

4B.5.4 Significance Assessment

4B.5.4.1 Cultural Significance

The cultural significance of Aboriginal relics and sites can only be assessed by the Aboriginal community, and in particular, the Elders. On completion of the field survey, separate listings of all sites recorded (during the four surveys) were forwarded to both Narrabri LALC and Gomeroi, to provide them with the information on which they could provide information on the cultural significance of the identified sites and artefacts. Narrabri LALC responded stating that *“sites that have been recorded should not be impacted on”*, and that, *“In relation to knapping areas that have been recorded these areas that require preserving and our recommendation is that the bore holes should be relocated”*. This second statement, relates specifically to Site 10b (see **Figure 4B.32**). Narrabri LALC further states that it is, *“keen to support and work with Narrabri Coal Mine with preserving these sites”*. No correspondence providing assessment of cultural heritage or recommendation on preferred site management has been received from Gomeroi.

4B.5.4.2 Scientific Significance

AS&R (2009a) has assessed the scientific significance, ie. the potential of a site or place to generate knowledge through archaeological research or knowledge, of the sites and artefacts identified during the four field surveys as follows.

Panels 1 to 7 Survey

The majority of the artefact containing sites (36 of the 41) are considered to be of low scientific significance as they are of very low artefact density (<10 artefacts) and in disturbed contexts. Sites 38 and 39, however, are considered to be of higher scientific significance as they contain at least 113 artefacts (and maybe as many as 500 artefacts) which would provide a good sample for further analysis into choices of material, knapping strategies and tool types.

Site 43, a fireplace, is also of higher scientific significance as through collection of the charcoal or ash remaining within the site, the age of the site could be obtained through C₁₄ (radio-carbon) date. This would allow for a better understanding as to the period of Aboriginal occupation of the region.

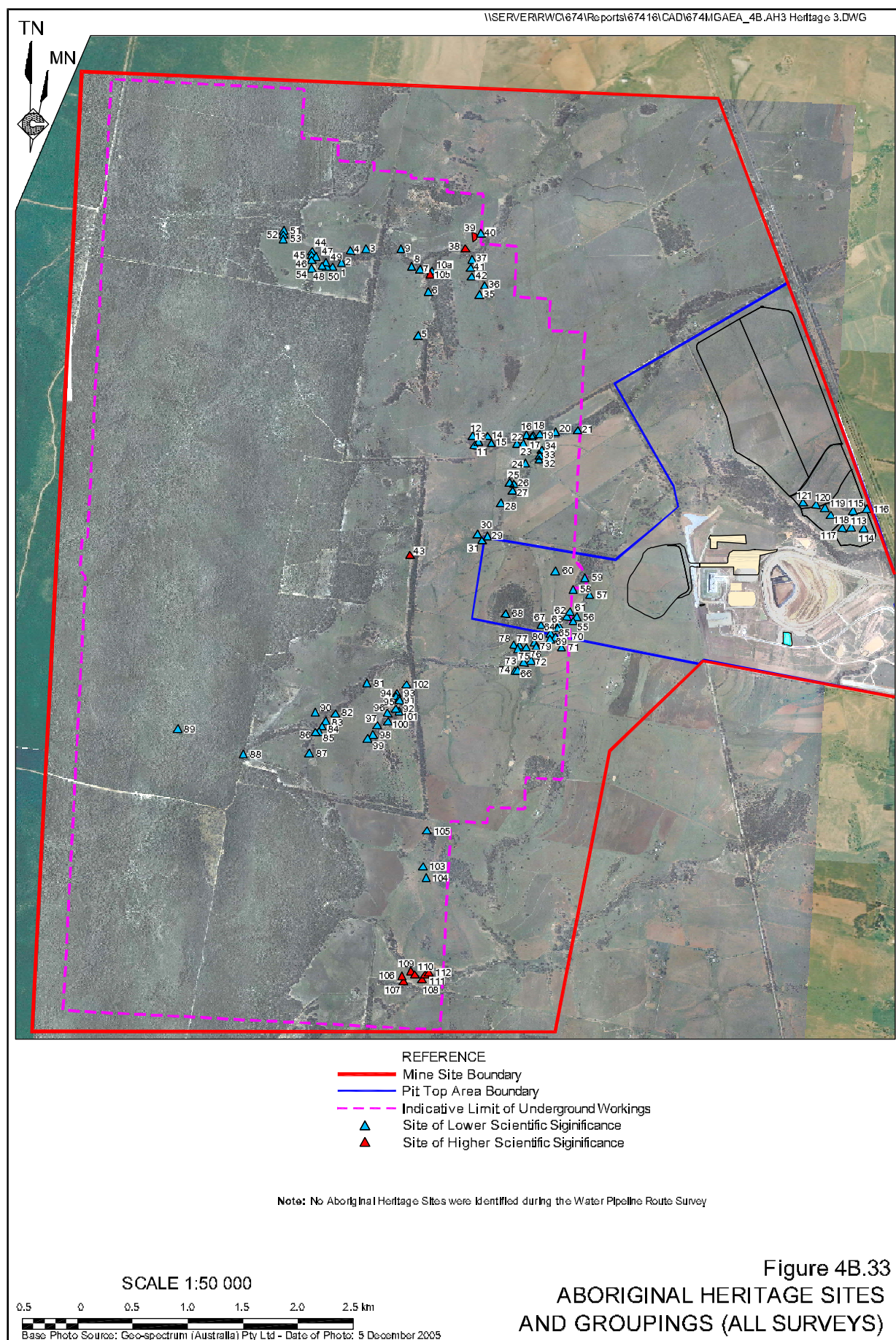
Panels 8 to 26 Survey

Similar to the sites of the Panels 1 to 7 Survey, the majority of the identified sites (62 of 69) are of low artefact density and low scientific significance. However, the complex of sites numbered 106 to 112 (see **Figure 4B.33**) occur in an environment in which there are likely to be many more artefacts, and may provide useful information on knapping strategies, material choice, material use, and intra-site activity areas.

Brine Storage Area and Water Pipeline Route

None of the nine sites recorded in the Brine Pond Storage Area are of scientific significance. No sites were recorded along the Water Pipeline Route.





4B.5.5 Management Measures

In-situ Protection of Sites

Of the 43 sites identified within the Mining Area above LW1 to LW7 (Panels 1 to 7 Survey), the Proponent would avoid impact to those identified as being of scientific significance (Sites 38 and 39), specifically noted by the Aboriginal stakeholders (Site 10b) or of higher artefactual density (Site 19). These sites would be protected from inadvertent or accidental damage by vehicular traffic by the erection of fencing, para-webbing or equivalent method and signs erected identifying an “Environmental Protection Zone”. By marking these sites in this manner, gas drainage and ventilation design can be more easily tailored to avoid these.

