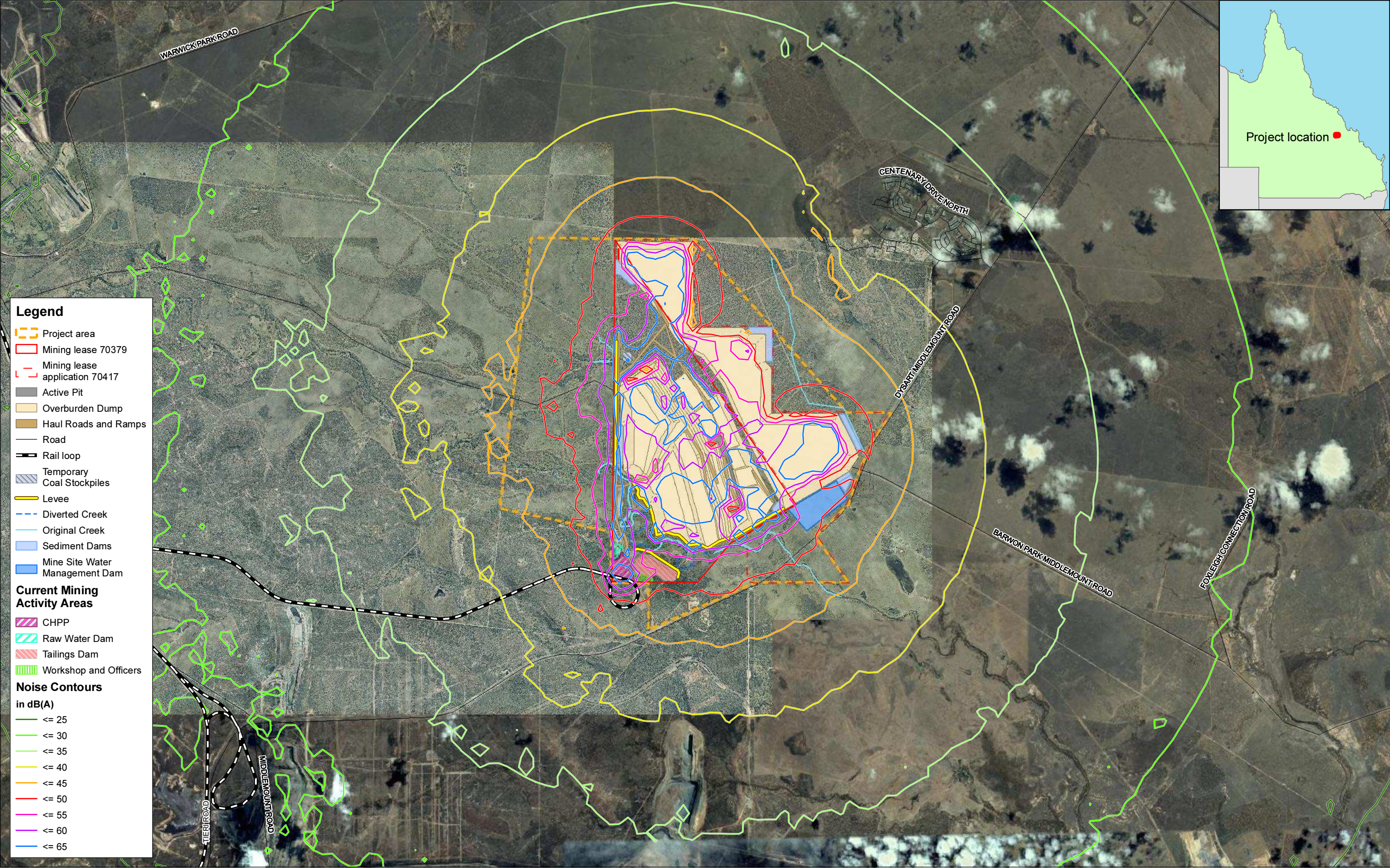
Legend: + Point Source — Line Source ● Receiver

