Table 11 Predicted Maximum Noise Emissions, dBA LAmax

Receiver	NAG	North of WRE3		South of WRE3		Criteria
		Standard overburden	Blue metal overburden	Standard overburden	Blue metal overburden	
R1	A	38	43	<30	33	45
R2	B	<30	<30	<30	<30	45
R3	C	**47**	**52**	36	41	45
R4	A	39	44	41	**46**	45
R5	A	<30	<30	<30	33	45
R6	A	<30	<30	<30	30	45
R8	A	<30	<30	<30	<30	45
R9	A	<30	31	<30	<30	45
R10	A	36	41	<30	30	45
R11	A	36	41	<30	30	45
R12	A	<30	32	<30	<30	45
R13	C	38	43	<30	32	45
R16	D	36	41	30	35	46
R17	D	36	41	30	35	46
R18	C	42	**47**	31	36	45
R19	C	42	**47**	32	37	45
R21	C	43	**48**	32	37	45
R22	D	43	**48**	32	37	46
R23	D	43	**48**	32	37	46
R24	D	43	**48**	33	38	46
R25	C	44	**49**	33	38	45
R26	C	44	**49**	33	38	45
R27	C	45	**50**	34	39	45
R28	C	**46**	**51**	35	40	45
R29	C	**47**	**52**	35	40	45
R32	D	**47**	**52**	35	40	46
R33	C	**46**	**51**	34	39	45
R35	C	43	**48**	32	37	45
R37	D	43	**48**	32	37	46
R40	C	43	**48**	32	37	45
R41	C	44	**49**	33	38	45
R42	C	42	**47**	31	36	45

Sleep disturbance predictions identify exceedances of the relevant criteria at the majority of receivers when blue metal overburden is dumped at the northern sections of WRE3. Notwithstanding, it is understood that current operating procedures avoid this practice during night periods, in particular when inversions are present. Dumping of blue metal overburden within the southern area of WRE3 significantly reduces the potential for sleep disturbance impacts, and results in a 1dB exceedance at R4 when blue metal overburden is being dumped. For standard overburden, noise predictions comply with relevant LAmax criteria at all receivers during inversion meteorological conditions when dumping to WRE south.

5.3 Noise Mitigation

As noted in Section 5.1.1, completed architectural building treatments to the majority of the 17 dwellings affected by on-site noise (especially in areas where construction of barriers or stockpiles are not a reasonable or feasible option), with remaining treatments scheduled to be completed in 2015 The treatments to dwellings include acoustic improved glazing to window and doors, and the provision of mechanical ventilation. Allowing for residents to close their windows would result in an improved internal acoustic amenity of between 10-20dB depending on dwelling construction and orientation. This measure would be particularly relevant for night time operations and effectively mitigate against the elevated night time noise levels modelled under inversion conditions, both LAeq and LAmax.

Figure 5 provides a locality plan identifying receivers that are being treated and the current status of the work to date.

A further noise mitigation measure which would reduce the noise impacts of night time waste rock dumping would be restricting waste rock placement to 'short tipping' methods. Short tipping involves the placement of waste rock slightly back from the edge of the WRE slope, with this to pushed over the slope edge during daytime operations. Long tipping allows for the waste rock to be tipped directly over the WRE slope. Short tipping reduces the period of noise exposure of each tipping action as there would be no movement of rocks down the slope. While this may have limited influence on modelled or measured LAeq, the occurrence of LAmax events would be reduced and is considered to be positive for surrounding receivers.

