

Appendix D
Acoustics Impact Assessment



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BENGALLA MINING COMPANY PTY LTD

ACOUSTIC IMPACT ASSESSMENT

MODIFICATION TO DEVELOPMENT CONSENT

REPORT J0130-103-R1

8 APRIL 2016

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GLOSSARY

The following acoustical terms are used in this report:

Sound Pressure	Small air pressure variations above and below normal atmospheric pressure that are perceived by human ears as sound.
Sound Power	Sound energy emitted by a source, measured in watts (W) or expressed on a decibel scale with 0 dB representing 1 picowatt (1 pW) of sound power. While both sound pressure (in pascals) and sound power (in watts) can be expressed on a decibel scale, they are not interchangeable or directly comparable. Sound power levels are most commonly expressed as unweighted decibels (dBL), particularly when referring to sound power levels in frequency bands, but can be expressed as A-weighted decibels (dBA).
Frequency	The rate of sound pressure or sound power fluctuations per second, expressed as cycles per second or hertz (Hz). Human ears in good condition can typically detect sound pressure in the frequency range 20 Hz to 20,000 Hz (20 kHz), depending on the sound level.
Decibels, dB	A noise level unit based on a logarithmic scale of Pascals of sound pressure above and below atmospheric pressure, or watts of sound power. Expressing a sound level in decibels implies root-mean-squared (RMS) unless explicitly stated otherwise. Human ears in good condition can typically detect sound pressures from the threshold of perception at 0 dB (20 uPa) to the approximate threshold of pain at 140 dB (200 Pa). An increase of 10 dB is perceived as an approximate doubling of sound level by an average human ear.
dBL	Linear decibels, the same as dB but used to explicitly define a decibel scale in the absence of any weighting within the audible range.
dBA	A-weighted decibels, where the A weighting means frequencies below 500Hz and above 10kHz are artificially reduced to approximate the frequency response of an average human ear. Most sound monitoring instruments include an A-weighting option, enabling direct measurement of noise levels in dBA.
LA90	The A-weighted noise level exceeded 90% of the time (which can be thought of as the quietest 10% of the time) over a defined measurement period, usually 15 minutes or one hour, and widely accepted as the background noise level.
LAeq	The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location.

1 INTRODUCTION

Bengalla Mining Company Pty Limited (BMC) is seeking approval from the NSW Minister for Planning or their delegate for a modification to SSD-5170. The modification is sought under section 96(2) of the *Environmental Planning and Assessment Act* (EP&A Act) for the following:

- Alterations to the approved height of the Main Overburden Emplacement Area (Main OEA) to improve visual amenity from primary viewing locations in and surrounding the township of Muswellbrook and Denman Road, in two selected locations (Visual Relief Areas):
 - The Northern Relief Area constructed to a maximum height of Reduced Level (RL) 300; and
 - The Southern Relief Area constructed to a maximum height of RL 290.
- Establishment of a new gravel access road from Wybong Road to the Dry Creek Diversion Project Construction Site Office being a former homestead (Homestead Access).

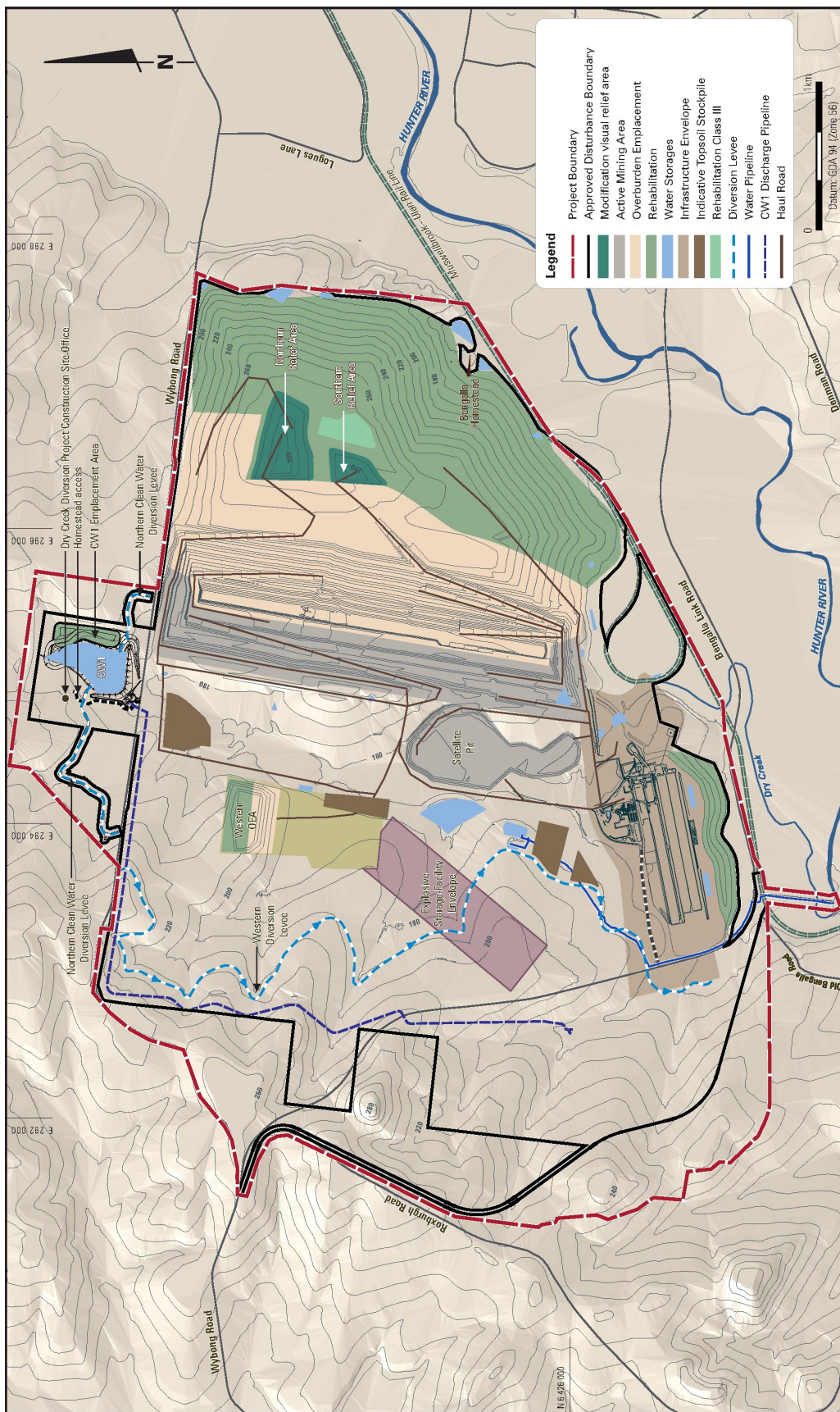
Modification interactions with the approved conceptual Year 4 and Year 8 mine plans are presented on Figure 1 and Figure 2 respectively. The figures have been provided by Hansen Bailey for inclusion in this report.