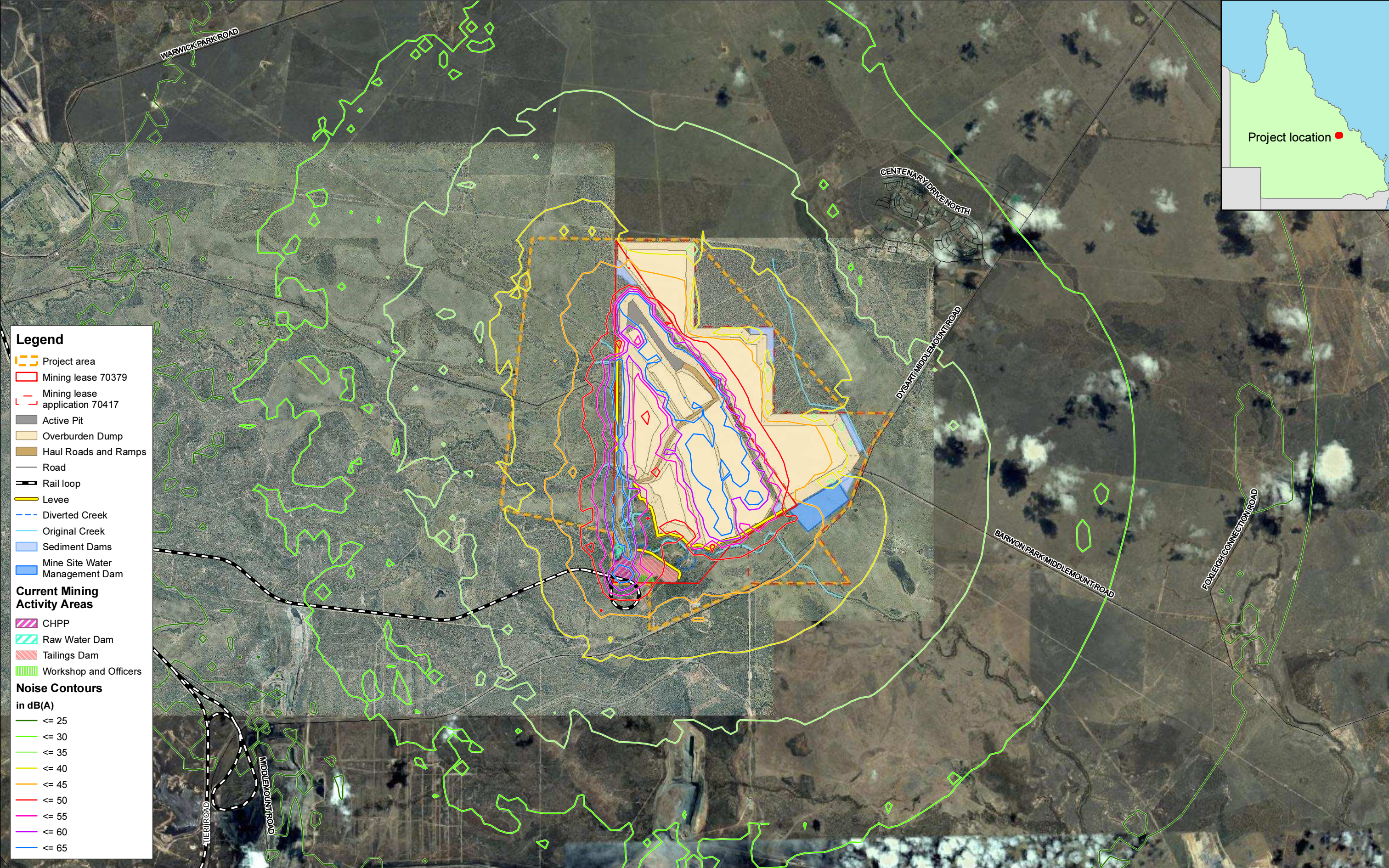


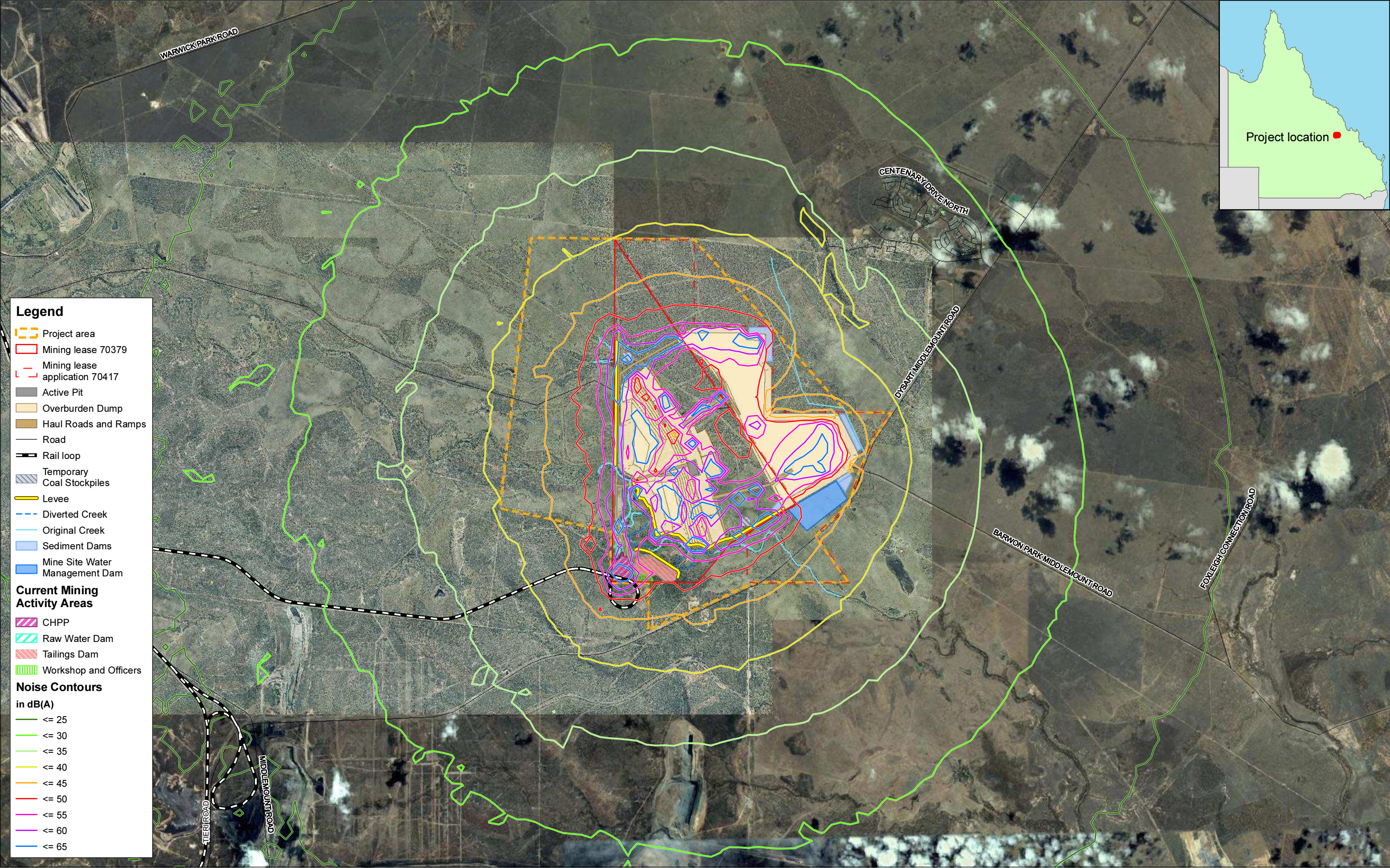
Legend: + Point Source — Line Source ● Receiver	Noise Level - dB(A) ≥ -99 ≥ -90 ≥ -80 ≥ -70 ≥ -60 ≥ -50 ≥ -40 ≥ -30 ≥ -20 ≥ -10 ≥ 0 ≥ 10 ≥ 20 ≥ 30 ≥ 40 ≥ 50 ≥ 60 ≥ 70 ≥ 80 ≥ 90 ≥ 100	Consultant: RENZO TONIN & ASSOCIATES <i>inspired to achieve</i> Acoustics, Vibration & Structural Dynamics Sydney Melbourne Brisbane Gold Coast Kuwait 96 Petrie Terrace, BRISBANE QLD 4000 P: 07 3367 3131 E: brisbane@renzotonin.com.au		Client: middlemount coal PTY LTD	Project: MIDDLEMOUNT MINE SOUTHERN EXTENSION PROJECT	Description: SOUTHERN EXTENSION PROJECT FIGURE E4 YEAR 2043 - ADVERSE WEATHER CONDITIONS PREDICTED OPERATIONAL NOISE LEVELS	
				Noise levels are approximate due to interpolation of contours and should be used for reference only. For information only and not for construction. This information is protected by copyright.	Project No.: QB827-01	Created by: pj	
				Fig Ref: QB827-01C05 (r5)	Grid: 01_C1		
				Date: 2020.07.17	Scale: 1: 72740 A3		