Following the completion of activities in the vicinity of the protected site, the fencing would be removed to allow the cattle to continue to graze the area, and thereby provide a measure of weed control and potential grass-fire hazard reduction that would otherwise not occur if the fencing was to remain.

The Proponent has also committed to avoiding the remaining Aboriginal sites, wherever practicable, through modification to the location or alignment of surface disturbing activities and access roads. It is considered likely that most if not all of these sites would be avoided as the majority of the identified sites occur adjacent to drainage lines, areas likely to be avoided anyway by the Proponent as unsuitable for the purposes of drilling.

No specific protection measures have been developed for the Aboriginal sites located over the remainder of the Mining Area. These areas would be the subject of further more detailed field surveys (including representatives of the registered Aboriginal stakeholders) undertaken over specific areas, eg. LW8 to LW13, LW14 to LW18 etc. The field survey and development of specific management measures to manage the sites identified would be undertaken in accordance with an updated Aboriginal Cultural Heritage Management Plan (ACHMP) for the Mine Site (which is currently being prepared by the Proponent in consultation with the registered Aboriginal stakeholders). This approach to managing Aboriginal sites is considered appropriate given that during the ensuing period between the commencement of the Longwall Project and disturbance over LW8 and beyond, it is probable that many of sites currently not visible would become exposed and similarly many sites currently exposed would no longer be identifiable. It is therefore appropriate that specific management measures be developed and implemented based on the Aboriginal record of the time.

Assuming the implementation of the measures described above, the proposed in-situ management strategy for Aboriginal sites is likely to be highly effective in preventing impact on the Aboriginal sites of higher scientific and cultural significance. The association between the artefact and the location would be maintained, with the local setting returned to pre-mining conditions once the mine has progressed beyond the affected longwall panel.

Site Salvage

The Proponent acknowledges that on some occasions, the location of disturbance associated with ventilation or gas drainage may have restricted scope for relocation due to the requirement to maintain a safe environment underground. Based on the location of the identified sites and proposed disturbance presented in **Figure 4B.32**, a list of the sites that are located within the immediate vicinity of proposed surface disturbing activities and which should be salvaged unless the Company can avoid them has been compiled.



Site	Site Name	Site Type	No of Artefacts
1	Pine Creek T2/OS 1	Artefact scatter	10 to 15
3	Pine Creek T2/OS 2	Artefact scatter	7
6	Pine Creek T2/OS 5	Artefact scatter	3
9	Pine Creek T2/ISO 3	Isolated artefact	1
11	Pine Creek T1/OS 8	Artefact scatter	11
12	Pine Creek T1/OS 9	Artefact scatter	3
15	Pine Creek T1/OS 11	Artefact scatter	2
28	Pine Creek T1/ISO 9	Isolated artefact	1
29	Pine Creek T1/IAO 10	Isolated artefact	1
30	Pine Creek T1/OS 19	Artefact scatter	2
32	Pine Creek T1/OS 21	Artefact scatter	2
33	Pine Creek T1/OS 22	Artefact scatter	2
34	Pine Creek T1/OS 23	Artefact scatter	4
35	Pine Creek T2/OS 24	Artefact scatter	2
40	Pine Creek T2/OS 27	Artefact scatter	4
43	Pine Creek T1/FP1	Fireplace	-

In the instance where a site cannot be avoided, the Proponent would follow the appropriate archaeological management strategy which would be to salvage the artefact(s) and remove them to a secure place agreed to by the registered Aboriginal stakeholders. Any salvage operation would be undertaken following consultation with both Narrabri LALC and Gomeroi and would form part of the updated ACHMP for the Mine Site. Subject to modification by the local Aboriginal stakeholders, salvage would be undertaken as follows.

- The archaeologist would return to the Panels 1 to 7 Survey Area, accompanied by Sites Officers from Narrabri LALC and Gomeroi, to salvage the artefacts from those sites.
- The artefacts would be taken by the archaeologist to allow him time to produce a full analysis of the material. In the case of Site 43, sufficient charcoal or ash would be removed to enable radio-carbon dating).
- The salvaged artefacts would be returned to the authorised Aboriginal organisation within 21 days of the salvage.
- The salvaged artefacts would be placed in the care and control of the Aboriginal organisation agreed to by Narrabri LALC and Gomeroi.
- The archaeologist would produce a report of the salvage, including full descriptions of the salvaged material, and an interpretation of the archaeological record within the Salvage Area.
- Copies of the reports would be given to Narrabri LALC, Gomeroi, DECCW and the Proponent.



- The archaeologist would lodge updated Site Recording Forms for those sites that have been salvaged with DECCW for amending the AHIMS Site Register.
- Should an appropriate long term storage facility or ‘keeping place’ not be available at the time of salvage, the Proponent has committed, following consultation with the local Aboriginal stakeholders and DECCW, to providing an interim facility until a long term facility is identified.

The proposed salvage of artefacts would be a reliable and effective method of avoiding impacts on the artefacts themselves. However, as these artefacts would be removed from their original location, a residual impact on the site itself would be incurred.

4B.5.6 Assessment of Impacts

4B.5.6.1 Impacts of Surface Disturbance Associated with Longwall Panels 1 to 7

In most cases, there would be no direct impact on the identified sites, as the Proponent would modify surface activities to avoid the identified site. Fencing off the most culturally and scientifically significant sites, would assist in the design of surface activities to avoid these sites.

In the event that mine gas drainage or ventilation requirements prevent the relocation of activities away from an identified site, the impact would be minimised by salvaging, cataloguing and securely storing all artefacts that would be disturbed if retained in-situ. While it is acknowledged that the residual impact on the site itself could not be mitigated, the artefacts themselves would be saved and add to the archaeological record of the region (which currently is very concise). All salvage activities would be undertaken in accordance with an ACHMP to be developed in consultation with Narrabri LALC and Gomeroi, with representatives of both organisations invited to take part in the salvage operations.

On the basis that site salvage would be a last resort of the Proponent, and that the salvage operations would be undertaken as described in Section 4B.5.5, the impact on Aboriginal cultural heritage would be minimised.

