

10.12 Noise

A noise impact assessment has been undertaken by SLR for the proposed Mandalong Southern Extension Project in order to:

- Assess the potential noise impacts on surrounding sensitive receivers (see **Figure 5**) associated with the construction and operational phases of the Project; and
- Identify appropriate mitigation measures to minimise noise emissions, along with appropriate monitoring and management strategies.

The assessment focussed on the Project's two surface infrastructure sites, being the existing Mandalong Mine Access Site and proposed Mandalong South Surface Site. A quantitative assessment of noise generating activities at the Cooranbong Entry Site will be undertaken as part of the development application for the Northern Coal Logistics Project.

SLR's noise assessment has been prepared with reference to *Australian Standard AS1055:1997 Description and Measurement of Environmental Noise*, and in general accordance with the *NSW Industrial Noise Policy* (INP) (EPA 2000) and *Interim Construction Noise Guideline* (ICNG) (DECC 2009). Where issues relating to noise are not addressed in the INP or ICNG, such as sleep disturbance, reference has been made to the *NSW Environmental Noise Control Manual* (ENCM) (EPA 1994) and the *NSW Road Noise Policy* (RNP) (DECCW 2011). It addresses the key issues raised within the DGRs (see **Section 1.7.2**).

A copy of SLR's *Noise Impact Assessment* (2013b) is contained within **Appendix R**, with significant findings and recommendations summarised below.

10.12.1 Sensitive Receptors

As evident on **Figure 5** and outlined in **Section 2.5**, there are a number of privately-owned residences in the area surrounding the existing Mandalong Mine Access Site and proposed Mandalong South Surface Site.

10.12.2 Existing Environment

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The overall level of a sound is usually expressed in terms of A-weight decibels (dBA), which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 to 4000 Hertz), and less sensitive at lower and higher frequencies. SLR (2013b) advises that a change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, while a change of 3 dBA to 5 dBA corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

Below is a summary of terminology relevant to understanding noise:

L_{A1} - noise level exceeded for 1 percent of the 15 minute interval.

L_{A10} - noise level exceeded for 10 percent of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} - noise level exceeded for 90 percent of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} – A-weighted equivalent noise level (essentially the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

As part of the noise impact assessment for the Project and to assist with the determination of relevant noise criteria, SLR (2013b) carried out short-term operator-attended and long-term unattended noise monitoring surveys at five locations representative of the nearest potentially affected receivers to the Mandalong Mine Access Site and Mandalong South Surface Site (see **Figure 19**). The objective of the background noise survey was to measure the background ($L_{A90(\text{period})}$) and the average ($L_{Aeq(15\text{minute})}$) noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to determine the relevant project specific noise criteria. The noise levels measured during the unattended noise monitoring are summarised in **Table 49**.

The results of the operator-attended surveys indicate that the existing noise levels in the vicinity of the Mandalong Mine Access Site are dominated by road traffic along the Sydney-Newcastle F3 Freeway and Mandalong Road. The mine was not discernible at monitoring locations NM1 and NM2. Noise sources in the vicinity of the proposed Mandalong South Surface Site included traffic on Mandalong Road, breeze in trees, bird song/calls and frogs. There was no existing industrial noise discernible at monitoring locations NM3, NM4 and NM5.

Table 49 – Existing Ambient Noise Levels

Location	Period ¹	Background $L_{A90(\text{period})}$ (dBA)	Average $L_{Aeq(\text{period})}$ (dBA)
Mandalong Mine Access Site			
NM1	Day	52	61
	Evening	54	61
	Night	46	61
NM2	Day	40	55
	Evening	41	52
	Night	37	50
Mandalong South Surface Site			
NM3	Day	31	42
	Evening	34	39
	Night	32	37
NM4	Day	34	46
	Evening	41	50
	Night	33	48
NM5	Day	<30	45
	Evening	<30	38
	Night	<30	39

1. Daytime 7 am to 6 pm; Evening 6 pm to 10 pm; Night-time 10 pm to 7 am. On Sundays and Public Holidays - Daytime 8 am to 6 pm; Evening 6 pm to 10 pm; Night-time 10 pm to 8 am.

10.12.3 Noise Criteria

Construction Noise Goals

The project specific noise goals for construction activity have been established by SLR (2013b) with reference to the ICNG (DECC 2009) and using the results of the ambient noise measurements presented in **Section 10.12.2**. The resulting construction noise goals for the Project are presented in **Table 50**.

Table 50 – Project Specific Construction Noise Goals

Location	Time of Day ¹	Noise Goals, $L_{Aeq(15\text{minute})}$ (dBA)	
		Noise Affected	Highly Noise Affected
R1 to R4	Recommended standard hours	50	75
	Outside recommended standard hours	42	N/A
R5 to R10	Recommended standard hours	62	75
	Outside recommended standard hours	51	N/A
R11 to R15	Recommended standard hours	41	75
	Outside recommended standard hours	36	N/A
R16 to R18; R24 to R27	Recommended standard hours	44	75
	Outside recommended standard hours	38	N/A
R19 to R23; R28 and R29	Recommended standard hours	40	75
	Outside recommended standard hours	35	N/A

1. Recommended standard hours - Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm (no work Sundays or public holidays).

Operational Noise Criteria

The operational noise criteria for the Project have been established by SLR (2013b) with reference to the INP (EPA 2000) and using the results of the ambient noise measurements presented in **Section 10.12.2**.

The acoustical environment at residences in the vicinity of the Mandalong Mine Access Site typifies an urban environment, with heavy and continuous traffic flows, and near to commercial and industrial districts. On this basis, the residences in this general area (R5 to R10) have been assessed as “urban” receiver types. The acoustical environment at R9 was observed to be dominated by road traffic noise during all periods. The noise levels measured at this location are 10 dBA higher than the acceptable amenity criterion provided in the INP for the evening and night-time periods. On this basis, for these periods, residences in the vicinity of the Sydney-Newcastle F3 Freeway near the Mandalong Mine Access Site have been assessed as areas of high traffic noise as defined in the INP.

The existing noise levels at residential areas at a greater distance from the Sydney-Newcastle F3 Freeway, including those in the vicinity of the proposed Mandalong South Surface Site, are dominated by natural sounds and some local traffic. On this basis, all other residences (R1 to R4 and R11 to R29) have been assessed as “rural” receiver types.

The relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance are not provided in the INP and hence, sleep arousal has been assessed by SLR (2013b) using the guidelines set out in the ENCM. To avoid the likelihood of sleep disturbance, the ENCM (EPA 1994) recommends that the $L_{A1(1\text{minute})}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time period.

The resulting operational project specific noise criteria for the Project are listed in **Table 51**.

Table 51 – Project Specific Operational Noise Criteria

Location	Period	Background $L_{A90(\text{period})}$ (dBA)	Adopted RBL (dBA)	Intrusiveness Criteria $L_{Aeq(15\text{minute})}$ (dBA)	Amenity Criteria $L_{Aeq(\text{period})}$ (dBA)	Sleep Disturbance Noise Goal ($L_{A1(1\text{minute})}$) (dBA)
R1 to R4	Day	40	40	45	50	-
	Evening	41	40 ¹	45	45	-
	Night	37	37	42	40	52
R5 to R10	Day	52	52	57	60	-
	Evening	54	52 ¹	57	51 ³	-
	Night	46	46	46	51 ³	61
R11 to R15	Day	31	31	36	50	-
	Evening	34	31 ¹	36	45	-
	Night	32	31 ¹	36	40	46
R16 to R18; R24 to R27	Day	34	34	39	50	-
	Evening	41	34 ¹	39	45	-
	Night	33	33	38	40	48
R19 to R23; R28 and R29	Day	<30	30 ²	35	50	-
	Evening	<30	30 ²	35	45	-
	Night	<30	30 ²	35	40	45

1. Adopted rating background level (RBL) differs from the measured background to take into account INP Application Notes (OEH 2010) which state "it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive level for daytime. The intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening."