1.1 Receptors

Bengalla adjoins rural and residential receptors on all sides, with other operating and approved coal mines located south east and north of Bengalla. Some of the closest rural properties have previously been purchased by BMC to provide land for the mine or a noise and/or air quality buffer around the mine.

A number of properties not owned by BMC have been purchased by owners of the approved but currently undeveloped Mt Pleasant Mine located to the north or the operating Mt Arthur Coal Mine located to the south east. Properties and residences owned by BMC or other mining companies are not considered to be noise-sensitive receptors and are not specifically assessed in this report.

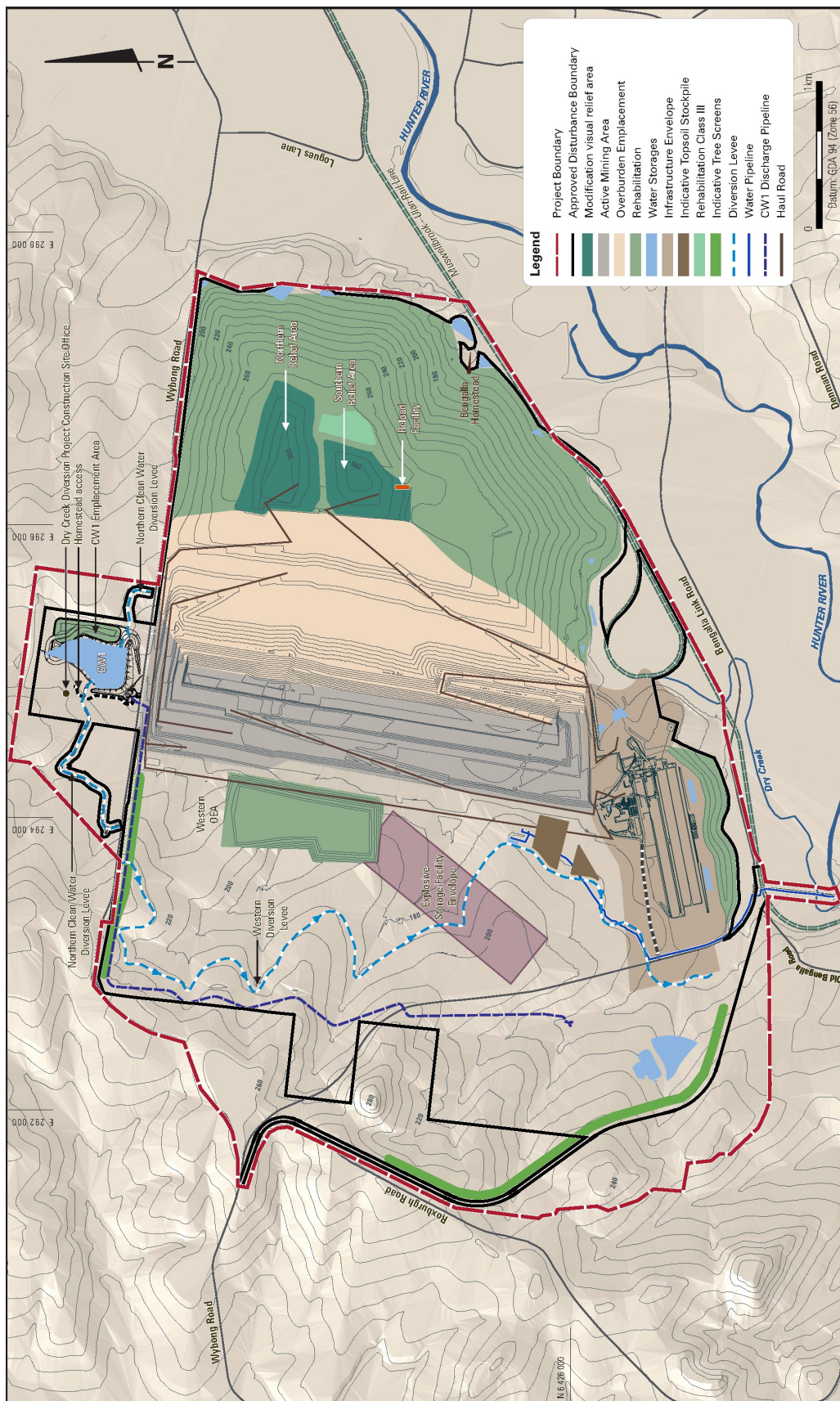
Figure 1: Modification Overview – Year 4 Mine Plan



BENGALLA MINE
 Modification Overview - Year 4 Mine Plan



Figure 2: Modification Overview – Year 8 Mine Plan



BENGALLA MINE
 Modification Overview - Year 8 Mine Plan



2 NOISE CRITERIA

Bengalla Mine currently operates under Development Consent SSD-5170 (as modified) issued by the Minister for Planning on 3 March 2015. The Development Consent includes a number of conditions to minimise environmental impacts based on current NSW government guidelines and policies, including the following relevant conditions.

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the owner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 5 and 6 of schedule 4.

Table 1: Land subject to acquisition upon request

Acquisition Basis	Receiver No
Noise	152, 153, 154, 156

Note: To interpret the land referred to in Table 1, see the applicable figure in Appendix 4.

2. If the Applicant receives a written request for acquisition from the owner of the land listed in Table 2 and if that land is no longer subject to acquisition upon request under the relevant development consent or project approval shown in Table 2, then the Applicant shall acquire the land in accordance with the procedures in conditions 5 and 6 of schedule 4.

Table 2: Land subject to acquisition upon request

Acquisition Basis	Receiver No	Mine
Noise	112, 113, 114, 120	Mt Arthur
Noise & Air	117, 118, 119, 155	
Noise & Air	166, 168, 171	Mt Pleasant
Air	169	

Note: To interpret the land referred to in Table 2, see the applicable figure in Appendix 4.

NOISE

Noise Criteria

4. Except for the noise-affected land in Tables 1 and 2, the Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 4 at any residence on privately owned land.