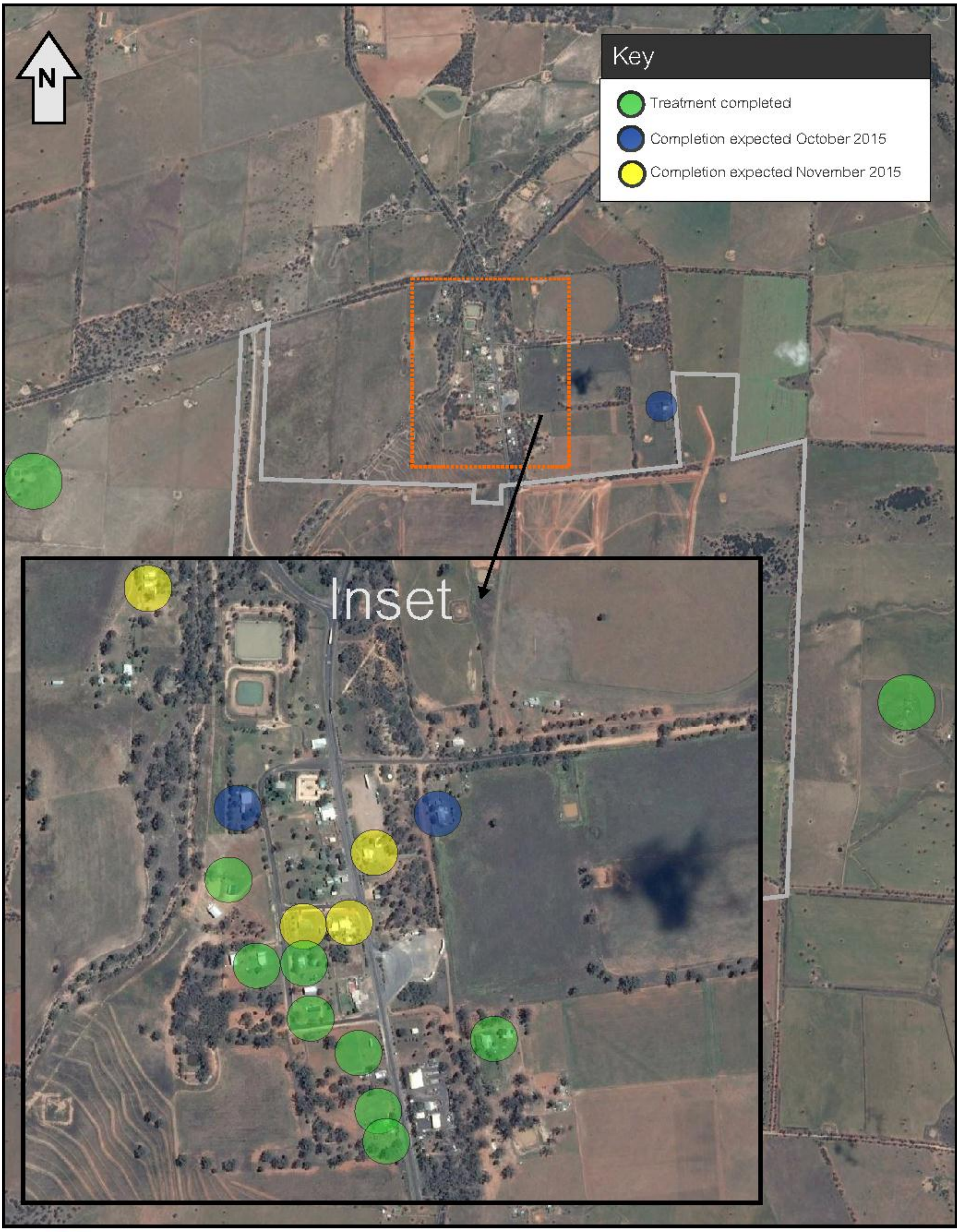

Figure 5 - Dwelling Acoustic Treatments

Tomingley Gold Mine - Modification 3

5.4 Blasting Results

Blast overpressure and vibration results have been calculated using the method given in the AS2187-2: Explosives – Storage and use Part 2: Use of explosives, 2006 and ICI Explosives Blasting Guide, as applicable to blasting in hard rock. This formula has been shown to be conservative in calculating overpressure and vibration.

The relevant formulae are as follows:

$PVS = 1140\ (R/Q\ ^{\wedge 0.5})^{\wedge -1.6}$

$dB = 164.2 - 24(\log_{10} R - 0.33 \log_{10} Q)$

Where,

PVS = peak vector sum ground vibration level (mm/s)

dB = peak airblast level (dB Linear)

R = distance between charge and receptor (m)

Q = charge mass per delay (kg) or maximum instantaneous charge (MIC)

The Mines blast parameters identify a maximum instantaneous charge (MIC) of up to 68kg. Future blasting positions within Cal2 are greater than 1400m to the nearest residential receiver at R3. **Table 12** provides the calculated blast MICs for the minimum offset distance where blasting would occur within future extraction areas of Cal2.

Table 12 Blast Overpressure and Vibration Results

Approximate minimum distance from future blast areas to receivers (m)	Derived overpressure (dB(L)peak)	Derived vibration PPV (mm/s)	MIC (kg)
1400	103	0.3	68

The conservatively predicted blast overpressure and vibration levels identify that a maximum MIC of 68kg would comply with current blasting criteria at distances of greater than 1400m.

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6 Conclusion

MAC has conducted a noise and blasting assessment (NBA) of potential impacts associated with the proposed modification (Mod3) to the existing Tomingley Gold Mine (TGM) project approval (PA) (PA 09_0155).

The results of the NBA demonstrate that current operational noise exceed relevant criteria at a number of receivers, in particular when dumping occurs at the northern end of WRE3 during night inversion conditions. Critically, these exceedances occur when the reasonable and feasible noise mitigation measures nominated in previous noise assessments, as well as additional noise mitigation measures implemented since, are undertaken. As an example, modification of existing dumping procedures to the southern end of WRE3 significantly reduces noise impacts at the majority of receivers situated in Tomingley village. Further, placement of waste rock on WRE 3 at night was recently suspended following complaint from the resident to Receiver R4. This suggests both an underestimation of noise emissions of previous noise assessments, as well as a commitment of the Applicant to respond to and resolve noise issues.

Mod3 would see a progressive reduction in mining noise emissions within the surrounding community. While noise associated with the initial mining of Cal2 would result in exceedances of current noise criteria, these exceedances would be reduced to 1dBA at three residences under noise enhancing conditions after approximately 6 months (coinciding with Mod3 - Scenario 3 predictions). As open cut mining operations occur progressively deeper, and post open cut mining operations, noise from the underground operations are predicted to satisfy relevant criteria at all receivers during noise enhancing meteorological conditions.

On the basis of noise predictions of this NBA, which accurately represent noise emissions with the implementation of reasonable and feasible mitigation measures, and the at-receiver architectural treatments provided to noise affected dwellings, it is recommended that the noise criteria of PA 09_0155 be revised to reflect the modelled LAeq noise levels.

Sleep disturbance associated with dumping of blue metal overburden are predicted to be above the relevant sleep disturbance criteria. To mitigate this impact, TGO have provided or committed to architectural building treatments to 17 dwellings surrounding the Mine. The treatments include upgrades to existing glazing of residents along with installation of air conditioning and would see a minimum improvement of 10dB within each habitable dwelling (ie windows closed scenario).

Overpressure and vibration from blasting are anticipated to satisfy the ANZECC criteria for the nearest residential receivers.

7 References

Environment Protection Authority (EPA) 2000, NSW Industrial Noise Policy (INP).

Australian and New Zealand Environment Conservation Council (ANZECC) 1990.

SLR Consulting Australia Pty Ltd (SLR), Noise and Blasting Assessment 2011.

Noise and Sound Service, 2014; Tomingley Gold Mine - Environmental Assessment, Modification 2. Appendix 1 - Noise Bund Assessment.

Noise and Sound Service, Noise Compliance Report 2015.