2. Measured background level was less than 30 dBA, therefore a RBL 30 dBA has been adopted in accordance with the INP.

3. Amenity criteria established with reference to assessment in areas of high traffic noise in accordance with the INP.

Road Traffic Noise Criteria

Both the construction and operation of the Mandalong South Surface Site have the potential to increase road traffic noise received at residents adjacent to Mandalong Road. The road traffic noise criteria adopted by SLR (2013b) for the Project are listed in **Table 52**.

Table 52 – Road Traffic Noise Criteria

Road Category	Type of Project/Land Use	Assessment Criteria	
		Day (7am to 10pm) $L_{Aeq(15\text{hour})}$ (dBA)	Night (10pm to 7am) $L_{Aeq(9\text{hour})}$ (dBA)
Freeway/arterial/sub-arterial roads – Mandalong Road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land-use developments	60	55

10.12.4 Impact Assessment

SLR (2013b) utilised SoundPLAN (Version 7.1), with a three-dimensional digital terrain map, to model the noise emissions associated with the Project under calm and prevailing atmospheric conditions. Sound power levels of relevant existing and approved plant and equipment was obtained from measurements of plant already operating at the Mandalong Mine Access Site, sourced from SLR's database of similar equipment and/or from information supplied by the manufacturer or other consultants. Coal transport to the Delta Entry Site and Cooranbong Entry Site will continue to be undertaken via the existing underground conveyor systems and therefore will not contribute to surface noise emissions.

A summary of SLR's (2013b) noise modelling predictions at the nearest sensitive receivers are summarised below. The full datasets are provided in SLR's (2013b) report in **Appendix R**.

Construction Noise

The most significant construction impacts are expected to occur during bulk earthworks at the proposed Mandalong South Surface Site and construction of the access road, which are likely to occur concurrently (see **Section 4.13.2**). All construction activity will occur between the standard hours of 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturday (no construction on Sundays or public holidays), with the exception of the ventilation shafts. Given the depth these shafts need to reach and the intention to commence underground mining in the Southern Extension Area in 2018, sinking of these shafts will be required to be undertaken 24 hours a day, seven days a week for up to 78 weeks. If sinking of the shafts was to be restricted to standard construction hours only, it would take over two years and prolong impacts to the surrounding receivers.

Table 53 provides the acoustically significant plant and equipment associated with each stage of construction considered by SLR (2013b).

Table 53 – Acoustically Significant Construction Plant and Equipment

Construction Stage	Acoustically Significant Plant and Equipment	Sound Power Level (dBA) (each)
Access road	3 x 14H graders	111
	6 x 8-12t rollers	110
	3 x 30t moxy watercarts	112
	2 x 615 elevating scrapers	111
	2 x 20-30t excavators	111
	3 x 30-45t excavators (inc. rock hammers)	129
	4 x 30t moxys	108
	3 x D8/D9 dozers	110
	6 x truck and dog	96
Excavation including topsoil stripping and stockpiling	3 x D8/D10 dozers	110
	4 x 30-45t excavators (inc. rock hammers)	129
	4 x 30t moxys	108
	2 x 14H graders	111
	4 x 623 compactors	110
	4 x 12t rollers	110
	3 x 623 scrapers	111
	2 x 30t moxy watercarts	112
	2 x bobcats	98
	2 x 10t excavators	108
Shaft sinking	Drill rig	104
	2 x 450kW hydraulic pumps	106
	Compressor	79
	10t hydraulic excavator	108
	Telehandler	107
	Mobile crane	104
	Dump truck	108

Noise from daytime construction activity associated with the access road and site excavation has been modelled by SLR (2013b) assuming all equipment from both these stages is operating simultaneously. Shaft sinking activity will occur after the completion of the access road and site excavation. Noise associated with operation of the Mandalong South Surface Site will not occur concurrently with any construction activity. SLR (2013b) advises that the construction scenarios assessed are considered to be representative of worst-case scenarios for both recommended standard hours and outside these hours.

Access Road and Site Excavation

Figure 53 illustrates the assumed location of plant and equipment for the construction of the access road and site excavation at the Mandalong South Surface Site.