4B.5.6.2 Impacts of Subsidence

The impacts of subsidence on Aboriginal sites, ie. differential lowering of the ground surface and/or surface cracking on the identified site types has been assessed by AS&R (2009a). The following provides a summary of the assessed impact of subsidence.

Scarred Trees

The scarred tree (Site 20) is described by AS&R (2009a) as a healthy, living tree with a strong root system and is located on the northern bank of Pine Creek Tributary 2 over the retained chain pillar on the maingate side of LW1. The site is almost certainly within the zone likely to be affected by surface cracking and could possibly be affected by altered drainage patterns. However, AS&R (2009a) have assessed that it is probable that the tree’s root system would resist any change to local drainage and/or surface cracking and would be unlikely to fall. AS&R (2009a) concludes that any impact to the tree resulting from subsidence would be minimal if at all.



Axe-grinding Grooves.

The three axe-grinding grooves occur on two sandstone floaters (Site 10b) and so the only impact to the site from subsidence would be the vertical displacement of the floaters, which would have no impact on the axe-grinding grooves.

Artefact Scatters

All of the artefact scatters and isolated artefacts occur on actively degrading surfaces, and some occur within active gullies, and AS&R (2009a) notes that most are likely to have been displaced by slope-wash, stock movement, land clearance, ploughing, harrowing and vehicular traffic, ie. there would be very few artefacts in their original depositional context.

Any subsidence and/or cracking is likely to displace artefacts vertically, however, this is unlikely to have any significant impact on the natural processes affecting horizontal displacement of the artefacts. On the basis of the above it is assessed that the likely impact to open artefact scatters from subsidence to be minimal.

4B.5.6.3 Assessment of Cumulative Impact

The archaeological record of the region is limited, largely due to the fact that most surveys for sites of Aboriginal heritage are associated with proposed development, of which there has been little locally. In the absence of a detailed regional record, AS&R (2009a) considered the cumulative impact of salvaging sites within the Panels 1 to 7 Survey Area in two ways.

1. The impact of salvaging sites relative to the total number of known sites in the Panels 1 to 7 Survey Area.
2. The impact of salvaging sites in the Panels 1 to 7 Survey Area relative to the anticipated total number of sites likely to be present in the Mine Site.

Known Sites in the Panels 1 to 7 Survey Area

As the Proponent has committed to avoiding those sites deemed to be of higher scientific and cultural significance, the only sites likely to be impacted are those of low artefact density or site types which are frequently identified. The cumulative impact of disturbance to a small number of these sites (disturbance is considered unlikely as the Proponent would preferentially avoid all sites) would therefore be minor as a large number of similar low density sites would be retained.

Further mitigating the cumulative impact of the Longwall Project, the Proponent has committed to salvaging those Aboriginal sites that cannot be avoided and undertaking the archaeological research in accordance with the management measure described in Section 4B.5.4. The cumulative impact would be further mitigated by retaining the salvaged artefacts in a 'keeping place', such that a direct connection to the Aboriginal community could be maintained.

Anticipated Archaeological Record of the Mine Site

The southern half of the Mine Site contains similar landforms to that of the Panels 1 to 7 Survey Area and it is therefore anticipated that there would be a similar number and type of sites over the remaining Mining Area as identified in the Panels 1 to 7 Survey Area. By extrapolating the number of sites recorded in the ~800ha area of the Panels 1 to 7 Survey Area over the remaining ~2 400ha of the Mine Site (and taking into account that there are likely to be fewer sites upstream in the densely vegetated woodland covering the western third of the Mine Site),



then it is reasonable to assume that at least another 120 sites would be recorded in the remaining area the vast majority (at least 90%) of which would be isolated artefacts or scatters of five or less artefacts. This prediction is supported by the results of the Panels 8 to 26 Survey Area within which 69 sites were identified of which 82% contained ≤ 5 artefacts.

Assuming any sites of higher scientific or cultural significance could be avoided, eg. the complex of Sites 106 to 112 (see **Figure 4B.33**) (through for example the design of the gas drainage infrastructure), only low density artefact sites or those types which are frequently identified are likely to be disturbed. The cumulative impact on the local and regional archaeological record is therefore likely to be minor for the same reasons as discussed for the panels 1 to 7 Survey Area.

Based on the relatively low proportion of sites likely to be disturbed and salvaged and the maintenance of those sites of higher significance (cultural and scientific), AS&R (2009a) concludes that the sites remaining after salvage would be representative of the type, number and content of sites throughout the wider region.

4B.6 NON-INDIGENOUS HERITAGE

The non-indigenous heritage assessment was undertaken by Archaeological Surveys and Reports Pty Ltd. The full assessment is presented in Volume 2, Part 6 of the Specialist Consultant Studies Compendium with the relevant information from the assessment summarised in the following subsection. The full assessment is referred to as AS&R (2009b) throughout this document.

4B.6.1 Desktop Search of Heritage Listed Items

A desktop search of the Mine Site on the following heritage databases was conducted on 24 August 2009.

- Narrabri Local Environmental Plan 1992 – Schedule 2.
- Australian Heritage Council Database (which includes places listed in the World Heritage List, National Heritage List, Commonwealth Heritage list and Register of the National Estate).
- National Trust of Australia.

No listed heritage sites were identified within the Mine Site, nor within the vicinity of the Mine Site, with the nearest identified sites being in Narrabri. Additionally, no listed sites occur within Baan Baa nor Turrawan.