Table 4: Noise Criteria dBA

Location	Day LAeq,15min	Evening LAeq,15min	Night	
			LAeq,15min	LA1,1min
109, 110, 156, 161	40	40	40	45
106, 108	39	39	39	45
27, 169	39	39	36	45
105, 126	38	38	38	45
22, 23, 24, 25, 29, 43, 44	38	38	36	45
167	38	38	35	45
19, 64, 66	38	37	36	45
180, 184, 186	37	37	35	45
146	37	37	37	45
102, 130, 145, 189	36	36	36	45
All other privately owned residences	35	35	35	45

Note: To interpret the land referred to in Table 4, see the applicable figure in Appendix 4.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 5 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

2.1 Construction Noise

Construction noise levels produced during establishment of most industrial developments are normally assessed to the *Interim Construction Noise Guideline* (ICNG). Section 1.2 of the ICNG states it does not apply to construction associated with quarrying and mining and suggests this activity should be assessed under the *NSW Industrial Noise Policy* (INP). Section 1.3 of the INP, however, specifically excludes construction noise. The *Draft Industrial Noise Guideline* (Draft ING) prepared by the Environment Protection Authority (EPA) in September 2015 similarly excludes construction noise.

The Homestead Access is indirectly related to mining activity and would be completed using a construction fleet rather than a mining fleet. This relatively short term component is therefore assessed to noise criteria in the ICNG which recommends:

- A ‘noise affected’ level of 10 dBA above the background noise level which represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq,15min level is greater than the ‘noise affected’ level, all feasible and reasonable noise control measures should be applied in an effort to meet the ‘noise affected’ level; and
- A ‘highly noise affected’ level which represents the point above which there may be a strong community reaction to noise. Additional mitigation measures such as reduced working hours or respite periods should be considered in consultation with the relevant authority and the community.

3 OPERATIONAL NOISE

3.1 Noise Assessment Method

Noise levels from the Modification to potentially affected receptors were determined by modifying the most recent noise model of Bengalla Mine, which was originally developed during preparation of the Continuation of Bengalla Mine Environmental Impact Statement (Bengalla EIS), to include the modified OEA terrain as sought in the Modification and varied equipment operating locations.

The noise model is based on RTA Technology’s Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receiver locations or as contours over a receiver area. It is recognised in NSW as the most appropriate choice for situations involving complex topography and a large number of individual noise sources and where a detailed assessment of the effects of atmospheric conditions on noise propagation is required.

The modified terrain file was supplied by Hansen Bailey and BMC for inclusion in the noise model, while the modelled equipment locations were adjusted to suit the terrain. As the terrain remained unaffected by the Modification except for sections of the OEA above RL 270, the majority of

equipment locations were not changed from the EIS noise model. All other noise model parameters including CHPP equipment, mobile equipment fleet, source noise levels and prevailing weather conditions have remained unchanged from the Bengalla EIS noise model and comply with relevant recommendations in the Draft ING.

The Bengalla EIS reported predicted noise levels for project years 1, 4, 8, 15 and 24, however the Modification is not expected to significantly affect received noise levels in all years assessed in the Bengalla EIS. The Modification visual relief areas have been designed to integrate with the existing operations from approximately Year 4 to approximately Year 9. Noise levels in project Year 1 would not be affected as the OEA would remain unchanged from the approved mine plan. Noise levels in the later Years 15 and 24 would be slightly lower at residences located generally east of Bengalla Mine due to the increased OEA height acting as a more effective noise barrier, however the decrease in noise level at these receptors is not expected to be significant and has not been investigated in detail.

The relatively small section of the OEA to be constructed above the currently approved RL 270 limit is best represented by assessed Years 4 and 8, therefore noise levels during these two years are the focus of this assessment.

Noise contour figures showing proposed noise levels associated with the Modification are presented in Appendix A.

3.2 Weather Conditions

A summary of prevailing weather conditions is presented below. A more detailed analysis of prevailing weather conditions was presented in the Bengalla EIS and remains relevant to this assessment.

Table 1: Modelled Weather Conditions.

Atmospheric Parameter	Day Neutral	Day and Evening Prevailing		Night Prevailing	
Temperature, °C		20		10	
Relative Humidity, %		70		90	
Wind Speed, m/s	0	3		0	2
Wind Direction	-	SE	SSW	-	ENE
Temp Gradient, °C/100m		-1		3	
Equivalent Inversion	-1	6.5	6.5	3	8

Modelled weather conditions comply with relevant recommendations in the Draft ING, specifically including Fact Sheet D attached to the Draft ING which recommends appropriate weather related noise model parameters. The F stability class is represented in the noise model by a 3°C/100m temperature inversion which is near the upper end of the F class temperature gradient range.

3.3 Noise Control Strategies

Since operations commenced at Bengalla in 1998, BMC has invested significant resources into achieving all reasonable and feasible noise mitigation measures in an effort to minimise operational noise levels. BMC has a long history of working with equipment manufacturers to achieve the lowest possible equipment sound levels, particularly with regard to CHPP equipment and the haul truck fleet. All existing noise control options assessed in the Bengalla EIS are also assumed in this assessment.

3.4 Operational Noise Sources

3.4.1 Existing Noise Sources

BMC currently utilise a number of items of fixed and mobile equipment to uncover, extract, process and transport coal. Average sound power levels for existing equipment are listed in Table 2 and are identical to those adopted in the Bengalla EIS.

Table 2: Existing Noise Sources and Sound Power Levels.