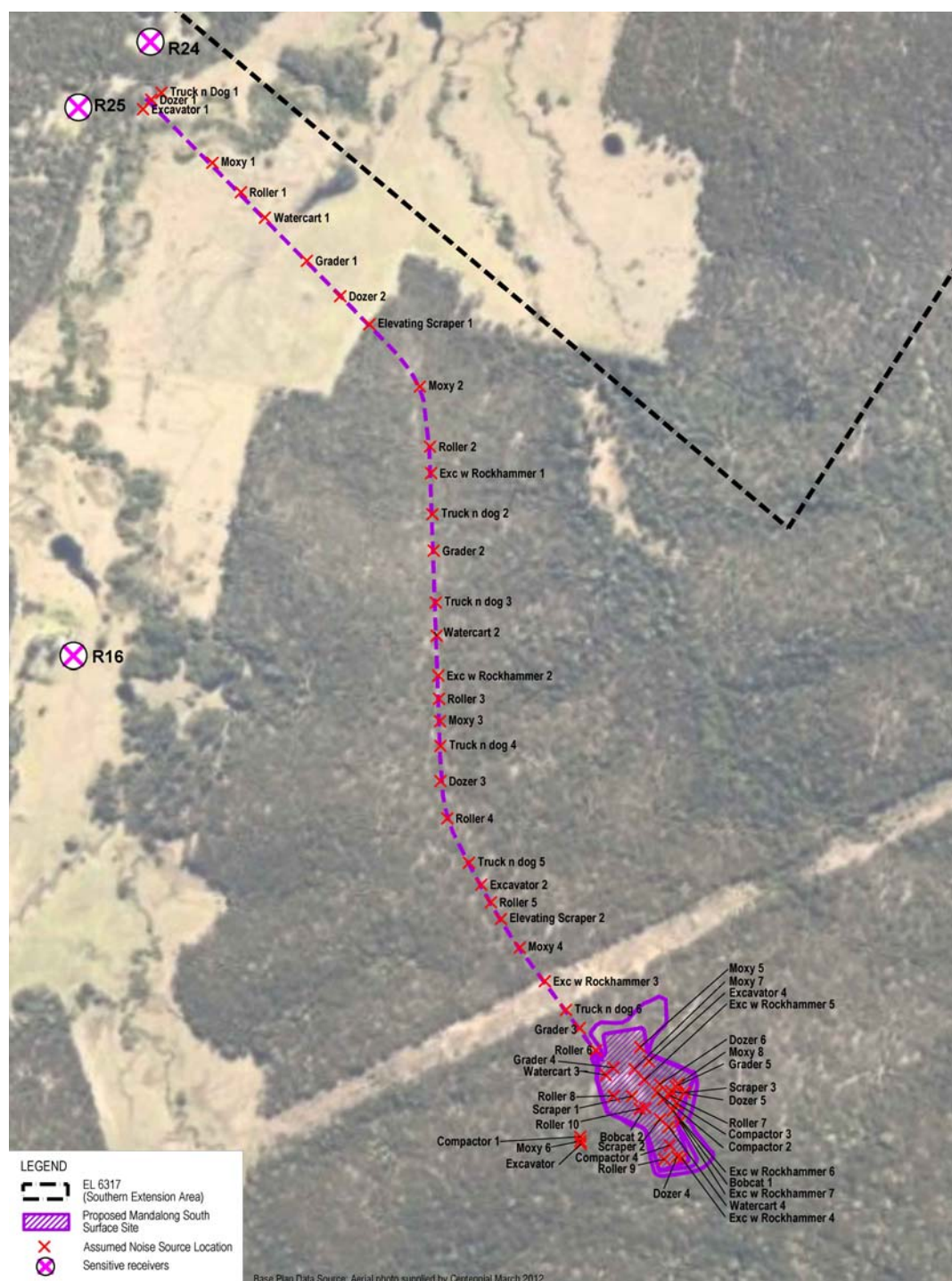


Figure 53 – Assumed Location of Construction Noise Sources for Access Road and Site Excavation

The noise modelling results for construction of the access road and site excavation at the Mandalong South Surface Site are listed in **Table 54**. Construction noise levels have only been provided for the residences in the vicinity of the Mandalong South Surface Site (R11 to R29) given construction activity will not contribute to noise levels in the vicinity of the Mandalong Mine Access Site.

Table 54 – Construction Noise Modelling Results – Access Road and Site Excavation

Location	Period	Noise Criteria $L_{Aeq,15\text{minute}}$ (dBA)		Predicted Construction Noise $L_{Aeq(15\text{minute})}$ (dBA)
		Noise Affected	Highly Noise Affected	
R11	Recommended standard hours ¹	41	75	<30
R12		41	75	44
R13		41	75	46
R14		41	75	48
R15		41	75	52
R16		44	75	58
R17		44	75	53
R18		44	75	54
R19		40	75	33
R20		40	75	55
R21		40	75	34
R22		40	75	<30
R23		44	75	44
R24		44	75	62
R25		44	75	61
R26		44	75	54
R27		44	75	52
R28		40	75	46
R29		40	75	43

1. Monday to Friday 7.00 am to 6.00 pm, Saturday 8.00 am to 1.00 pm (no work Sundays or public holidays).

Without mitigation measures in place, predictions indicate that the “noise affected” level during the construction of the access road and site excavation at the proposed Mandalong South Surface Site will be exceeded by up to 18 dBA, in particular for those residents located near the junction of Mandalong Road and the proposed access road. These exceedances are attributable to the close proximity of construction activities to the residences and/or the high noise activity of rock hammering during excavation. Notwithstanding this, construction noise during recommended standard hours is not predicted to exceed the “highly noise affected” level at any nearby residence.

The effect of noise barriers located at a distance of approximately 15 metres from residences R24 and R25 was considered by SLR (2013b). Noise barriers at heights of 2 metres above ground were input to the noise model assuming the same construction scenario as shown above in **Figure 53**. The effect of these barriers was a predicted reduction in construction noise at R24 of 7 dBA and a reduction of 1 dBA at R25. The minimal reduction predicted at R25 is attributed to the local topography and the relative height of the residence compared to that of the barrier and construction equipment. SLR (2013b) anticipates that with detailed design of height and location of each barrier that a reduction of up to 10 dBA would be achievable at each residence.

Rock hammering activities will be undertaken in areas that are away from the majority of residences and limited to between the hours of 8.00 am and 4.00 pm Monday to Friday and between 9.00 am and 1.00 pm Saturday.

Shaft Sinking

Shaft sinking will be required to be undertaken 24 hours per day, seven days per week for up to 78 weeks. In modelling noise from shaft sinking outside of recommended standard construction hours, SLR (2013b) has adopted the following assumptions:

- The drill rig will operate continuously;
- The hydraulic pumps will operate continuously and will be housed in a closed shed;
- Compressor, excavator, telehandler and mobile crane will operate intermittently during shaft sinking at 50 percent utilisation;
- A dump truck, used to haul waste material, will be limited to recommended standard hours; and
- A temperature inversion is present during the night-time period (representative of a worst-case meteorological scenario).

Noise modelling was undertaken by SLR (2013b) at the nearest potentially affected residences (R11 to R29) for the shaft sinking activity at the Mandalong South Surface Site. The results, which are listed in **Table 55**, show that shaft sinking within standard recommended hours is predicted to be below the relevant “noise affected” level at all considered residential receivers. However, shaft sinking activity outside of standard recommended hours is predicted to marginally exceed (by 1 dBA) the relevant “noise affected” level at R20 on Toepfers Road.

Due to this predicted exceedance, in an accordance with the ICNG (DECC 2009), Centennial Mandalong will implement all feasible and reasonable work practices with the aim of reducing construction noise emissions to below the “noise affected” level. While equipment with reduced sound power level will be sourced and utilised where practicable, due to the close proximity of some receptors, it is unlikely that this alone would reduce noise emissions to meet the noise affected goal (SLR 2013b). On this basis, Centennial Mandalong has committed to installing a temporary barrier measuring seven metres high and 20 metres long at a distance of 20 metres from the drill rig at the intake shaft site to provide acoustic shielding for the shaft sinking activity.

Figure 54 illustrates the assumed location of plant and equipment for the shaft sinking activity, along with the temporary noise barrier, at the Mandalong South Surface Site.