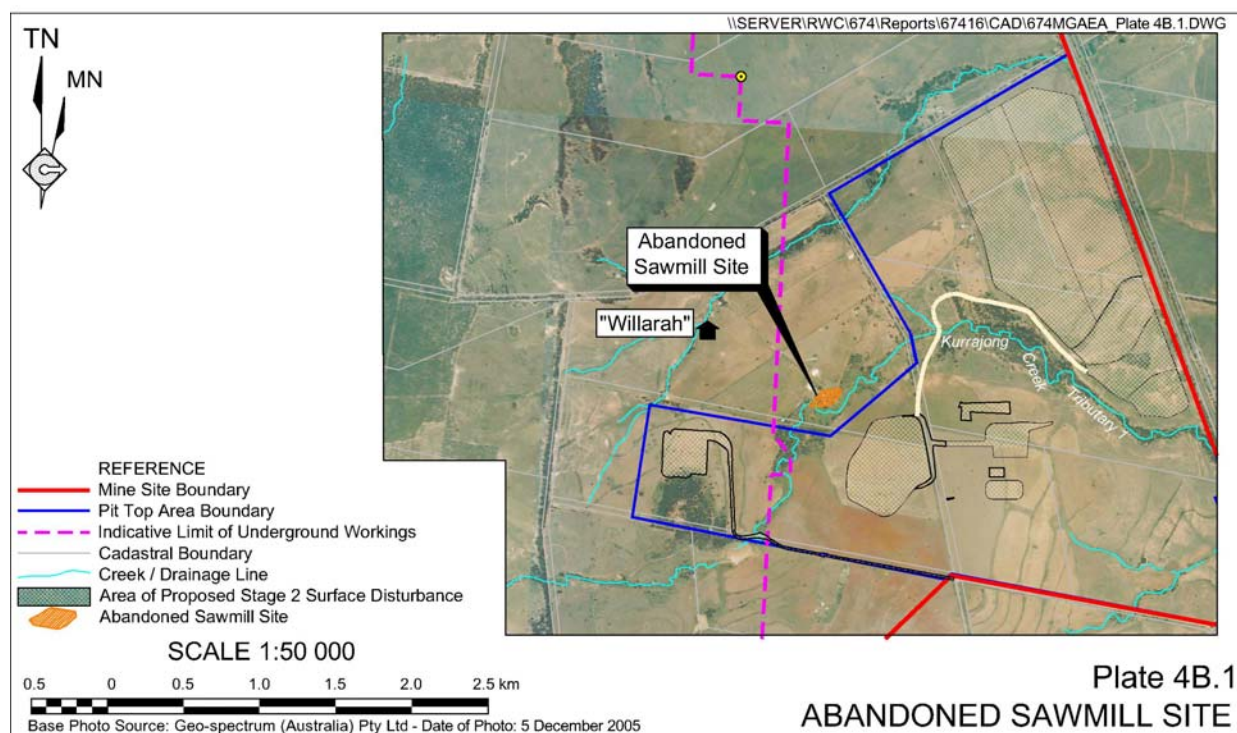
4B.6.2 Field Survey of the Mine Site

Archaeological Surveys and Reports Pty Ltd (AS&R) was commissioned to undertake a field survey to record structures, places or relics of heritage significance within the Mine Site. While AS&R identified several older residential structures which would classify as relics (as defined by Section 4 of the *Heritage Act 1977*), only one structure of interest, an abandoned sawmill, was identified.



The sawmill, which AS&R considers to provide an excellent example of the material, equipment and the sequence and relationship of the equipment to the milling process, occurs on the northern bank of Pine Creek Tributary 1, inside the western boundary fence line of the “Willarah” property (see **Plate 4B.1**). A comprehensive photographic record of the site along with a site plan have been recorded and held by (AS&R, 2009b).

Section 4B.6.3 provides an assessment of the heritage significance of the site.



4B.6.3 Assessment of Impacts

While the sawmill site is not listed on the registers of the National Trust, Australian Heritage Council or the Narrabri LEP 1992, it is considered an item of historic interest and accordingly warrants an assessment of its heritage significance.

The following evaluates the sawmill against the NSW Heritage Office (2001) criteria.

- Criterion (a) – *an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).*
 Nothing is known of the history of this sawmill and its role would only have been significant to the immediate local community. AS&R (2009b) assesses that the site does not meet this criterion.
- Criterion (b) – *an item has a strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area).*
 AS&R (2009b) assesses that the sawmill does not meet this criterion.

- Criterion (c) – *an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).*

There is no evidence to suggest that the site was unique or in any way technically different to others that might exist elsewhere in the Pilliga or on the adjacent properties. AS&R (2009b) assesses that the site does not meet this criterion.

- Criterion (d) – *an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.*

AS&R (2009b) assesses that the sawmill does not meet this criterion.

- Criterion (e) – *an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area).*

The information provided by the site is only of value to a specific application, eg. educational purposes and illustration of the milling process. It is probable that there are numerous other abandoned sawmill sites elsewhere and that the Mine Site sawmill is just one of many variations of the sawmilling process. AS&R (2009b) assesses that the site does not meet this criterion.

- Criterion (f) – *an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).*

AS&R (2009b) assesses that the sawmill does not meet this criterion.

- Criterion (g) – *an item is important in demonstrating the principal characteristics of a class of NSW's:*

- *cultural or natural places; or*
- *cultural or natural environments (or a class of the local area's: cultural or natural places; or cultural or natural environments).*

AS&R (2009b) assesses that the sawmill does not meet this criterion.

AS&R (2009b) concludes that “*the Sawmill is assessed to be of no local historical interest, and of only low educational value, insufficient to warrant its classification as a structure of Heritage Significance*”.

4B.7 NOISE AND VIBRATION

The noise and vibration assessment was undertaken by Spectrum Acoustics Pty Ltd. The full assessment (hereafter as Spectrum Acoustics, 2009) is presented as Volume 2, Part 6 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections. In addition, information on the pre-mining noise environment presented in the previous noise assessment undertaken for Stage 1 of the Narrabri Coal Mine remains applicable in 2009 has been used during this assessment. That report is referred to hereafter as Spectrum Acoustics (2007).



4B.7.1 Introduction

Based on the risk analysis undertaken for the Project (see Section 3.3 and **Table 3.5**), the potential environmental noise impacts requiring assessment and their unmitigated risk rating are as follows.

- Increased noise levels associated with Mine Site activities causing annoyance, distractions, ie. amenity impacts (moderate risk).
- Increased noise and/or vibration levels associated with road and rail traffic causing annoyance, distractions, ie. amenity impacts (moderate risk).
- Maximum noise levels causing sleep disturbance (moderate risk).
- Increased noise levels associated with the project leading to reduced production, ie. impacts on livestock (low risk).
- Blasting-related ground vibration resulting in structural damage to buildings and structures (moderate risk).
- Nuisance/amenity impacts on surrounding landowners / residents resultant from blasting related ground vibration and air overpressure soundwave (low risk).

In addition, the Director-General's Requirements issued by DoP require that the assessment of noise and noise impacts refer to the *NSW Industrial Noise Policy*, *Environmental Criteria for Road Traffic Noise* (EPA, 1999) and *Environmental Noise Control Manual* (EPA, 1994)).

Relevant information on the pre-mining noise environment, environmental noise criteria, proposed operational safeguards and mitigation measures for the Longwall Project and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures is presented in the following sub-sections.

4B.7.2 Pre-mining Noise Environment

As identified in Section 4A.3.2 and **Figure 4A.4**, approximately 14 non-project related residences are located within a 5km radius of the Pit Top Area at which noise may be audible under certain meteorological circumstances during the construction and operation of the Stage 2 components of the Narrabri Coal Mine.