Noise Source, Height Above Ground, m	Sound Power Level, dBL re 1pW *										Total	
	31.5	63	125	250	500	1000	2000	4000	8000	Lin	A	
Mobile Equipment												
Dragline 9020	15	124	121	119	109	111	108	104	99	90	127	113
Excavator EX3600	6	117	118	121	115	112	109	107	102	94	125	115
Excavator EX5500	6	117	118	121	115	112	109	107	102	94	125	115
Loader L1800	3	106	109	114	111	109	108	106	104	101	119	113
Truck 830E	3	116	121	120	115	113	109	106	102	97	125	115
Tracked Dozer D11	2	108	106	116	107	111	109	107	99	93	119	114
Wheel Dozer 854	3	106	109	114	111	109	108	106	104	101	119	113
Water Cart R90	3	107	108	117	116	111	110	108	103	96	121	115
Drill SK50	2	110	115	120	117	112	107	102	95	95	123	114
Grader 16M, 24M	2	97	99	109	105	103	104	102	96	88	113	108
Coal Processing and Transportation Equipment												
Sizing station ST103	15	112	108	108	104	101	100	95	84	73	115	104
Transfer ST104	10	101	103	108	105	102	99	97	94	86	112	105
Transfer ST105	8	101	103	108	105	102	99	97	94	86	112	105
Yard conveyor /200m	1	105	100	101	101	97	93	91	88	81	109	100
Raw stacker SK101	8	96	98	103	100	97	94	92	89	81	107	100
Raw reclaimer RC301	3	115	111	109	106	101	96	94	90	80	118	104
Transfer ST301	8	98	102	104	102	100	97	95	91	84	109	103
Surge bin BN301	20	89	94	92	93	94	96	95	93	87	103	101
CPP ST401	15	126	122	120	117	112	107	105	101	91	129	115
CPP Second Stage	15	120	116	114	111	106	101	99	95	85	123	109
Reject transfer ST701	8	117	109	105	102	107	106	105	99	89	119	111
Reject bin BN701	20	111	107	105	102	97	92	90	86	76	114	100
Transfer ST801	12	104	106	111	108	105	102	100	97	89	115	108
Sampling station ST802	12	96	98	103	100	97	94	92	89	81	107	100
Stackers SK801, 802	8	96	98	103	100	97	94	92	89	81	107	100
Reclaimer RC801, 802	3	115	111	109	106	101	96	94	90	80	118	104
Transfers ST803, 804	8	96	98	103	100	97	94	92	89	81	107	100
Train conveyor /200m	1	107	102	103	103	99	95	93	90	83	111	102
Train bin BN801	15	96	98	103	100	97	94	92	89	81	107	100
Locomotive (on loop)	3	109	109	102	101	105	104	100	94	88	114	108

* dBL means unweighted, as opposed to A-weighted, noise levels. Total dBL and dBA sound power levels are shown in the last two columns.

3.5 Predicted Mining Noise Levels

Noise contour figures showing predicted noise levels under calm and prevailing weather conditions have been produced for years 4 and 8 and are attached in Appendix A.

Noise levels were reported in the Bengalla EIS for all receptors predicted to receive a noise level over 35 LAeq,15min. As the Modification only affects noise levels at receptors located generally east of Bengalla, only those receptors are included in Table 3. Other receptors included in the equivalent results table in the Bengalla EIS are located generally west of Bengalla and noise levels at these receptors are not significantly affected by the Modification.

Table 3 shows the maximum of predicted noise levels in project years 4 and 8 only, as noise levels in other years assessed in the Bengalla EIS are not affected by the Modification. The table also shows the noise levels reported in the Bengalla EIS, for all years, for direct comparison with the predicted noise levels.

Table 3: Predicted Noise Levels at Residences, LAeq,15min

Owner ID	Block ID	Approved (Bengalla EIS) All Assessed Years			Approved (Bengalla EIS) Years 4, 8 Only			Modification Years 4, 8 Only		
		Day	Day/ Evening	Night	Day	Day/ Evening	Night	Day	Day/ Evening	Night
		Neutral	Prevailing		Neutral	Prevailing		Neutral	Prevailing	
Eastern receivers subject to 38 day / 37 evening / 36 night LAeq,15min INP noise criteria										
10	19	25	37	34	21	36	33	25	36	33
	25	25	38	34	21	36	33	25	36	33
11	22	25	38	34	21	37	33	26	37	33
12	23	25	38	34	21	37	33	26	37	33
13	24	25	38	34	21	37	33	26	37	33
14	27E	24	37	34	22	36	33	25	36	33
	27W	25	39	34	22	37	33	26	37	33
15	29	31	38	35	28	36	33	28	36	33
25	43	32	38	35	29	36	34	29	36	34
26	44	32	38	35	30	36	34	30	36	34
44	64	32	33	36	29	31	35	29	31	35
46	66	32	32	36	29	30	36	29	30	36
Contour Figure		-	-	-	A1	A2	A3	A4	A5	A6

The approved noise levels shown in the leftmost columns of Table 3 are higher than approved noise levels in project years 4 and 8 which clearly indicates noise levels in project years 4 and 8 are lower than the noise levels in project year 1.

The results indicate a predicted noise level increase of up to 5 LAeq,15min due to the Modification at some receptors under calm weather conditions, however with a predicted noise level of 26 LAeq,15min under those conditions noise from Bengalla Mine is not expected to be clearly audible under those conditions.

Under prevailing weather conditions, predicted noise levels from the Modification do not appreciably change from the currently approved noise levels in project years 4 and 8 and, in all cases, remain below the predicted noise levels in Year 1 reported in the Bengalla EIS. The lack of noise level

increase under prevailing weather conditions is due to the loudest individual noise sources being acoustically unshielded with or without the Modification, whereas some of these noise sources will move from a shielded to an exposed location under calm weather conditions as a result of the Modification.

With no increase in currently approved noise levels at any receptor, no change to the noise related conditions in the SSD-5170 Development Consent (as modified) are required or recommended.

3.6 Sleep Disturbance

With no predicted change in noise levels during the night under prevailing weather conditions, no appreciable change in maximum noise levels is expected. Any disturbance to sleep that currently occurs despite best practise management measures currently employed at Bengalla would not increase as a result of the Modification.

4 CONSTRUCTION

4.1 Construction Noise

Dry Creek Diversion Project infrastructure including Clean Water Dam 1 (CWD1) is approved to be constructed on the northern side of Wybong Road, however the current approval excludes construction of the Homestead Access road from Wybong Road to the Dry Creek Diversion Project construction site office. Construction of the Homestead Access road is proposed as part of this Modification.

Construction of the Dry Creek Diversion Project is expected to require a number of relatively large earthmoving machines operating for a period of a few months, compared to construction of the proposed access road which will require fewer small machines for a period of a few days. Construction of the proposed Homestead Access road would therefore produce insignificant noise at all receptors compared to construction of the approved infrastructure.

4.2 Construction Related Traffic Noise

Construction of the proposed Homestead Access road would require few vehicle movements on nearby public roads compared to traffic associated with the construction of the adjacent Dry Creek Diversion Project.

Traffic associated with this component of the Modification would also be insignificant compared to existing and approved traffic associated with operation of Bengalla Mine and other approved developments in the area such as Mangoola Mine. Given the relatively insignificant traffic noise levels associated with the Modification, no traffic noise management measures are recommended.