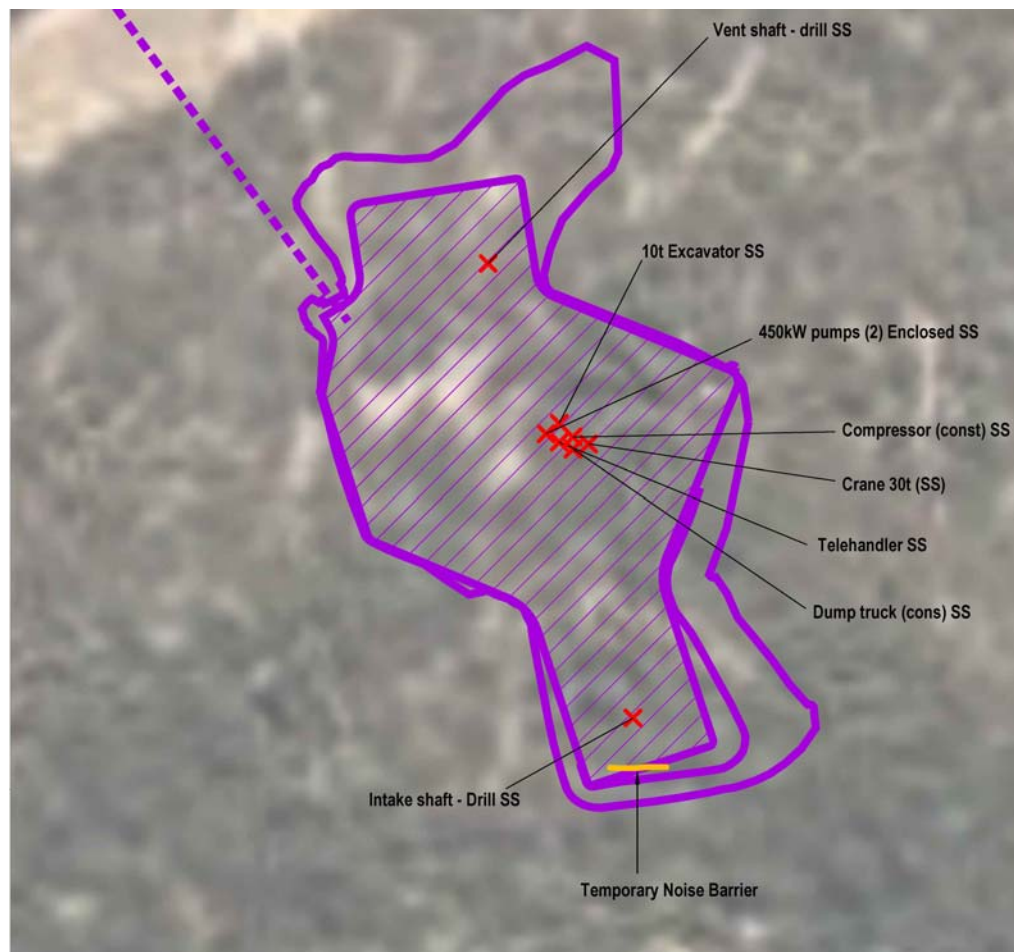


Figure 54 – Assumed Location of Construction Noise Sources for Shaft Sinking

SLR (2013b) re-modelled the shaft sinking activity inclusive of the noise barrier. The results are listed in **Table 55**.

Table 55 – Construction Noise Modelling Results – Shaft Sinking

Location	Period	Noise Criteria $L_{Aeq,15\text{minute}}$ (dBA)		Predicted Construction Noise $L_{Aeq(15\text{minute})}$ (dBA)	
		Noise Affected	Highly Noise Affected	Without Barrier	With Barrier
R11	Recommended standard hours ¹	41	75	<30	<30
	Outside recommended standard hours	36	N/A	<30	<30
R12	Recommended standard hours ¹	41	75	<30	<30
	Outside recommended standard hours	36	N/A	<30	<30
R13	Recommended standard hours ¹	41	75	<30	<30
	Outside recommended standard hours	36	N/A	<30	<30
R14	Recommended standard hours ¹	41	75	<30	<30
	Outside recommended standard hours	36	N/A	<30	<30
R15	Recommended standard hours ¹	41	75	<30	<30
	Outside recommended standard hours	36	N/A	<30	<30
R16	Recommended standard hours ¹	44	75	30	30
	Outside recommended standard hours	38	N/A	33	33

Location	Period	Noise Criteria L _{Aeq,15minute} (dBA)		Predicted Construction Noise L _{Aeq(15minute)} (dBA)	
		Noise Affected	Highly Noise Affected	Without Barrier	With Barrier
R17	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	32	32
R18	Recommended standard hours ¹	44	75	31	31
	Outside recommended standard hours	38	N/A	34	34
R19	Recommended standard hours ¹	40	75	<30	<30
	Outside recommended standard hours	35	N/A	<30	<30
R20	Recommended standard hours ¹	40	75	34	34
	Outside recommended standard hours	35	N/A	36	35
R21	Recommended standard hours ¹	40	75	<30	<30
	Outside recommended standard hours	35	N/A	<30	<30
R22	Recommended standard hours ¹	40	75	<30	<30
	Outside recommended standard hours	35	N/A	<30	<30
R23	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	<30	<30
R24	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	<30	<30
R25	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	<30	<30
R26	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	<30	<30
R27	Recommended standard hours ¹	44	75	<30	<30
	Outside recommended standard hours	38	N/A	<30	<30
R28	Recommended standard hours ¹	40	75	<30	<30
	Outside recommended standard hours	35	N/A	<30	<30
R29	Recommended standard hours ¹	40	75	<30	<30
	Outside recommended standard hours	35	N/A	<30	<30

1. Monday to Friday 7.00 am to 6.00 pm, Saturday 8.00 am to 1.00 pm (no work Sundays or public holidays).

The inclusion of the temporary noise barrier has the effect of reducing the predicted total noise emission from the shaft sinking activity at R20 to 35 dBA (SLR 2013b), which is compliant with the relevant noise goal.

Construction Vibration

The main vibration generating activities will occur during the construction phase of the proposed Mandalong South Surface Site and access road, including the operation of mobile equipment such as excavators with rock-hammers and dozers. Energy from construction equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. SLR (2013b) advises that the magnitude and attenuation of ground vibration is dependent on a number of factors, including:

- The efficiency of the energy transfer mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment);
- The frequency content;
- The stiffness of the medium (ground);

- The type of wave (surface or body); and
- The ground type and topography.

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. Notwithstanding this, given the separation distance between construction activity and the nearest potentially affected residential locations, vibration levels from these activities are predicted to be negligible at the nearest residential receivers (SLR 2013b).

Operational Noise

The sound power levels of relevant existing and approved plant and equipment have been obtained by SLR (2013b) from measurements of plant already operating at the Mandalong Mine Access Site, from SLR's database of similar plant and equipment and/or information supplied by the manufacturer or other consultants. The acoustic directionality of the mine ventilation fans has been considered in the noise model, with SLR (2013b) modelling the proposed ventilation fans at the Mandalong South Surface Site with the evases directed toward the east as per the conceptual layout shown on **Figure 24**.

The operational scenario modelled during each period together with sound power level information is summarised in **Table 56**.

Table 56 – Operational Scenario Considered in Noise Model

Plant and Equipment	Sound Power Level (dBA)	Period (number)		
		Day	Evening	Night
Approved Mandalong Mine Access Site				
Compressors ¹	96	✓	✓	✓
Forklift ^{*1}	102	✓ (1)	✓ (1)	✓ (1)
PJB ^{*1}	108	✓ (1)	✓ (1)	✓ (1)
Eimco ^{*1}	108	✓ (1)	✓ (1)	✓ (1)
Mine ventilation fans ¹	107	✓	✓	✓
Methane drainage plant (discharge) ¹	95	✓	✓	✓
Gas engines ²	102	✓	✓	✓
Methane flare and booster ²	96	✓	✓	✓
VAM-RAB unit ²	97	✓	✓	✓
Substation ¹	84	✓	✓	✓
Proposed Mandalong South Surface Site				
Substation ³	84	✓	✓	✓
Mine ventilation fans ³	107	✓	✓	✓
Deliveries (i.e. stonedust and ballast) ³	111	✓	✓	-
Inertisation plant ³	84	✓	✓	✓
Compressors ³	96	✓	✓	✓

* - the sound power level of this equipment has been reduced by 3 dBA in the noise model on the basis that these machines typically operate on the surface for up to 50% of the time at full engine speed in a busy 15 minute period.

1 - existing plant and equipment.

2 - approved, but yet to be installed/commissioned.

3 - proposed.

Figures 55 and **56** show the assumed location of plant and equipment for the typical operational scenario at the existing Mandalong Mine Access Site and proposed Mandalong South Surface Site, respectively.