Given the rural locality in which the Narrabri Coal Mine is located, none of the identified residences are currently subjected to significant noise-related impacts, for a high proportion of time, ie. noise levels from transportation or industrial sources. It is therefore assumed that background noise levels (L_{A90}) are currently at or below 30dB(A) at all residences during day, evening and night periods.

Under the *NSW Industrial Noise Policy*, it is a standard requirement that noise levels below 30dB(A) can be taken as 30dB(A) for the purposes of assessing industrial noise, such as noise that would be produced by the Longwall Project. As such, a 30dB(A) L_{90} background level has been adopted for all residences during the day, evening and night.



4B.7.3 Environmental Noise and Vibration Criteria

4B.7.3.1 Introduction

The assessment of impacts of the project on the local noise climate has been undertaken by calculating likely noise levels during both the site establishment and operational stages of the Longwall Project and comparing those noise levels against the noise criteria established through reference to:

- the *Industrial Noise Policy* (INP) - for site operational noise (EPA, 2000);
- NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999); and
- *Assessing Vibration: A Technical Guideline* (AVTG) published by the DECC

Criteria relevant to assessing the likelihood of sleep disturbance are drawn from current DECCW (EP&RG) considerations which, as yet, are not fully documented.

For the purposes of defining relevant criteria, the DECCW nominate the following times relevant to daytime, evening, night-time periods, ie. for Monday to Saturday.

- Daytime – 7.00am to 6.00pm
- Evening – 6.00pm to 10.00pm
- Night-time – 10.00pm to 7.00am

For Sundays and public holidays, night-time extends from 10.00pm to 8.00am.

4B.7.3.2 Site Establishment Noise Criteria

The Longwall Project is a continuation and expansion of the approved and commenced Narrabri Coal Mine operation. Accordingly, both DECCW and DoP consider the activities to be part of the ongoing mine operation and the existing operational noise criteria, as discussed in Section 4B.7.3.3, are applicable.

4B.7.3.3 Operational Noise Criteria

The INP specifies two noise criteria:

- an *intrusiveness criterion* which limits L_{Aeq} noise levels from the industrial source to a value of ‘background plus 5dB(A)’; and
- an *amenity criterion* which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Since there is no existing major industry dominating noise levels at any residences near the Mine Site, and road traffic noise is not continuous, only the intrusiveness criteria were considered in setting the existing project-specific operational noise limit.



In addition, as the Mine Site is situated in a rural environment with limited other noise sources, the INP default background noise level of 30dB(A) has been assumed for day, evening and night-time at all non-project related residences.

As a result, the relevant $L_{eq(15\text{-minute})}$ operational noise assessment criteria for the Project for all periods of the day is 35dB(A). It is noted that this is the lowest intrusiveness criterion that can be established under the INP.

4B.7.3.4 Sleep Disturbance Criteria

The DECCW recommends a $L_{1(1\text{-minute})}$ sleep disturbance criterion at building facade of background plus 15dB(A). As a result, the $L_{1(1\text{-minute})}$ sleep disturbance criterion that would apply to the Longwall Project would be 45dB(A).

4B.7.3.5 Road Traffic Noise Criteria

Vehicle noise associated with vehicles operating within the Mine Site is considered to be operational noise. However, vehicle noise associated with Stage 2 components (and the overall Mine Site) on public roads is considered to be road traffic noise. Road traffic noise emissions are managed under the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) applies.

It is noted that the Longwall Project would result in additional traffic travelling on the Kamilaroi Highway, an arterial road. These vehicle movements would be primarily the result of employees driving to and from work and delivery of consumables and other equipment.

Spectrum Acoustics (2009) notes that the ECRTN arterial road traffic noise criteria are intended to apply to a relatively high traffic flow road. However, as the traffic associated with the Project would tend to be concentrated into short periods of time around shift changes, Spectrum Acoustics (2009) states that the collector road noise traffic criteria are more appropriate for the Project.

As a result, the following $L_{Aeq(1hr)}$ road traffic noise criteria would apply to the Project.

- Day (7:00am to 10:00pm) – 60dB(A)
- Evening (10:00pm to 7:00am) – 55dB(A)

4B.7.3.6 Rail Traffic Noise and Vibration Criteria

Product coal would be transported from the Mine Site to the Port of Newcastle by train via the North Western Branch and Main Northern Railway Lines. **Table 4B.29** presents the noise limits recommended by Chapter 163 of the ENCM.

Table 4B.29
ENCM Recommended Train Noise Levels

Descriptor	Planning Levels	Maximum Levels
$L_{eq, 24 \text{ hour}}$	55dB(A)	60dB(A)
L_{max}	80dB(A)	85dB(A)
Source: Spectrum Acoustics (2009) – Table 5		



In addition, train traffic vibration criteria were determined based on Appendix B of *Assessing Vibration: A Technical Guideline*” (AVTG) published by the DECC. That document established a maximum allowable vibration velocity of 2.82mm/s for train-induced ground vibration.

4B.7.3.7 Blasting Criteria

The DECCW commonly adopts blasting assessment criteria based on the human comfort criteria identified in the document *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990* published by the Australian and New Zealand Environment and Conservation Council (ANZECC). These criteria have been adopted for any blasting associated with the construction of the ventilation shafts and are as follows.

- The recommended maximum overpressure level for blasting is 115dB(L).
- The level of 115dB(L) may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120dB(L) at any time.
- The recommended maximum vibration velocity for blasting is 5mm/s Peak Vector Sum (PVS).
- The PVS level of 5mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10mm/s at any time.

4B.7.4 Noise and Vibration Controls

A preliminary acoustic assessment identified that under some meteorological conditions, activities undertaken as part of site establishment would likely generate noise levels above the Mine Site noise criteria. In order to minimise the potential for any such noise exceedance, the following controls would be adopted.

Operational Noise Controls

- Ensure that all equipment exhibits sound power levels consistent with the schedules in *Appendix A* of Spectrum Acoustics (2009).
- Restrict the operation of scrapers during construction operations under temperature inversion conditions, namely cool, calm conditions that would typically occur in the late evening to early morning or southwest winds, to only one of the following areas.
 - the longwall unit assembly area;
 - the ROM coal pad area; or
 - the Reject Emplacement Area.
- Apply specific noise reduction in the order of 8dB(A) to 10dB(A) to each drill site over the northern portions of LW1 to LW6 (an equivalent point-source sound power level of ≤ 109 dB(A) in the direction of the affected residence(s)).