Appendix A - Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

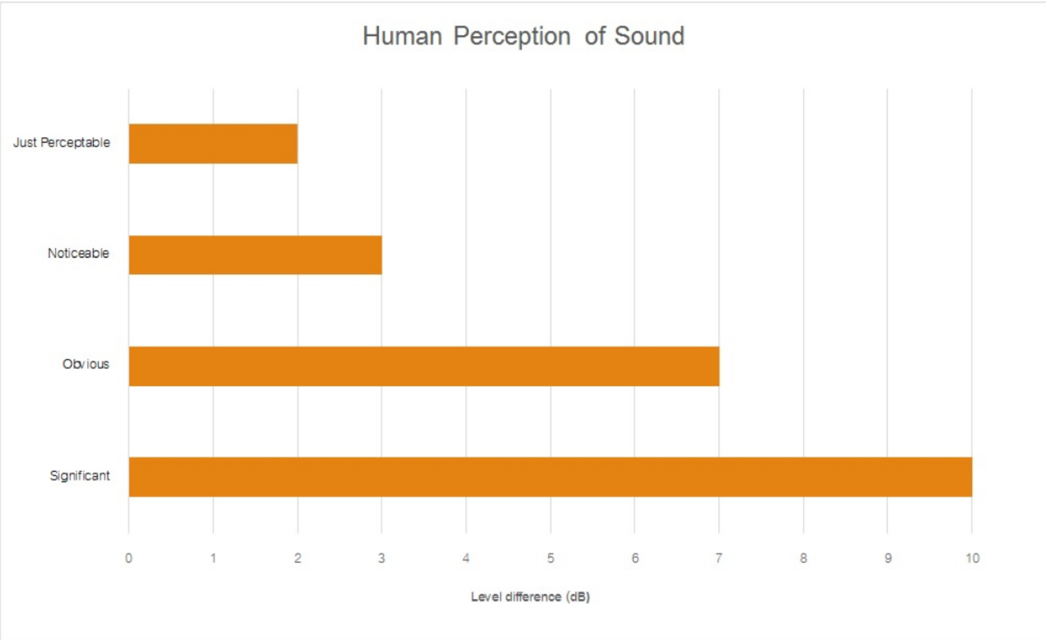
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B – Octave SWL Data

Table B1 LAeq(15-min) dB(A) Sound Power Level Spectrum

Noise Source	Octave Band Centre Frequency (Hz), dBA								Total
	63	125	250	500	1000	2000	4000	8000	dB(A)
Operational Plant									
Dozer (x1)	86	103	102	105	108	107	101	94	113
Wheeled Dozer (x1)	80	90	95	105	108	109	101	95	113
Excavator 120t (x2)	110	103	104	106	108	110	106	100	116
Excavator 85t (x1)	87	99	102	106	108	105	98	87	112
Grader (x2) [1]	78	94	101	105	110	107	103	98	113
FEL (x1)	94	99	104	107	105	107	98	93	113
Drill (x2)	81	103	104	106	109	108	100	92	114
Lighting Plant (x2)	73	81	90	87	94	90	87	81	98
Generator (x2)	55	76	86	88	87	84	78	67	93
Scraper (x2) [1]	85	96	96	101	105	104	100	97	110
Haul truck (x8) (all scenarios)	97	101	105	109	106	108	101	98	114
Ball mill (x1)	88	99	102	108	105	105	98	88	112
Primary/Secondary Crusher (x1)	88	98	101	108	110	111	106	95	115
Surface Mine Vehicle (SMV)	80	83	89	102	107	93	88	76	108
Mining truck (x1)	72	82	87	89	90	90	83	74	96
Ventilation Fan (x1)	90	100	98	95	93	92	89	80	104