Figure 55 – Assumed Location of Operation Noise Sources at Mandalong Mine Access Site

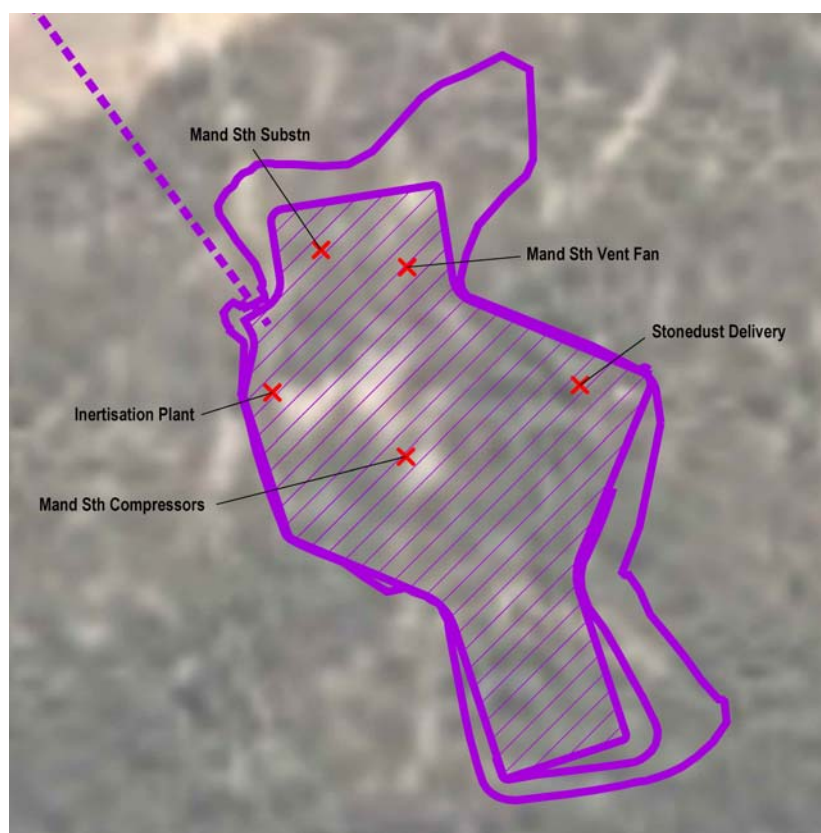


Figure 56 – Assumed Location of Operation Noise Sources at Mandalong South Surface Site

Operational noise from all sources that contribute to the total noise at each receiver was examined to identify characteristics that may cause greater annoyance, including tonality and impulsiveness. SLR (2013b) did not identify these characteristics in any of the sources considered.

Intrusive noise levels were assessed at the nearest potentially affected residential locations for calm and adverse meteorology conditions during the day, evening and night-time periods. The results of operational noise modelling, which are listed in **Table 57** and shown on **Figures 57** and **58**, indicate that the relevant intrusive noise criteria will be achieved at all the nearest residential locations to the Project (SLR 2013b). Predicted amenity noise emission levels ($L_{Aeq(15minute)}$) at the nearest potentially affected residential locations were conservatively estimated by SLR (2013b) from the predicted intrusive levels ($L_{Aeq(15minute)}$) based on the following assumption: $L_{Aeq(period)} = L_{Aeq(15minute)} - 2 \text{ dBA}$. The results of operational noise modelling indicate that the relevant amenity noise criteria will also be achieved at all the nearest residential locations to the Project (SLR 2013b).

Table 57 – Operational Noise Modelling Results

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$ (dBA)	Amenity Criteria $L_{Aeq(period)}$ (dBA)	Sleep Disturbance Noise Goal $L_{A1(1minute)}$ (dBA)	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)	
					Calm	Inversion + Drainage Wind ¹
R1	Day	45	50	-	<30	
	Evening	45	45	-	<30	
	Night	42	40	52	<30	34
R2	Day	45	50	-	35	
	Evening	45	45	-	35	
	Night	42	40	52	36	40
R3	Day	45	50	-	37	
	Evening	45	45	-	37	
	Night	42	40	52	38	42
R4	Day	45	50	-	34	
	Evening	45	45	-	34	
	Night	42	40	52	35	39
R5	Day	57	60	-	37	
	Evening	57	51	-	37	
	Night	46	51	61	37	41
R6	Day	57	60	-	36	
	Evening	57	51	-	36	
	Night	46	51	61	37	40
R7	Day	57	60	-	40	
	Evening	57	51	-	40	
	Night	46	51	61	40	43
R8	Day	57	60	-	40	
	Evening	57	51	-	40	
	Night	46	51	61	40	43
R9	Day	57	60	-	38	
	Evening	57	51	-	38	
	Night	46	51	61	38	42
R10	Day	57	60	-	35	