- If specific noise reduction of 10dB(A) cannot be achieved, suspend drilling operations under inversion conditions.
- Fully enclose the rotary breaker with a building (or similar) clad with tilt-up aerated concrete panels, or similar. This form of enclosure would substantially mitigate the low frequency noise from the rotary breaker.
- Enclose the CPP with fully clad steel sheeting with an acoustic profile and line 50% of the internal surface with acoustic insulation.
- Refrain from using the bulldozer on the Reject Emplacement Area under temperature inversion conditions.
- Refrain from construction activities within the Brine Storage Area under temperature inversion conditions.
- Update the existing Noise Management Plan (NMP) prior to the commencement of longwall mining activities. The NMP would incorporate the specific details of all noise controls and the measures to address noise criteria exceedances and/or complaints.
- Undertake noise monitoring at the residences most likely to be affected by noise generated by the initial operations of the Longwall Project, including monthly monitoring at “Greylands”, “Kurrajong” (if accessible), “Bow Hills” and “Naroo” during the first winter of construction operations.

Transport Noise Controls and Operational Procedures

- Ensure strict adherence to hours of operation, including road transport activities which would only occur between 7:00am to 10:00pm / 7 days. The despatch of rail wagons carrying product coal is not limited to these hours.
- All project employees and contractors would be instructed to enter and exit the Mine Site in a courteous manner and without causing undue traffic noise.

Blasting Controls

- Ensure that all blasts are designed by a suitably qualified and experienced blasting engineer or shotfirer and that each blast is designed to ensure compliance with the relevant assessment criteria or conditional requirements.

Other Noise and Vibration Controls

In addition to the design and operational features of the Longwall Project, the Proponent would apply the following noise controls.

- Ensure that equipment with lower sound power levels is used in preference to more noisy equipment.
- Maintain the on-site road network to limit body noise from empty trucks travelling on internal roads.
- Maintain an open dialogue with the surrounding community and neighbours to ensure any concerns over noise or vibration are addressed.



For the purposes of this assessment, and based on noise monitoring undertaken by Spectrum Acoustics (2009), inversion conditions are deemed to occur until 8:30am.

4B.7.5 Assessment Methodology

4B.7.5.1 Operational and Sleep Disturbance Noise Assessment

The noise impacts of the operating Longwall Project have been established by Spectrum Acoustics using the *Environmental Noise Model* to predict noise levels at the surrounding residences. The model was constructed by placing the various noise generating equipment in either the most exposed location that mobile equipment would be likely to operate in, or in the proposed location for fixed equipment such as the CPP or rotary breaker. This information was then used to determine estimated noise levels at each of the surrounding residences for three operational scenarios.

- **Scenario 1:** Establishment of additional surface facilities, roadworks, the main ventilation shaft and pre-drainage above LW1.
- **Scenario 2a:** All surface plant and train loading activities occurring. Goaf drainage pumps above LW1, pre-drainage construction and operation above LW3, goaf gas drainage construction above LW2 and ventilation operations (from the main ventilation shaft and rear of panel ventilation shaft).
- **Scenario 2b:** As for Scenario 2a with brine storage pond construction in the northern corner of the allocated area (representing worst-case operating conditions for residences to the north and northeast of the mining operations).
- **Scenario 3a:** All surface plant and train loading activities occurring. Goaf drainage pumps above LW23 and LW24, goaf gas drainage construction above LW24, pre-drainage construction above LW25 and LW26, and ventilation operations (from the main ventilation shaft and rear of panel ventilation shaft).
- **Scenario 3b:** As for Scenario 3a with brine storage pond construction in the southeastern corner of the allocated area (representing worst-case operating conditions for residences to the south and southeast of the mining operations).

The noise assessment initially assumed that all construction activities would take place simultaneously (as illustrated on **Figures 4B.34**) and that the sound power levels of all earthmoving equipment would correspond with the sound power levels presented in *Appendix A* of Spectrum Acoustics (2009). Additional noise modelling was then undertaken, incorporating additional noise control measures aimed at reducing the noise levels predicted at the various residences surrounding the Mine Site. The most effective of these controls would be implemented as described in Section 4B.7.4.



As mining operations would be undertaken 24 hours per day with the activities occurring during each period essentially the same, separate operational noise scenarios for each period were not calculated. However, based on the likelihood of intense temperature inversions and a prevailing wind from the southeast, the following meteorological conditions were modelled.

- Daytime lapse: 20°C, 70% relative humidity, no wind, 1°C/100m vertical temperature gradient.
- Temperature inversion (mild): 2-10°C, 80-95% relative humidity, 2°C/100m vertical temperature gradient
- Temperature inversion (moderate): 2-10°C, 80-95% relative humidity, 4°C/100m vertical temperature gradient
- Temperature inversion (severe): 2-10°C, 80-95% relative humidity, 6°C/100m vertical temperature gradient
- Prevailing (southeast) wind: 20°C, 70% relative humidity, 3m/s wind from the southeast.

A potential for sleep disturbance would occur during operations within the Pit Top Area due to general impact noise from the rotary breaker, CPP and coal (train) loading operations. Spectrum Acoustics (2009) modelled impact noise under the noise-enhancing atmospheric conditions discussed above using the sound power levels presented in *Appendix A* of Spectrum Acoustics (2009).

4B.7.5.2 Road and Rail Traffic Assessment

Additional rail traffic generated by the Longwall Project would be of an intermittent rather than constant nature. As a result, the methodology described in the document *Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974* published by the US Environmental Protection Agency was used to determine the road and rail traffic noise. The equations used in that assessment are presented as Equations 1 and 2 of Spectrum Acoustics (2009).

4B.7.5.3 Rail Vibration Assessment

Spectrum Acoustics (2009) notes that vibration levels from laden and unladen coal trains have been widely studied. These studies concluded that vibrations at a distance of 20m from the track are typically less than 1mm/s. As no residences in the vicinity of the Mine Site occur within 20m the North Western Branch Railway Line and the Main Northern Line, Spectrum Acoustics (2009) did not consider rail vibration further.

4B.7.5.4 Blasting Assessment

Blast overpressure and ground vibration levels have been predicted by Spectrum (2009) using the following standard equations sourced from the United States Bureau of Mines.