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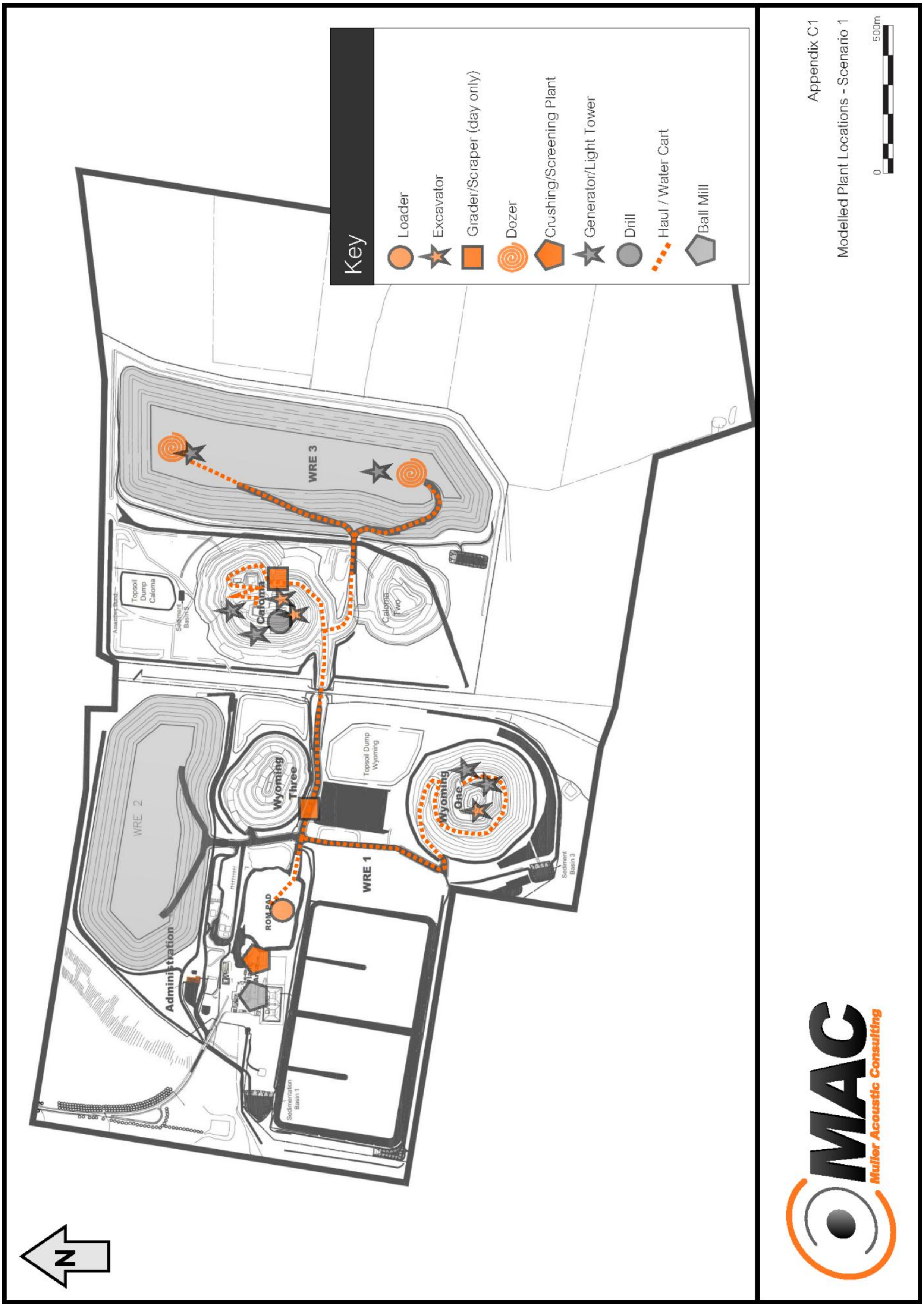
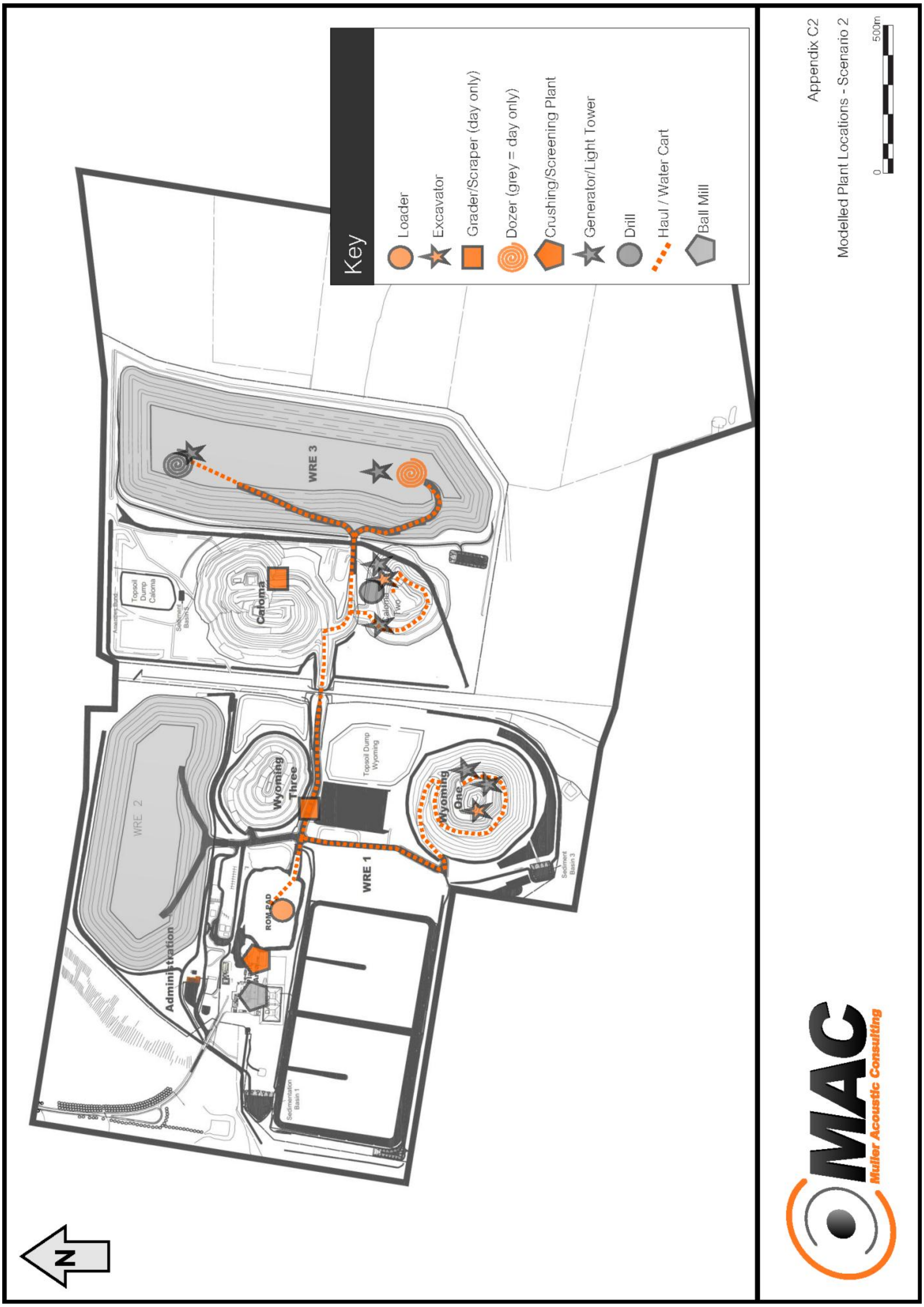