APPENDIX F **Noise Contour Maps from EIS**













APPENDIX G Meteorological Data

An Air Quality Assessment has been prepared by Katestone Environmental Pty Ltd for the Project. The report is titled *Middlemount Coal Mine – Southern Extension Project Air Quality and Greenhouse Gas Assessment* and dated June 2020 [Reference D10032-7].

The following text and figure are an extract from Pages 10 and 11 of the report.

MCPL operates a meteorological station south of the MCM ML 70379 boundary near the rail loop (Figure 3). Hourly average meteorological data from April 2016 to early December 2019 has been considered as part of this assessment. The distribution of hourly average winds measured by the monitoring station are presented in Figures 4 to 6 as annual, seasonal and diurnal wind roses. The winds are predominantly from the south-east quadrant, with an average wind speed of 2.2 metres per second (m/s).

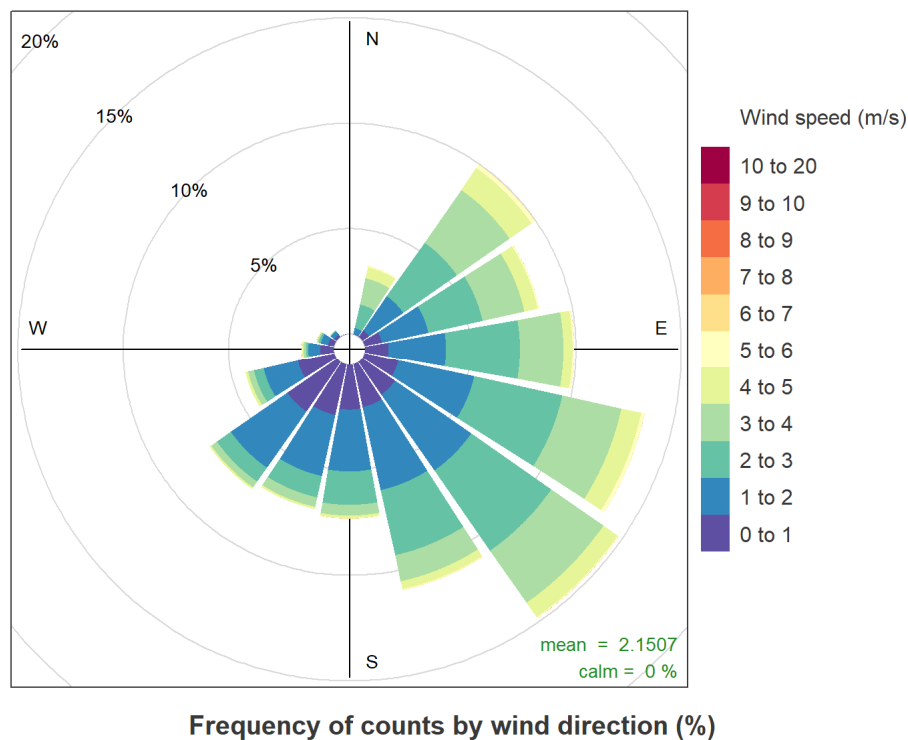


Figure 4 Annual distribution of winds measured at the MCM meteorological monitoring station

Our analysis of the wind roses concluded that wind effects were not a particular feature of the area. That is wind is not considered to be a feature where source to receiver wind speeds (at 10 metre (m) height) of 3 metres per second (m/s) or below occur for 30% of the time or more in any assessment period (day, evening, night) in any season as outlined in the Planning for Noise Control. For the Project we have therefore not used the default wind effects parameter of 3m/s.