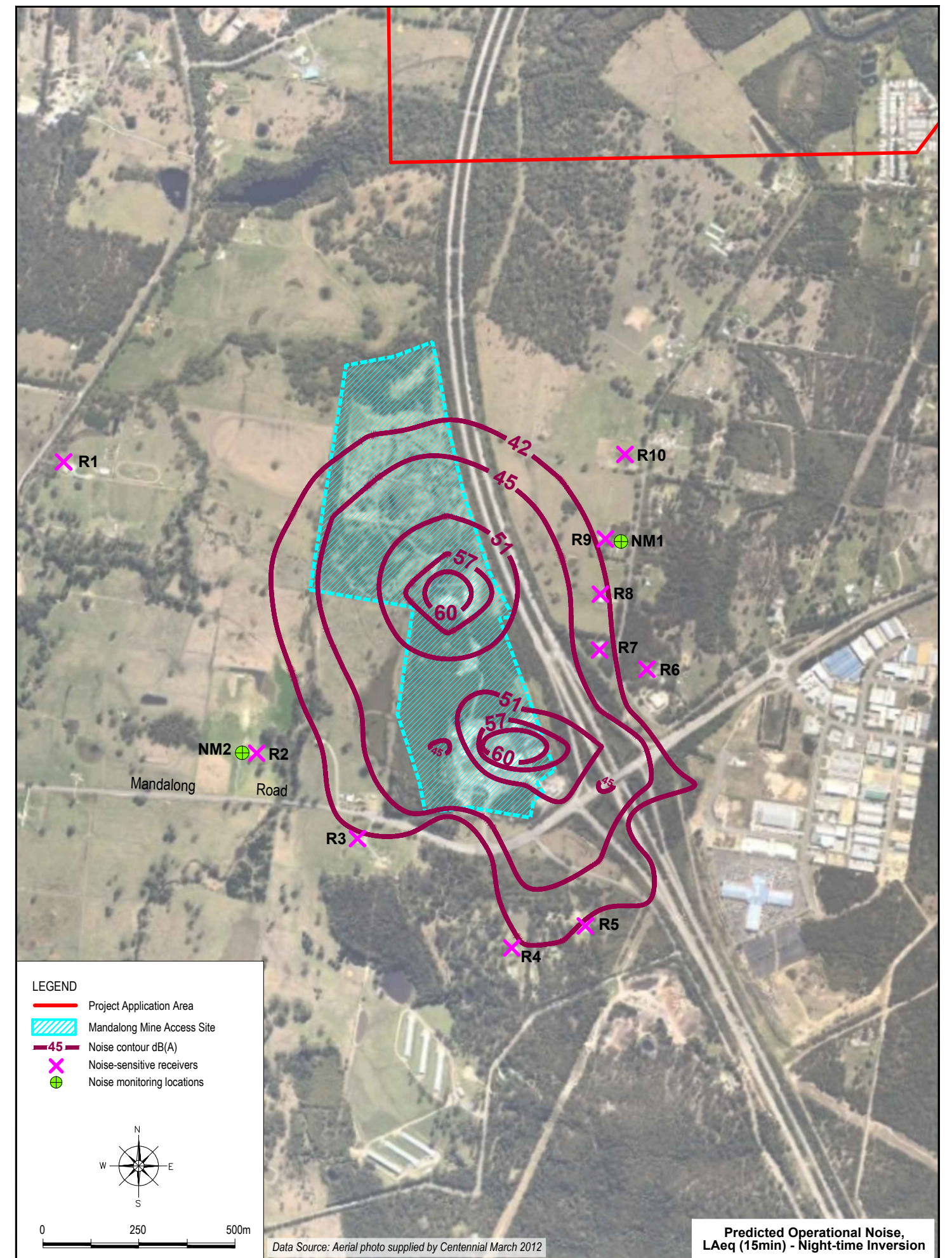
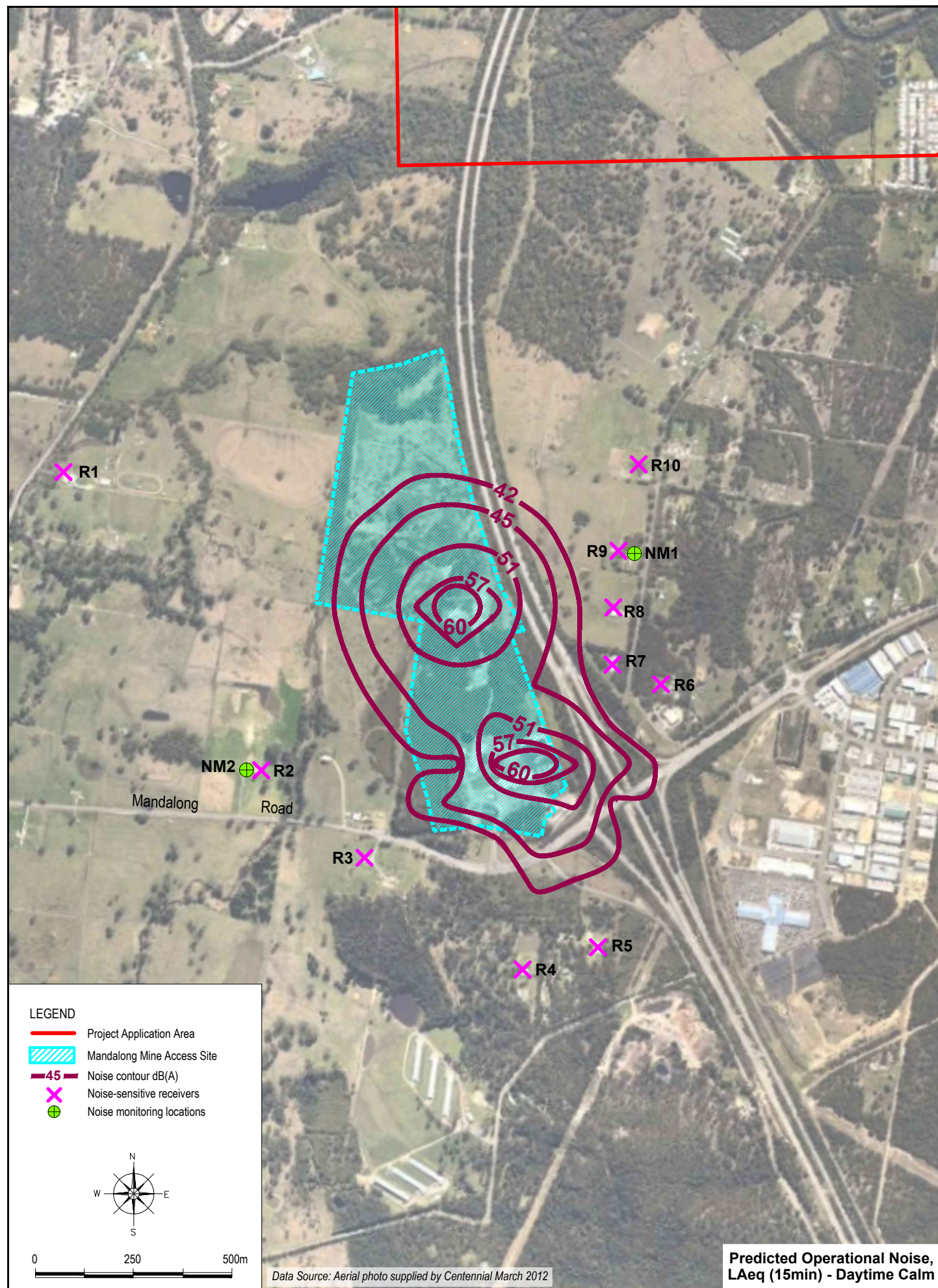
Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$ (dBA)	Amenity Criteria $L_{Aeq(period)}$ (dBA)	Sleep Disturbance Noise Goal $L_{A1(1minute)}$ (dBA)	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)	
					Calm	Inversion + Drainage Wind ¹
	Evening	57	51	-	35	
	Night	46	51	61	35	39
R11	Day	36	50	-	<30	
	Evening	36	45	-	<30	
	Night	36	40	46	<30	<30
R12	Day	36	50	-	<30	
	Evening	36	45	-	<30	
	Night	36	40	46	<30	<30
R13	Day	36	50	-	<30	
	Evening	36	45	-	<30	
	Night	36	40	46	<30	<30
R14	Day	36	50	-	<30	
	Evening	36	45	-	<30	
	Night	36	40	46	<30	<30
R15	Day	36	50	-	<30	
	Evening	36	45	-	<30	
	Night	36	40	46	<30	<30
R16	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R17	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R18	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R19	Day	35	50	-	<30	
	Evening	35	45	-	<30	
	Night	35	40	45	<30	<30
R20	Day	35	50	-	31	
	Evening	35	45	-	31	
	Night	35	40	45	<30	<30
R21	Day	35	50	-	<30	
	Evening	35	45	-	<30	
	Night	35	40	45	<30	<30
R22	Day	35	50	-	<30	
	Evening	35	45	-	<30	
	Night	35	40	45	<30	<30
R23	Day	35	50	-	<30	
	Evening	35	45	-	<30	

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$ (dBA)	Amenity Criteria $L_{Aeq(period)}$ (dBA)	Sleep Disturbance Noise Goal $L_{A1(1minute)}$ (dBA)	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)	
					Calm	Inversion + Drainage Wind ¹
	Night	35	40	45	<30	<30
R24	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R25	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R26	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R27	Day	39	50	-	<30	
	Evening	39	45	-	<30	
	Night	38	40	48	<30	<30
R28	Day	35	50	-	<30	
	Evening	35	45	-	<30	
	Night	35	40	45	<30	<30
R29	Day	35	50	-	<30	
	Evening	35	45	-	<30	
	Night	35	40	45	<30	<30