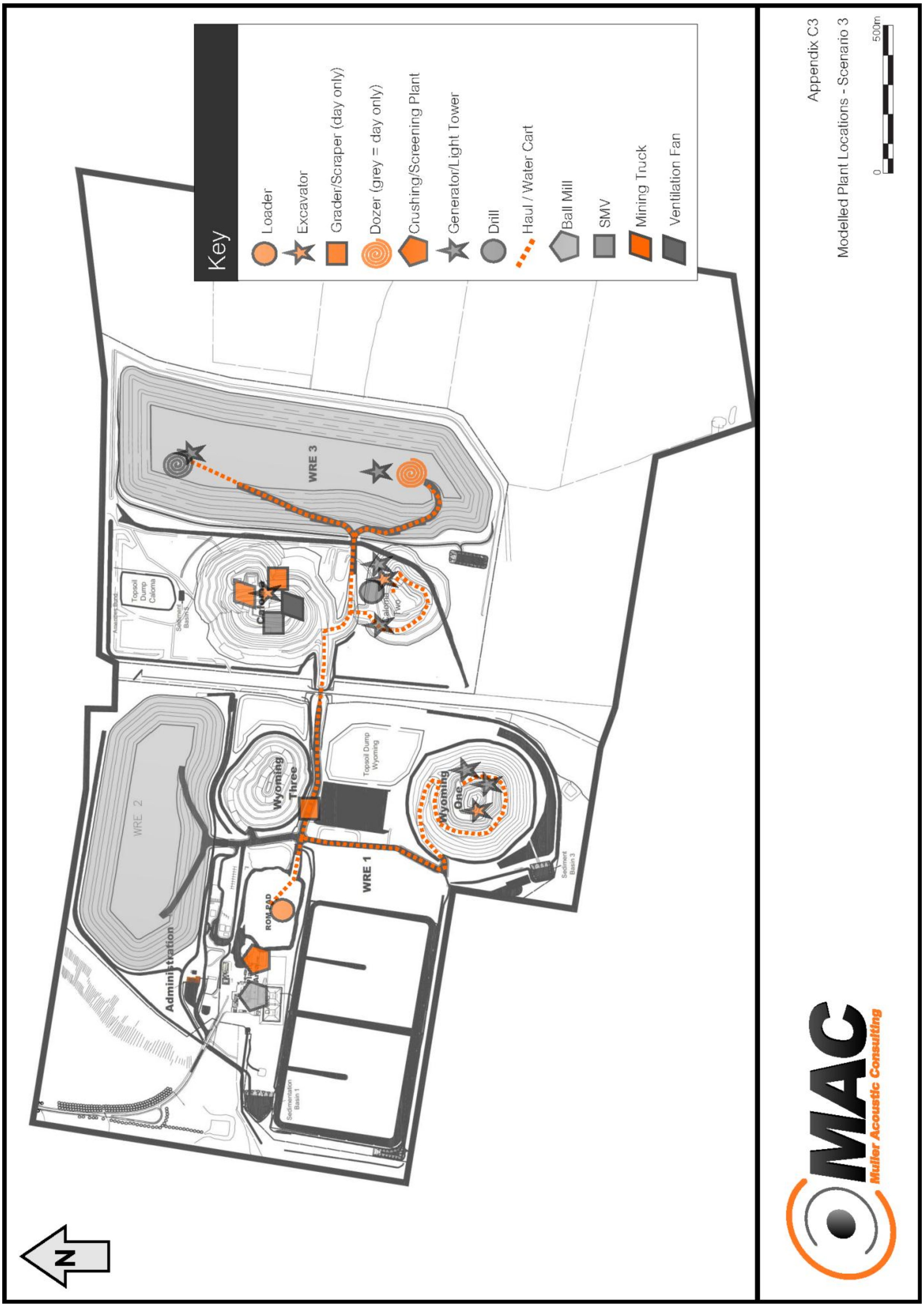
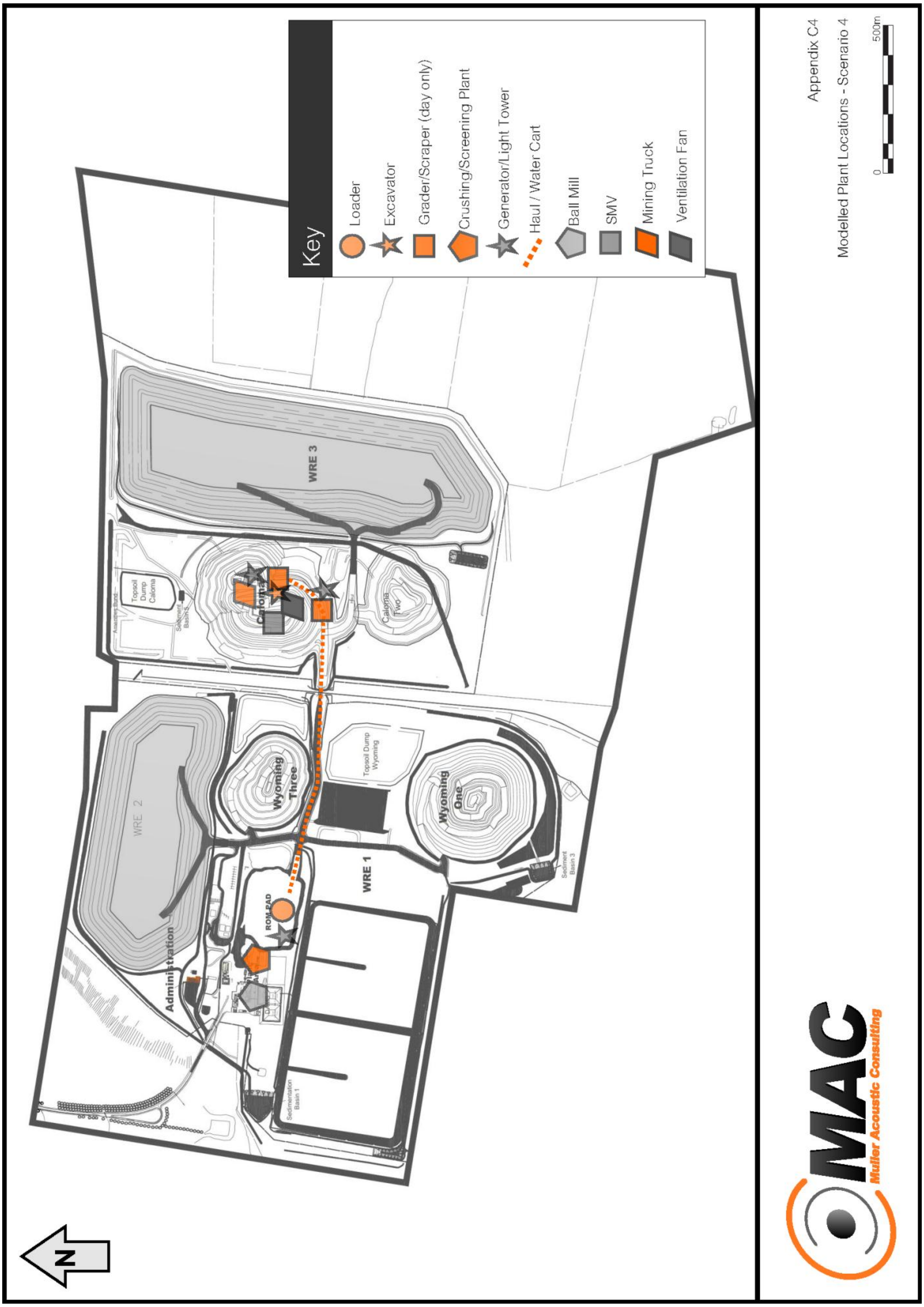
Appendix C – Modelled Plant Indicative Locations Octave SWL Data