5 BLASTING

The Modification does not affect mining activity, apart from a minor change to the deposition of overburden material, therefore has no effect on currently approved blasting impacts at any receptor. If anything, the minor increase in the height of the OEA from RL 270 to a maximum of RL 300 would slightly reduce overpressure levels at receptors located generally east of Bengalla, although any such change is unlikely to be clearly measurable.

6 CONCLUSION

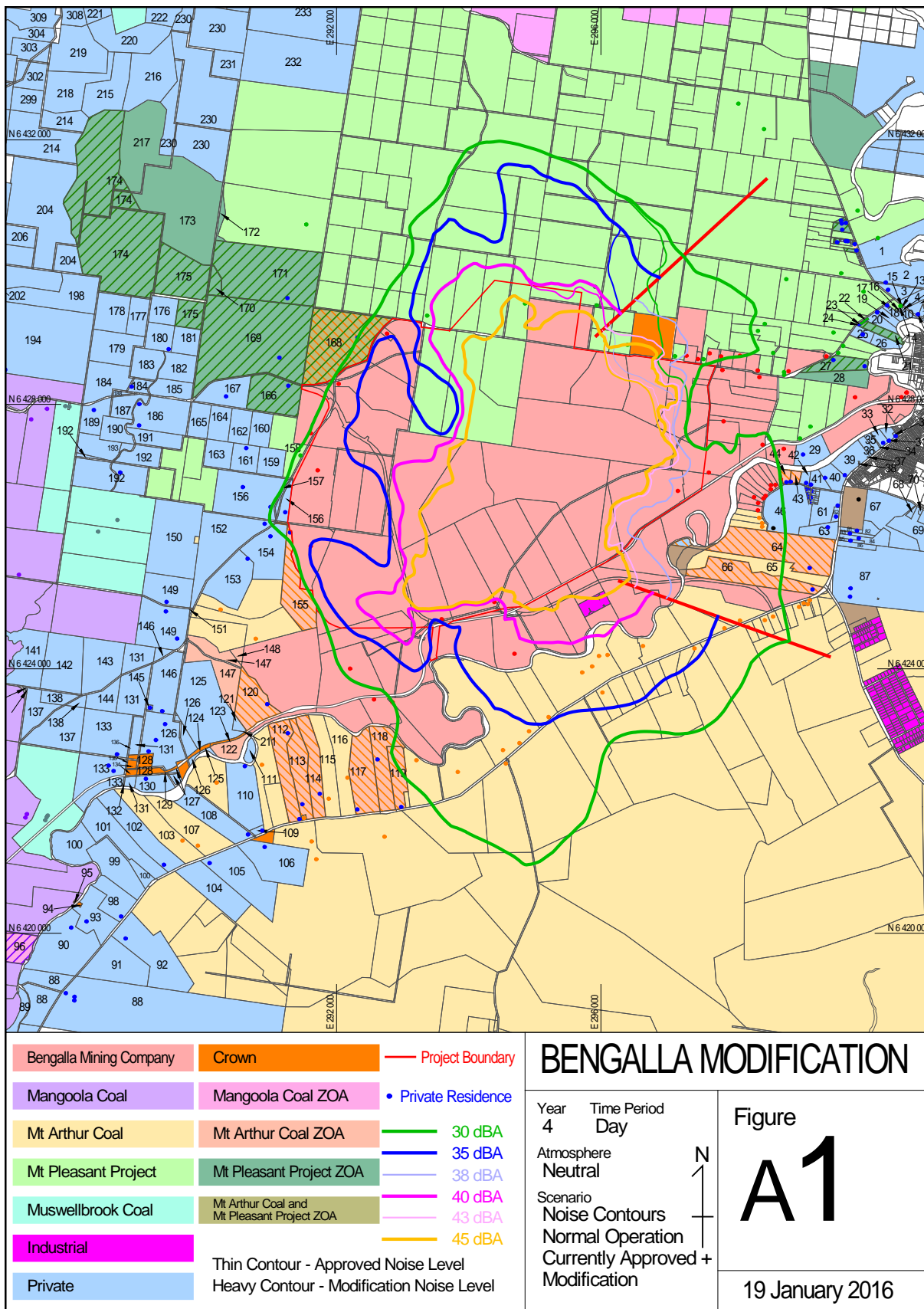
This assessment indicates the various components of the Modification have no significant potential to cause acoustic impacts at any receptor.