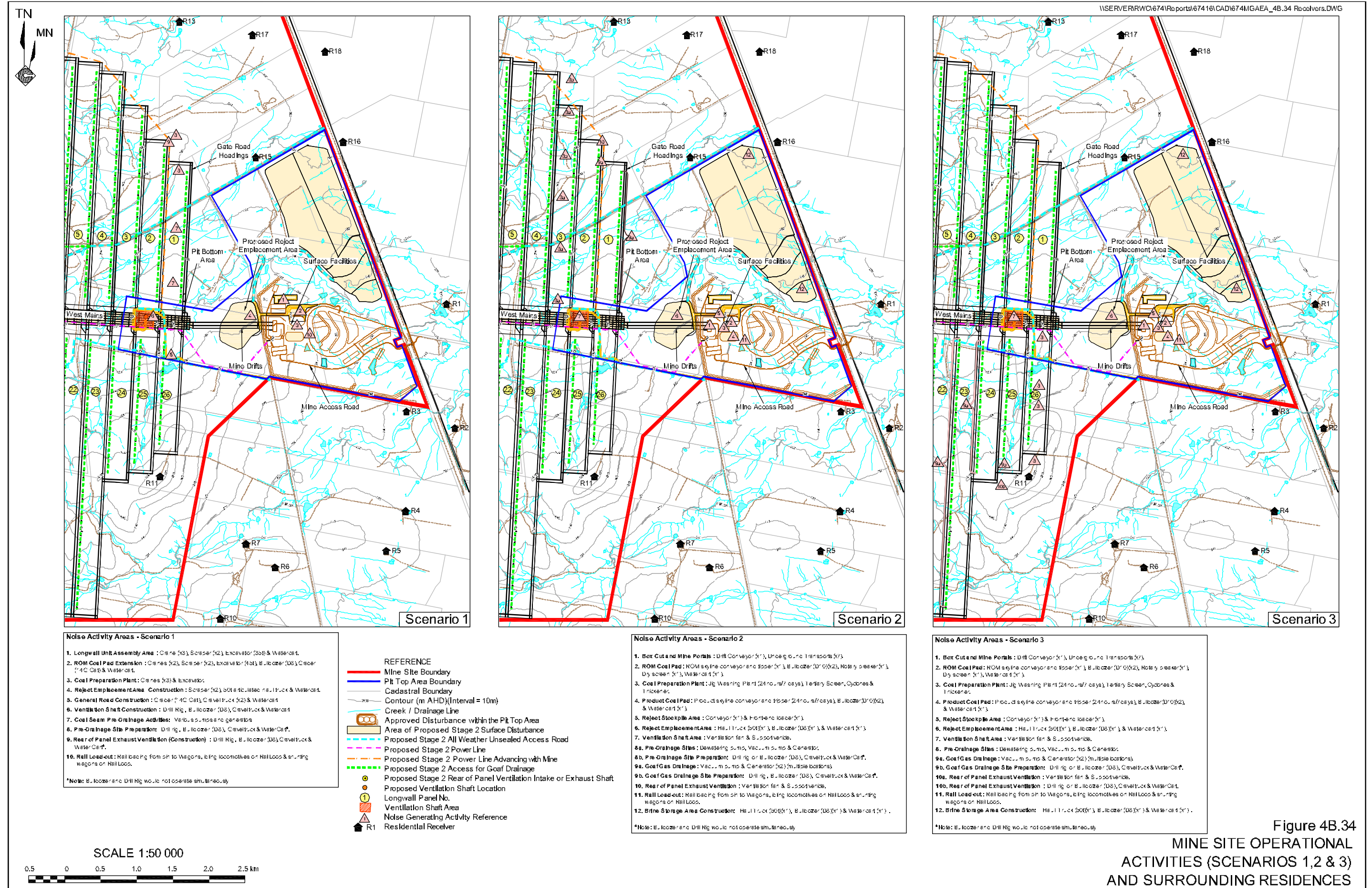


Figure 4B.34
 MINE SITE OPERATIONAL
 ACTIVITIES (SCENARIOS 1, 2 & 3)
 AND SURROUNDING RESIDENCES

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Blast Overpressure

$$OP = 165 - 24(\log_{10}(D) - 0.3 \log_{10}(Q)) \text{ [dB(L)]}$$

Where:

- D is distance from the blast to the assessment point (m); and
- Q is the weight of explosive per delay (kg).

Spectrum Acoustics (2009) reports that analysis of 12 months of blast data for a coal mine in the Hunter Valley has shown this equation to underestimate overpressure levels by up to 3dB(L) for small blasts (MIC 100-400kg) and over-estimate by 1dB(L) for larger blasts (MIC >400kg). Given the small MIC values likely to be necessary for ventilation shaft construction, a 3dB(L) correction has been applied for the Longwall Project.

Blast Vibration

$$PPV = 1140 \left(\frac{D}{Q^{0.5}} \right)^{-1.6} \text{ [mm/s]}$$

Where:

- D is distance from the blast to the assessment point (m); and
- Q is the weight of explosive per delay (kg).

4B.7.6 Assessment Results

4B.7.6.1 Operational Noise Assessment

Scenario 1

Figure 4B.35 presents noise contours generated by the noise modelling of Spectrum Acoustics (2009) for Scenario 1 under severe inversion and southeast wind conditions¹³. **Table 4B.30** presents the predicted operational noise levels at the nominated residential receivers on and surrounding the Mine Site under calm and noise enhancing conditions. The results presented in **Table 4B.30** apply a 4dB(A) reduction to the modelling results presented in Spectrum Acoustics (2009) under inversion conditions. This is based on the supplementary modelling undertaken by Spectrum Acoustics (2009) that calculated a reduction in the total number of operating scrapers from six to two reduces the predicted noise level received by 4dB(A). The results presented in **Table 4B.30** also apply the supplementary modelling results of Spectrum Acoustics (2009) related to the application of specific noise reduction measures to the drilling operations. Both noise mitigation measures are identified in Section 4B.7.4.

When considering the scale of noise exceedance, receivers are considered to be within a noise 'affectation' (or 'acquisition') zone or noise 'management' zone. The noise affectation zone refers to where there are exceedances greater than 5dB(A) that cannot reasonably or feasibly be reduced to the criterion level, or at least to no more than 5dB(A) above this level. The noise management zone refers to where the predicted noise levels are 1 to 5dB(A) above the criterion.

¹³ The contours supplied by Spectrum Acoustics (2009) and presented on **Figure 4B.35** are the unmitigated noise levels, ie. these do not incorporate the noise mitigation measures described in Section 4B.7.4 which are predicted to reduce received noise levels to the levels presented in **Table 4B.30**.