Key
Loader
Excavator
Grader/Scraper (day only)
Dozer
Crushing/Screening Plant
Generator/Light Tower
Drill
Haul / Water Cart
Ball Mill
Appendix C1
Modelled Plant Locations - Scenario 1
0
500m
WRE 3
WRE 2
WRE 1
Caloma
Caloma Two
Topsoil Dump Caloma
Wyoming Three
Wyoming One
Topsoil Dump Wyoming
ROM PAD
Administration
Sedimentation Basin 1
Sediment Basin 3
N
MAC
Muller Acoustic Consulting



Appendix C2
Modelled Plant Locations - Scenario 2


Key
Loader
Excavator
Grader/Scraper (day only)
Dozer (grey = day only)
Crushing/Screening Plant
Generator/Light Tower
Drill
Haul / Water Cart
Ball Mill
SMV
Mining Truck
Ventilation Fan
Appendix C3
Modelled Plant Locations - Scenario 3
0
500m
WRE 3
Topsoil Dump Caloma
Sediment Basins
WRE 2
Wyoming Three
Topsoil Dump Wyoming
Wyoming One
WRE 1
ROM PAD
Administration
Sedimentation Basin 1
Sediment Basin 3
N
MAC
Muller Acoustic Consulting


Key
Loader
Excavator
Grader/Scraper (day only)
Crushing/Screening Plant
Generator/Light Tower
Haul / Water Cart
Ball Mill
SMV
Mining Truck
Ventilation Fan
WRE 3
WRE 2
WRE 1
Caloma
Caloma Two
Wyoming Three
Wyoming One
Topsoil Dump Caloma
Topsoil Dump Wyoming
ROM PAD
Administration
Sedimentation Basin 1
Sediment Basin 3
N
Appendix C4
Modelled Plant Locations - Scenario 4
0
500m
MAC
Muller Acoustic Consulting

Appendix D – Operational Noise Contours

Scenario 1 - Night, Inversion, LAeq(15min)

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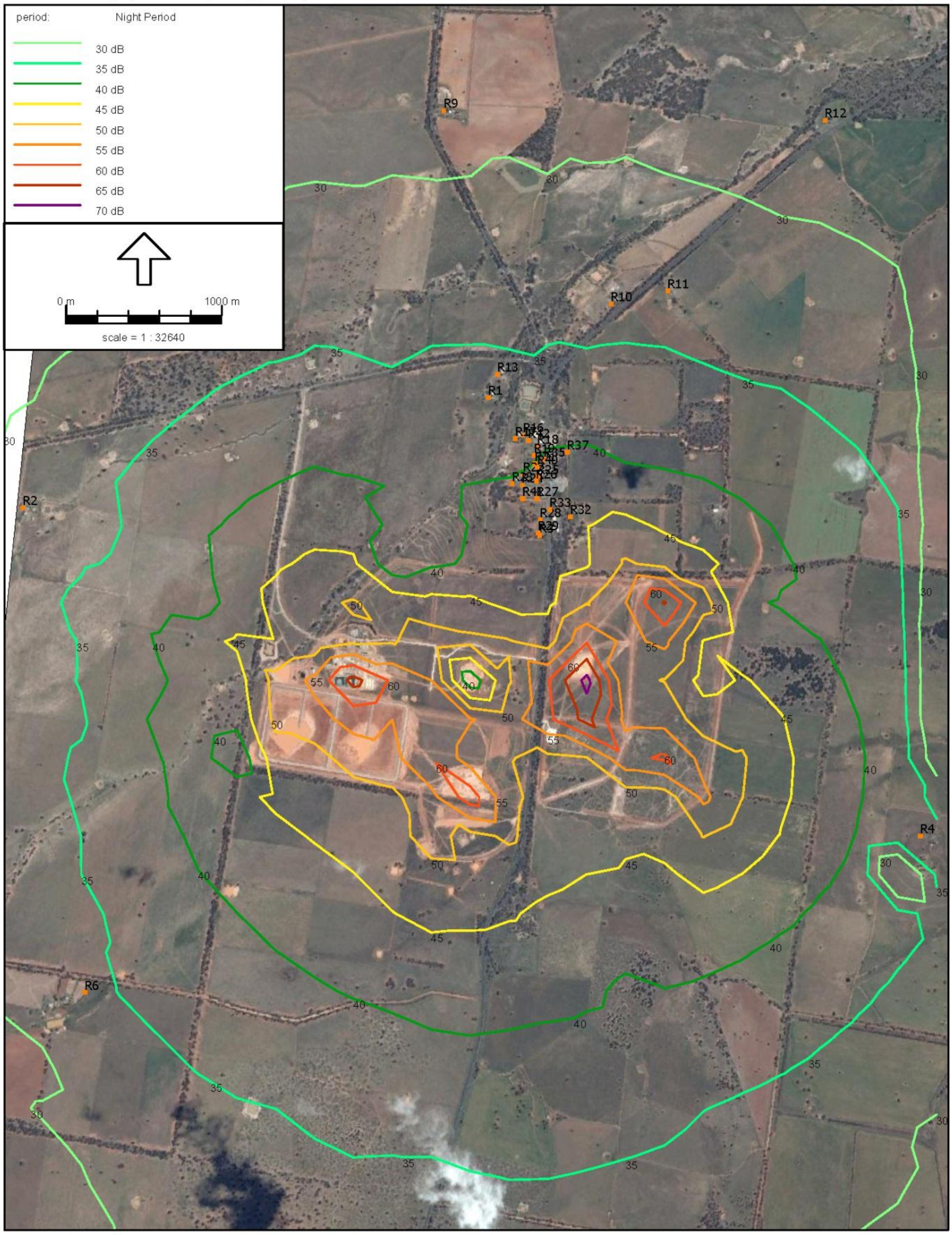