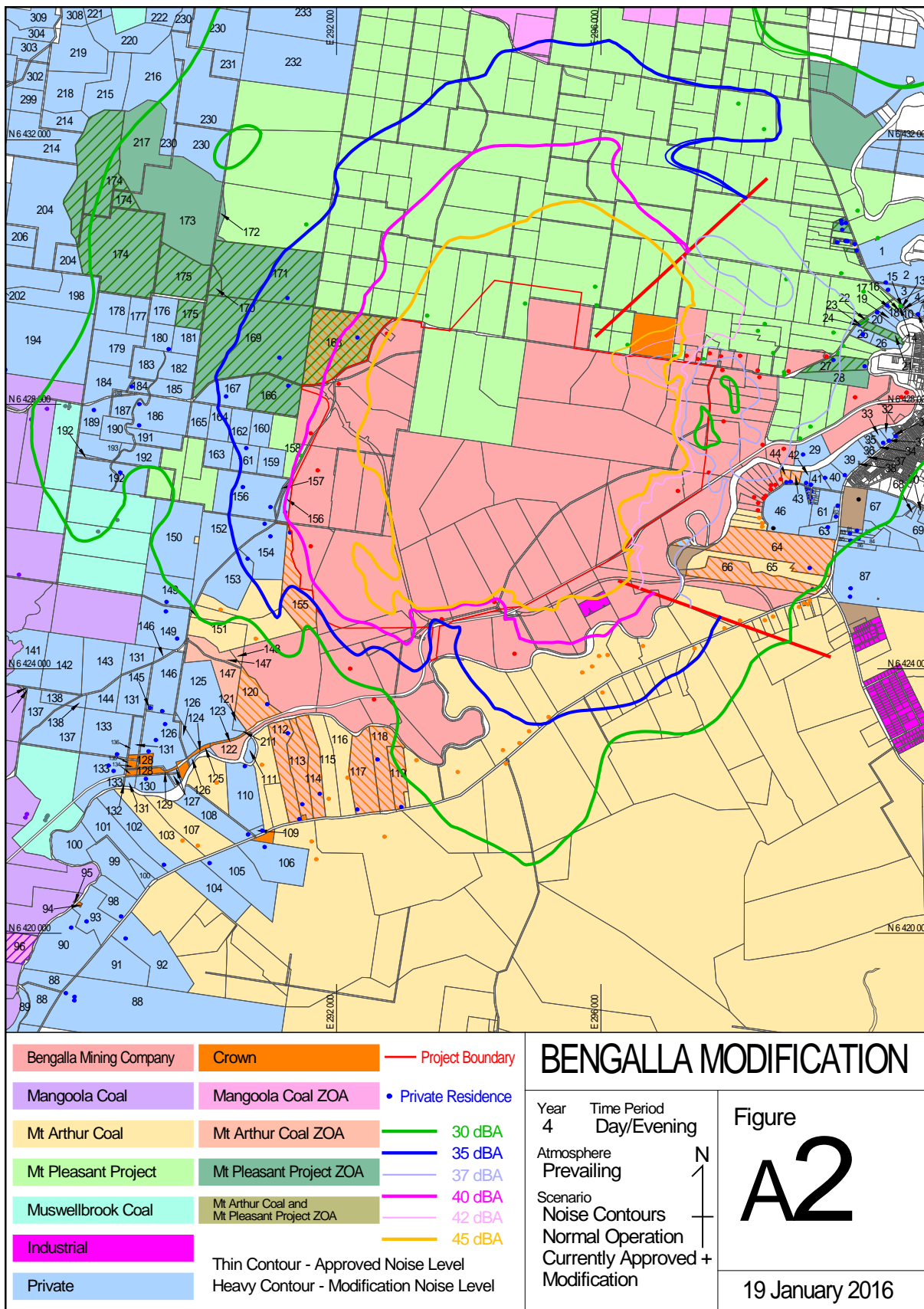
The proposed increase in OEA height from RL 270 to a maximum of RL 300 would increase noise levels at the closest receptors by up to 5 LAeq,15min during the day under calm weather conditions, however increased noise levels at those receptors and under those conditions would remain more than 10 dBA below current SSD-5170 (as modified) Development Consent noise limits. All noise levels associated with the Modification would remain below currently approved noise limits at all receptors, with insignificant noise level increases associated with the Modification under prevailing weather conditions.

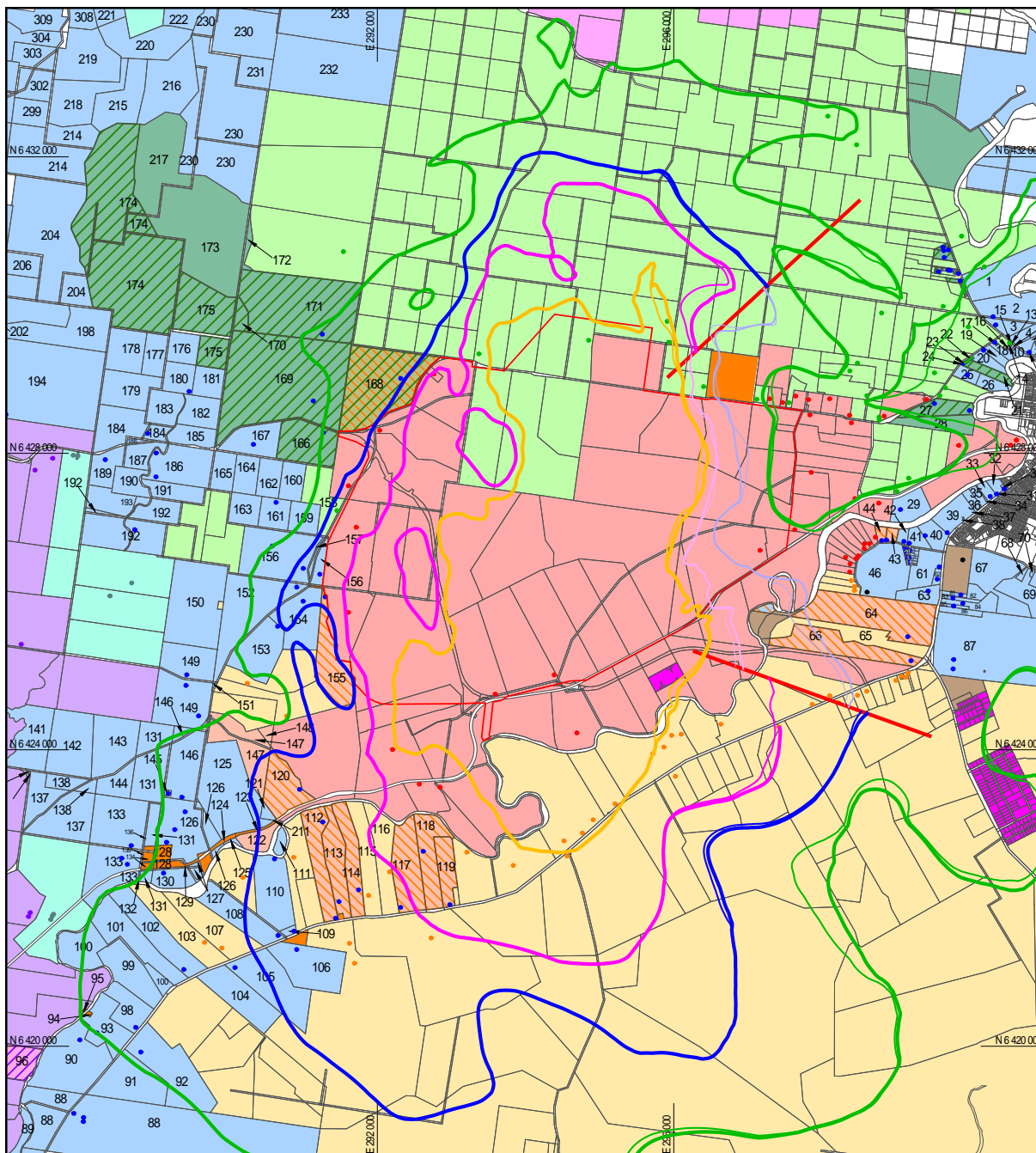
Construction work associated with the proposed Homestead Access would occur for a relatively brief period of a few weeks and would produce insignificant noise compared to currently approved mining noise levels. No construction noise impacts associated with the Modification are therefore predicted at any receptor.