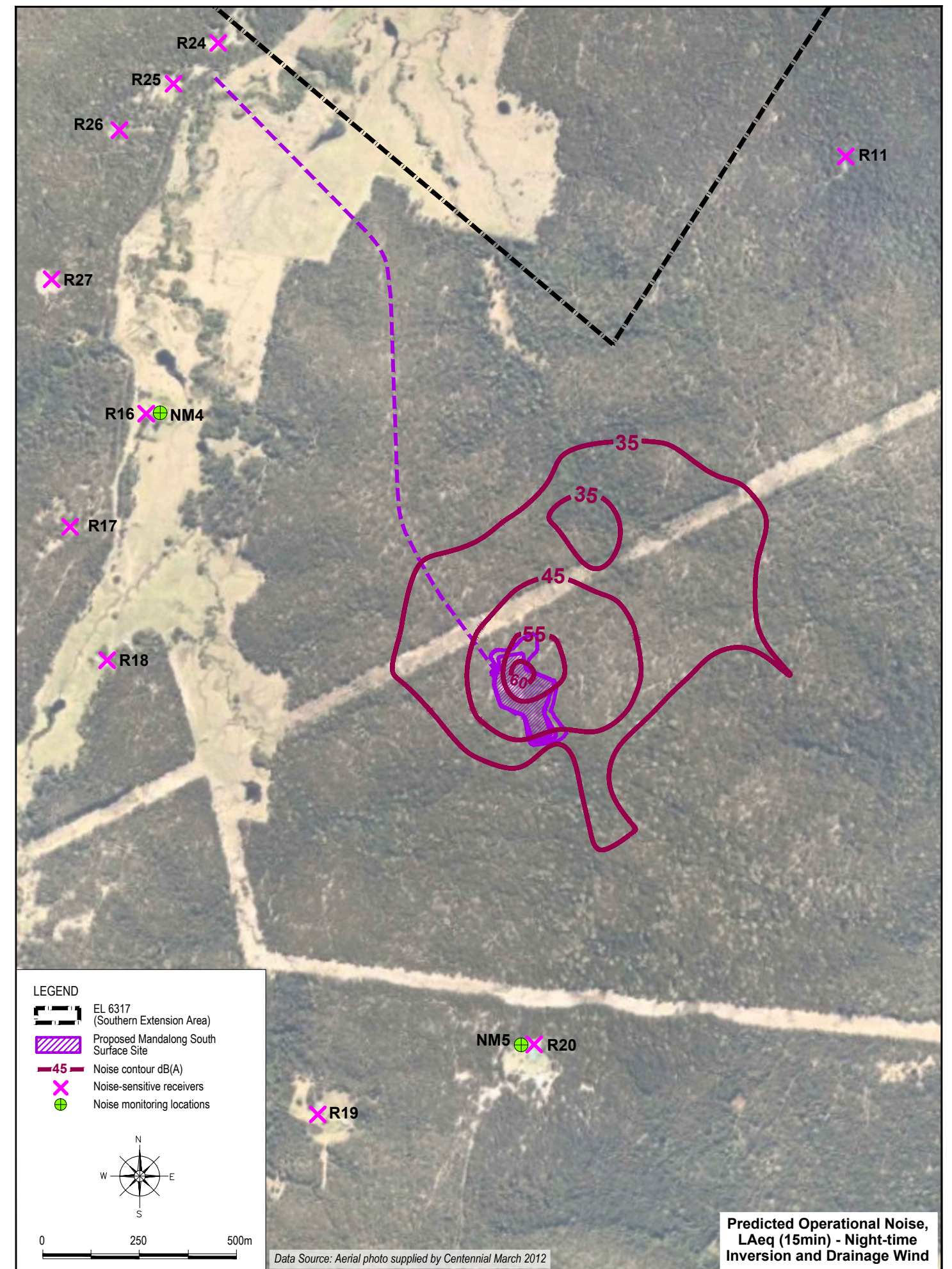
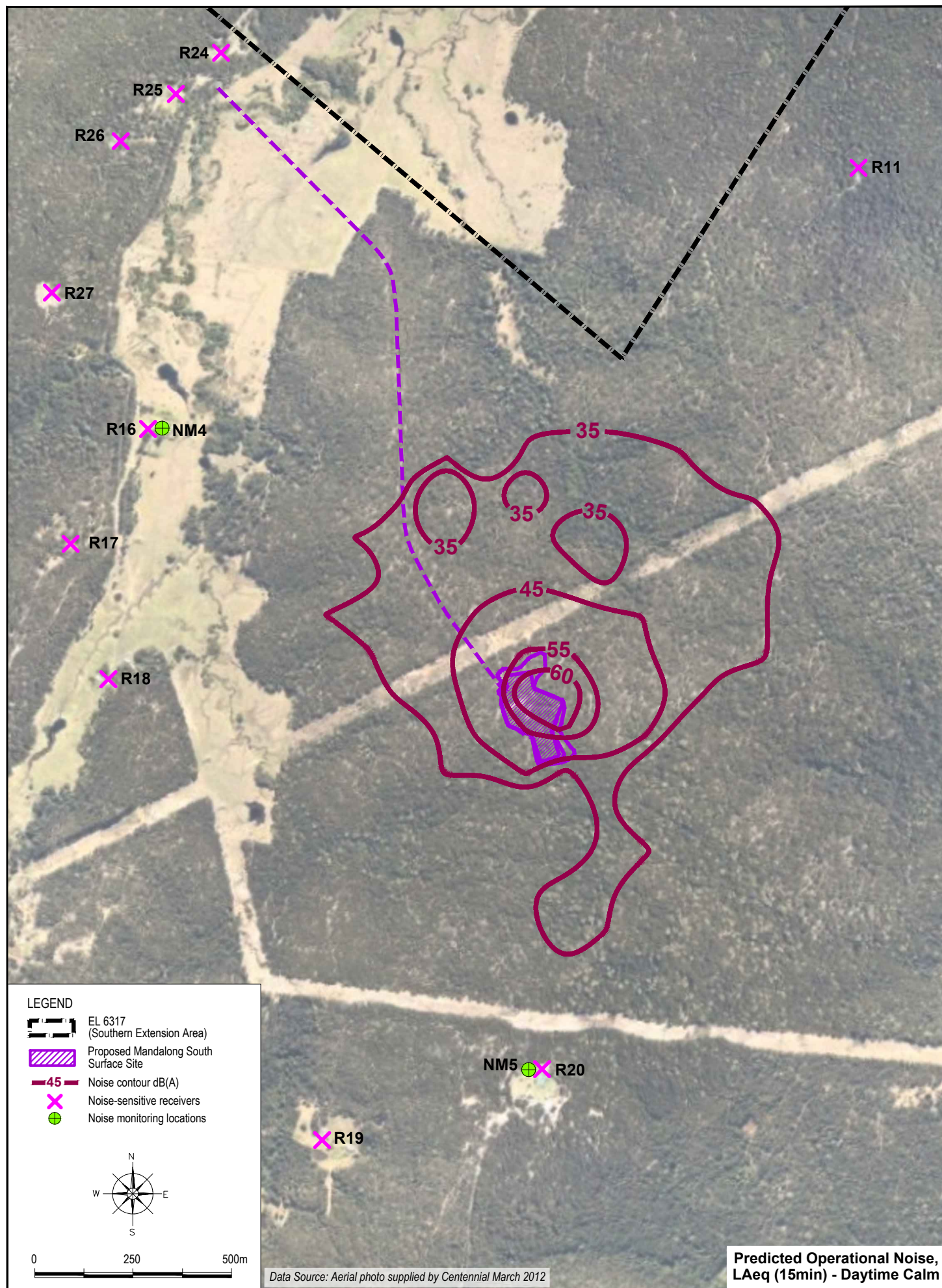
1 - Drainage flow wind has only been applied where the sources are at a higher altitude to the residential receiver and there is no intervening higher ground. Relevant residences are R12 to R19 and R24 to R28.