Industrial noise - ISO 9613.1/2, [Scenario 1 - Calibration (Existing)] , Predictor V11.00

Scenario 2 - Night, Inversion, LAeq(15min)

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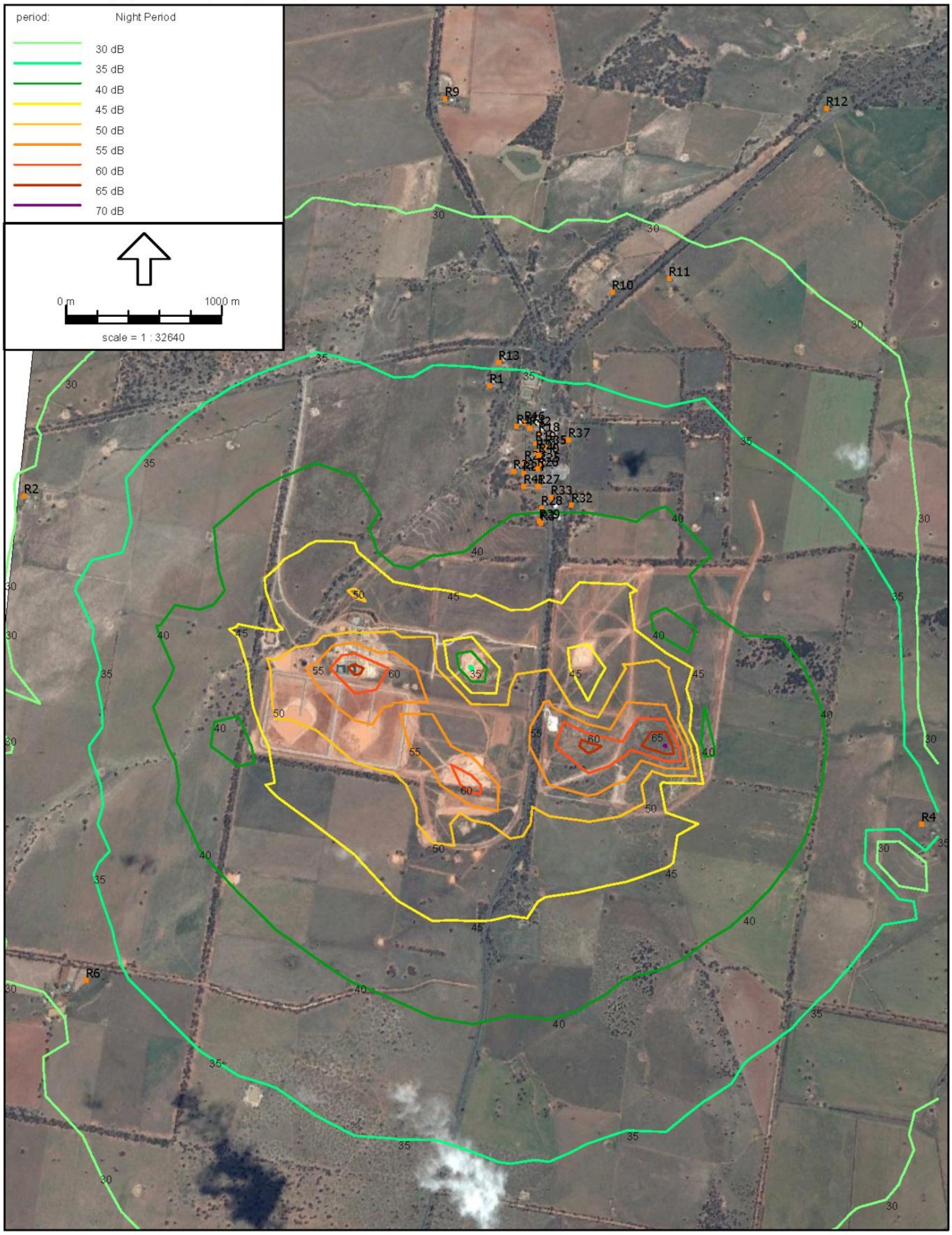

Industrial noise - ISO 9613.1/2, [Scenario 2 - Future (surface)] , Predictor V11.00

Scenario 3 - Night, Inversion, LAeq(15min)