APPENDIX A – NOISE CONTOUR FIGURES

FIGURE	NOISE CONTOURS – NORMAL OPERATION		
A1	Year 4	Day	Neutral weather conditions
A2	Year 4	Day/Evening	Prevailing weather conditions
A3	Year 4	Night	Prevailing weather conditions
A4	Year 8	Day	Neutral weather conditions
A5	Year 8	Day/Evening	Prevailing weather conditions
A6	Year 8	Night	Prevailing weather conditions







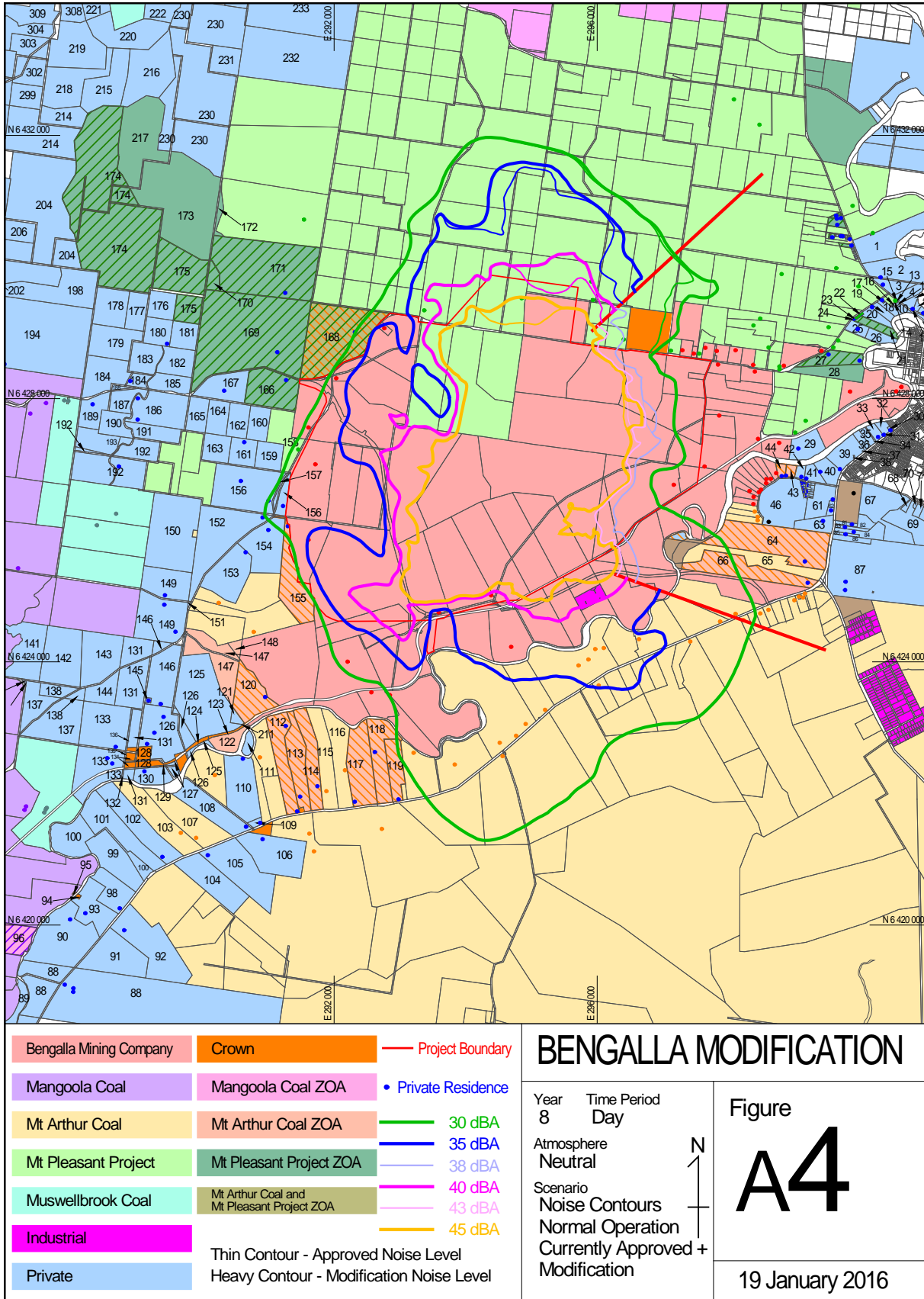
Bengalla Mining Company	Crown	— Project Boundary
Mangoola Coal	Mangoola Coal ZOA	• Private Residence
Mt Arthur Coal	Mt Arthur Coal ZOA	— 30 dBA
Mt Pleasant Project	Mt Pleasant Project ZOA	— 35 dBA
Muswellbrook Coal	Mt Arthur Coal and Mt Pleasant Project ZOA	— 36 dBA
Industrial		— 40 dBA
Private		— 41 dBA
		— 45 dBA
	Thin Contour - Approved Noise Level	
	Heavy Contour - Modification Noise Level	