All equipment proposed for operation during the night-time period at the proposed Mandalong South Surface Site is of a continuous nature and it is unlikely that the operation of fans, compressors and the substation would cause a significant maximum noise event. On this basis, SLR (2013b) concludes that it is not likely that sleep disturbance would occur as a result of operation of the Mandalong South Surface Site.

Due to the distance between the existing Mandalong Mine Access Site and the proposed Mandalong South Surface Site, the predicted noise emission levels from one site does not add to the levels predicted from the other (i.e. there is no residential location that would be affected by noise from both sites).



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Traffic Noise

Traffic noise levels have been predicted by SLR (2013b) using the US EPA's traffic noise model, which is an internationally accepted theoretical traffic noise prediction model that takes into account the L_{Amax} vehicle noise levels, receiver offset distance, passby duration, vehicle speed, ground absorption, number of hourly vehicle movements, receiver height, truck exhaust height and the height and location of any intervening barriers. Noise levels (L_{Amax}) of light and heavy vehicles on Mandalong Road were obtained by SLR personnel during operator-attended noise measurements

Construction-related road traffic noise levels and operation-related road traffic noise levels are both predicted to meet the relevant criteria at the nearest residences along Mandalong Road during both the day and night-time periods.

Cumulative Noise

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria are established with a view to maintaining acceptable noise amenity levels for residences (SLR 2013b). On this basis, the cumulative impact of the Project with existing industrial noise sources in the surrounding area has been assessed in the determination of the amenity criteria at each receiver location.

Existing industrial noise was not found to be a significant contributor to ambient noise levels at any of the monitoring locations (see **Section 10.12.2**) and therefore, further assessment of cumulative industrial noise is not required (SLR 2013b). For those receivers in close proximity to the Sydney-Newcastle F3 Freeway (R5, R6, R7, R8, R9 and R10), the existing noise levels are dominated by road traffic and these areas have been assessed by SLR (2013b) as areas of high traffic noise as defined in the INP.

Summary

Table 58 summarises the predictions and conclusions of SLR's (2013b) noise modelling exercise.

Table 58 – Noise Assessment Predictions

Noise	Compliance with Project Criteria	Notes
Construction		
Construction noise	Noise affected – ✖ Highly noise affected - ✔	Some residents will be "noise affected" during the construction phase, in particular residents R24, R25 and R26 located near the junction of Mandalong Road and the proposed access road. Shaft sinking activity outside of standard recommended hours is likely to marginally exceed (by 1 dBA) the relevant "noise affected" level at R20 on Toepfers Road.
Road traffic	✔	
Operation		
Operation noise	Intrusive level - ✔ Amenity level - ✔	
Cumulative	✔	
Sleep disturbance	✔	
Road traffic	✔	

10.12.5 Mitigation and Management

Centennial Mandalong will continue to employ the mitigation measures and management strategies currently adopted at the Mandalong Mine, as relevant to the Project, to minimise noise emissions. These are standard work procedures to minimise noise emissions, maintaining plant and equipment to ensure optimal operating conditions, and assessing the sound power levels when purchasing new plant and equipment. The fan evasee will also be designed and installed to be directed away from the closest sensitive receptors to minimise potential noise impacts.

The following additional noise mitigation and management commitments are made:

Noise Monitoring

Mandalong Mine's currently approved and implemented EMS, including the *Noise Monitoring Program*, will be reviewed and updated for the Mandalong Southern Extension Project. The review will take into consideration the findings and conclusions of the noise impact assessment (SLR 2013b), the commitments made in this EIS and all relevant consent conditions. As part of this review, Centennial Mandalong proposes to expand the existing noise monitoring program, which currently comprises annual operator-attended monitoring in the vicinity of the Mandalong Mine Access Site, to include quarterly operator-attended noise monitoring at and around the Mandalong South Surface Site to confirm the noise levels predicted by SLR (2013b). The optimal location for this additional monitoring will be determined in consultation with a suitably qualified consultant.

Centennial Mandalong will continue to report noise monitoring results on a monthly basis on Centennial's website and on an annual basis in the Annual Review.

Temporary Construction Noise Barrier

To provide acoustic shielding for the shaft sinking activity at the Mandalong South Surface Site, a temporary barrier measuring seven metres high and 20 metres long will be installed at a distance of 20 metres from the drill rig at the intake shaft site (see **Figure 54**).

Construction Management Plan

As recommended by SLR (2013b), a Construction Management Plan will be developed for the construction phase of the Mandalong South Surface Site. The following noise mitigation and noise management procedures, among others, will be incorporated into the Construction Management Plan:

- Where and when possible, construction equipment with reduce sound power levels will be sourced and used.
- Where necessary, and in consultation with potentially affected residents, temporary noise barriers will be established and maintained.
- Where and when possible, noisy equipment will be oriented away from noise sensitive receivers.
- Site personnel will be advised of noise compliance limits and the practical measures that can be undertaken to limit noise generation during their activities. This will include avoiding unnecessary use of radios and stereos and turning off plant and equipment when not in use.
- Internal traffic flow will be directed to minimise the need for reversing and, as such, the use of reversing alarms.
- Tipping actions and stockpiles will be positioned as far away from residential locations as possible.
- Rigid dump trucks used to haul waste material from the Mandalong South Surface Site during construction will be limited to recommended standard construction hours.

- Consultation with potentially-affected residences regarding the timing of acoustically significant events will be undertaken and, where possible, construction during the most sensitive times of the day will be limited.
- Rock hammering will be restricted to between the hours of 8.00 am and 4.00 pm Monday to Friday and between 9.00 am and 1.00 pm Saturday (no rock hammering on Sundays or public holidays).
- Any complaints in relation to construction noise will be promptly responded to and, where possible, measures implemented to avoid a recurrence of the issue.
- Noise monitoring within the construction site and at neighbouring property boundaries.

All potentially affected residents will be informed of the following prior to the commencement of acoustically significant construction activities at the Mandalong South Surface Site:

- The nature and duration of the works to be carried out;
- The expected noise levels; and
- Relevant contact details for site personnel.

Exploration Activities

The proposed exploration drilling activities will be undertaken within the bounds of Centennial Mandalong's mining leases and exploration licences, and in accordance with the requirements of the ICNG (DECC 2009). Consultation with potentially noise affected landholders will be undertaken in accordance with a Stakeholder Engagement Strategy in which all neighbouring landholders and any residents within 450 metres of a drill rig are notified of the timing, location and anticipated duration of the exploration drilling activities. Where drilling is to be undertaken in close proximity of residents, the following noise mitigation measures will be implemented:

- Temporary noise barriers will be established and maintained;
- Drilling will be undertaken adopting rotary methods with water circulation (rather than compressed air); and
- Avoiding the unnecessary use of radios and stereos.