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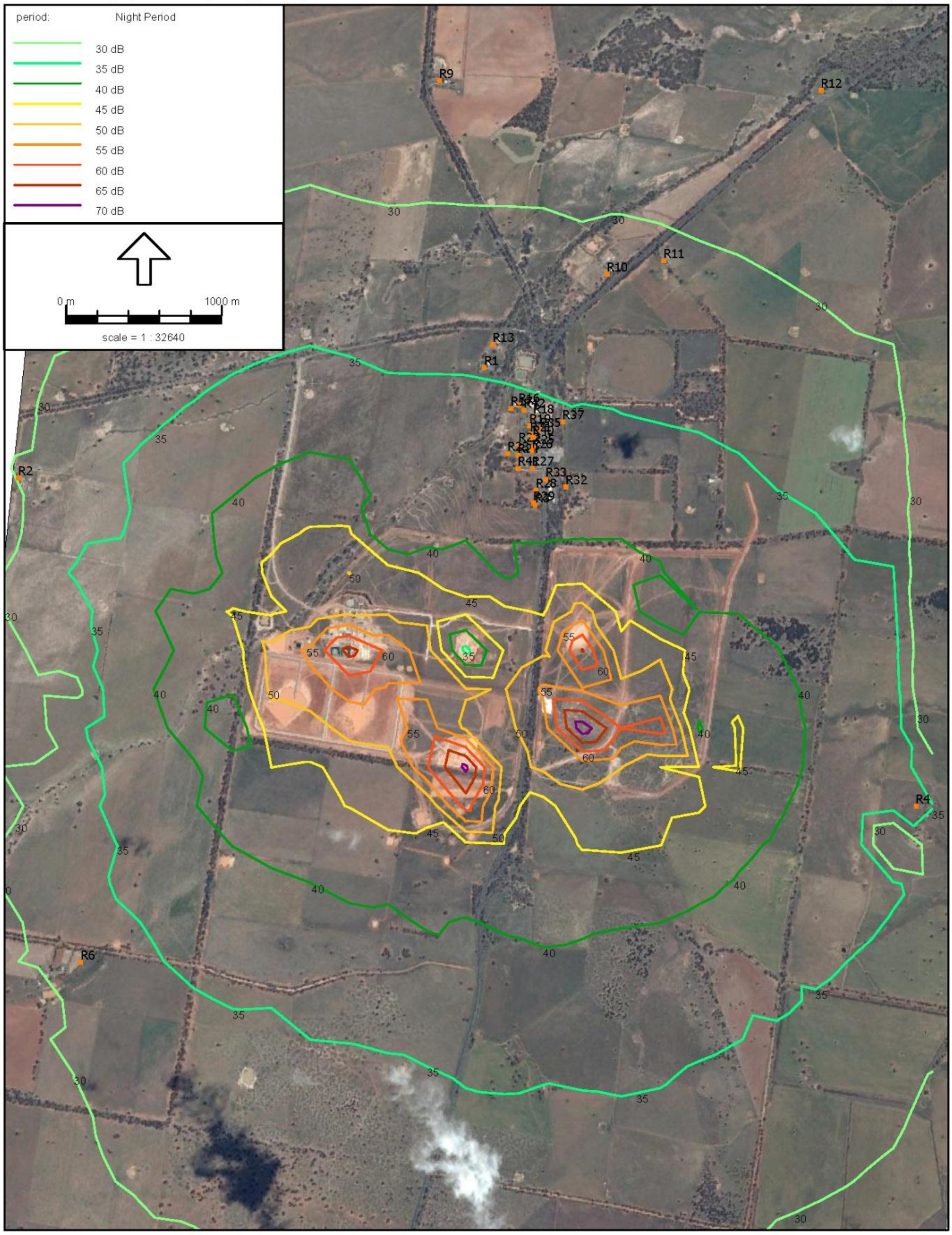

Industrial noise - ISO 9613.1/2, [Scenario 3 - Future Mid Level with underground] , Predictor V11.00

Scenario 4 - Night, Inversion, LAeq(15min)

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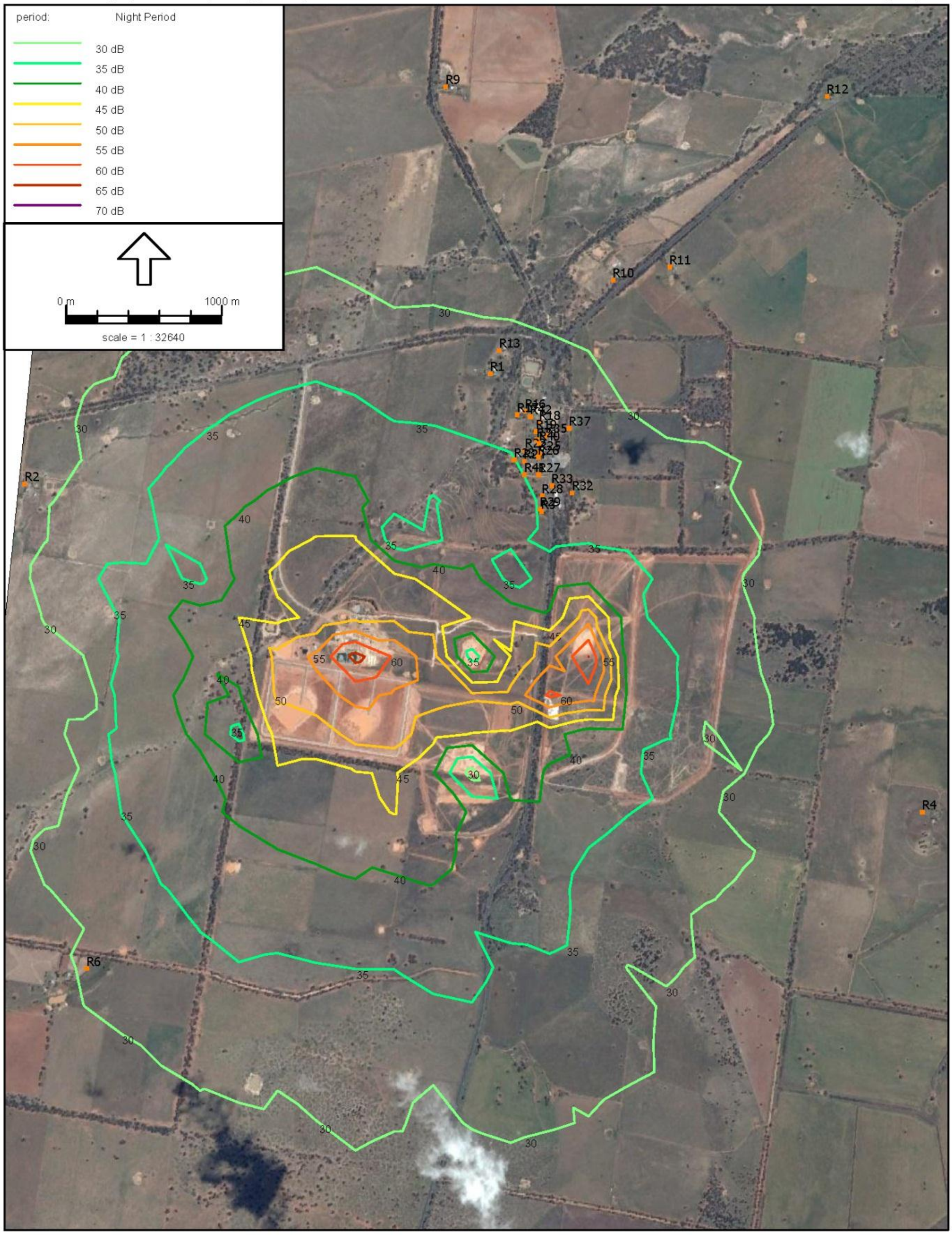

Industrial noise - ISO 9613.1/2, [Scenario 4 - Underground Only] , Predictor V11.00

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