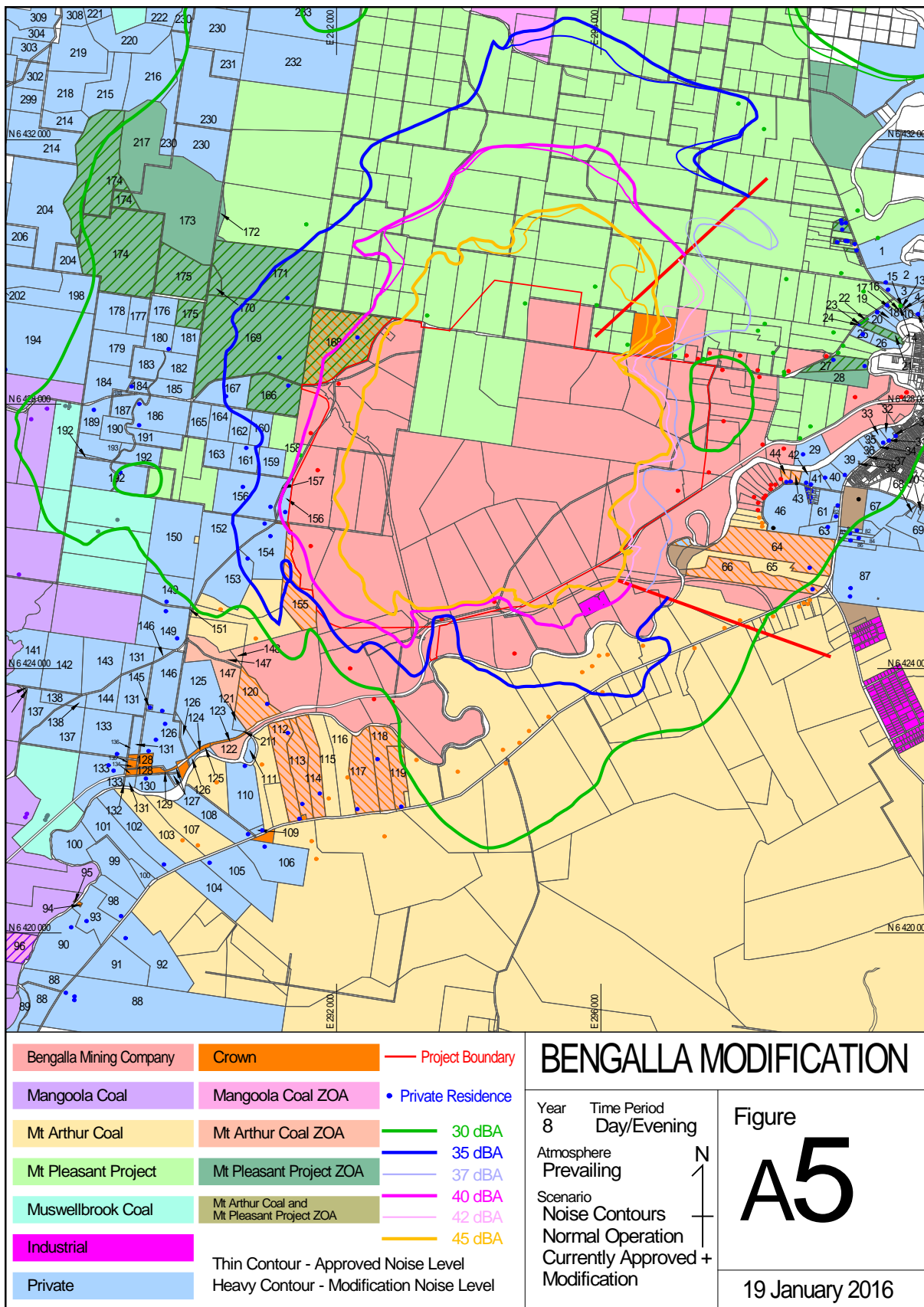
BENGALLA MODIFICATION

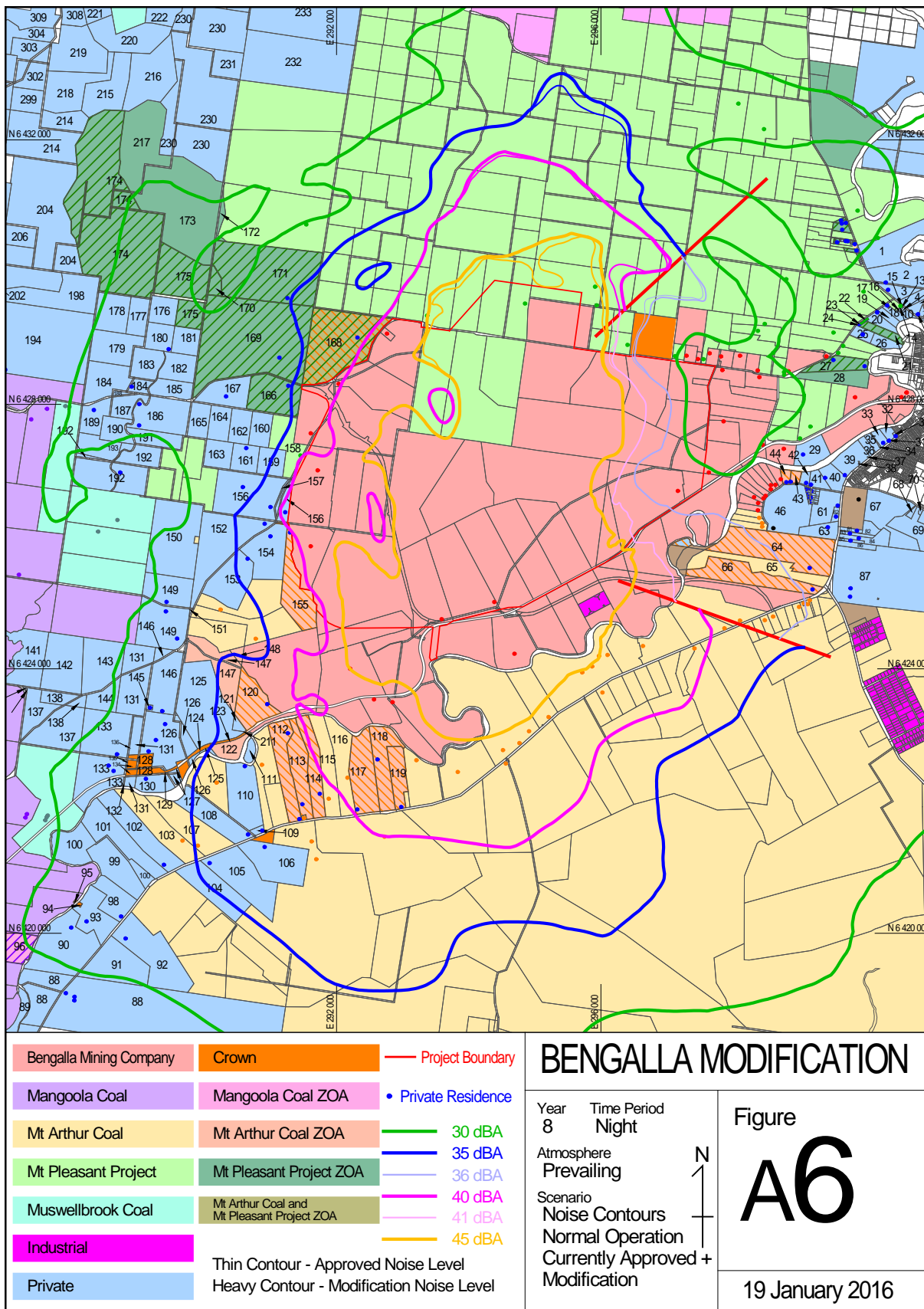
Year 4
 Time Period Night
 Atmosphere Prevailing
 Scenario Noise Contours
 Normal Operation
 Currently Approved + Modification

Figure
A3

19 January 2016







APPENDIX B – NOISE SOURCE LOCATION FIGURES

FIGURE NOISE SOURCE LOCATIONS – NORMAL OPERATION
 B1 Year 4
 B2 Year 8