Table 4B.30
Predicted $L_{eq(15\text{-minute})}$ Operational Noise Levels (Scenario 1)

Location		Scenario					Criterion dB(A)	Maximum Differential dB(A)*
		1	2	3	4	5		
		Lapse (calm)	Inversion ($^{\circ}\text{C}/100\text{m}$)			SE wind (3m/s)		
			2	4	6			
R1	"Bow Hills"	30	35	36	38	29	35	+3
R2	"Ardmona"	25	30	31	34	20	35	-1
R3	"Naroo"	31	36	37	40	26	35	+5
R4	"Oakleigh"	25	31	32	34	20	35	-2
R5	"Pineview"	<20	26	27	29	<20	35	-6
R6	"Matilda"	<20	27	28	30	<20	35	-5
R7	"Haylin View"	20	29	30	32	<20	35	-3
R10	"Merrilong"	<20	25	27	28	<20	35	-7
R11	"Kurrajong"	30	≤35*	≤35*	≤35*	28	35	0
R13	"Newhaven"	32	35	≤35*	≤35*	≤35*	35	0
R15	"Greylands"	35	≤35*	≤35*	≤35*	39	35	+4
R16	"Belah Park"	29	32	34	≤35*	32	35	0
R17	"Bungaree"	28	31	32	35	30	35	0
R18	"Merulana"	20	27	29	31	26	35	-4
Note: Bold = Exceedance of criterion								
Note *: Compliance achieved through noise mitigation of drilling operations								
Source: Modified after Spectrum Acoustics (2009) – Table 6 (4dB(A) reduction applied based on noise mitigation related to restricted operation of scrapers under inversion conditions – see Section 4B.7.4)								

Exceedances of noise criteria at the 'southern' receivers (R1 to R11), where operating scrapers are the dominant noise source, would be maintained within the noise management zone (assuming the implementation of the nominated noise control measures).

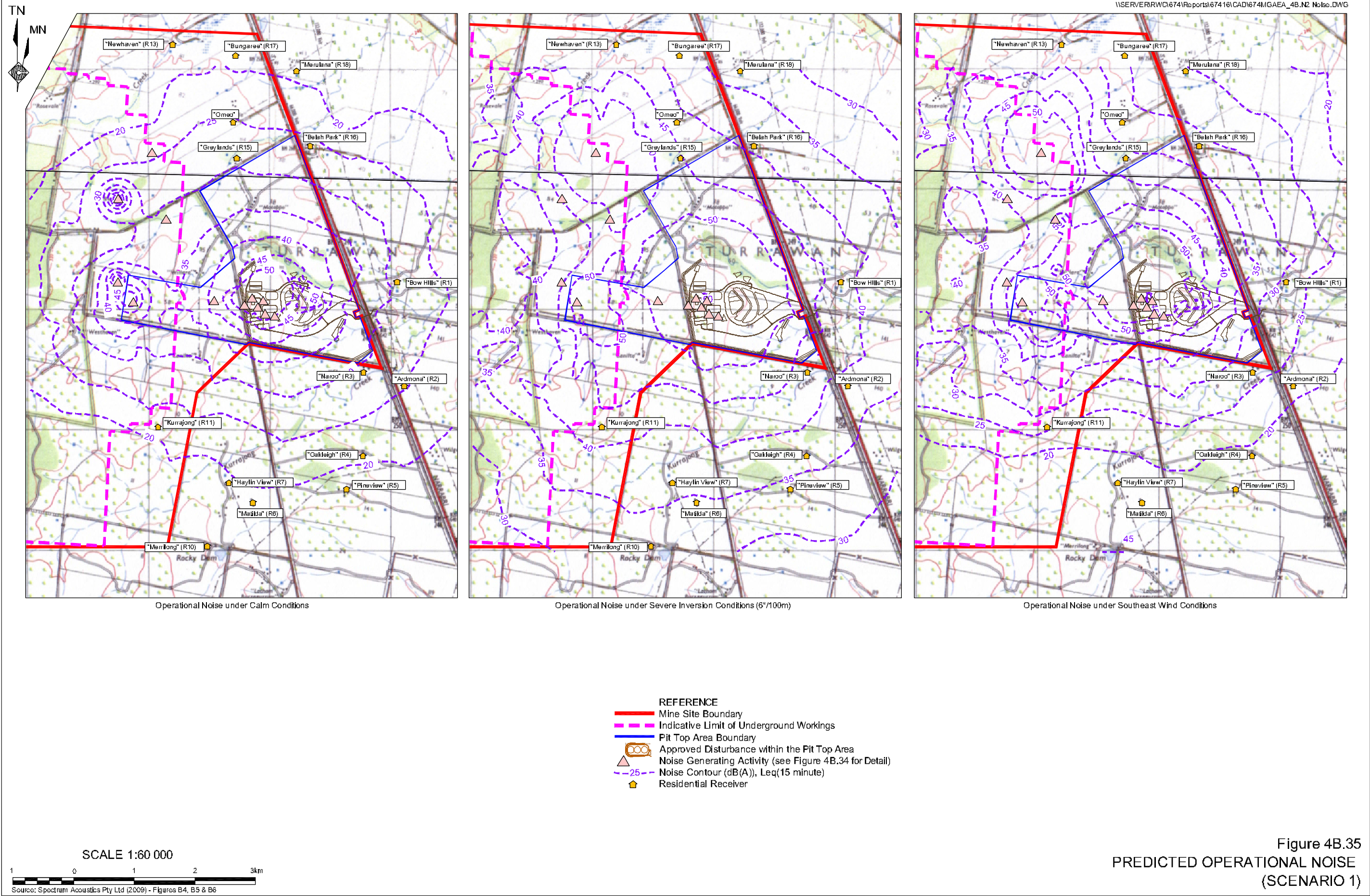
Exceedances of noise criterion at the 'northern' receivers (R13 to R18), where the dominant noise sources are drilling activities at the northern ends of LW1 to LW3, would be restricted to southeast wind conditions (in the event the specific noise reductions are not implemented at each drill site, rather drilling operations restricted under inversion conditions).

Through the implementation of the proposed noise controls documented in Section 4B.7.4, exceedance of the noise criterion could be achieved at most receivers under most conditions. When inversions occur, exceedances of up to 5dB(A) are predicted at "Naroo" and "Bow Hills". Exceedances of up to 4dB(A) are also predicted under southeast wind conditions at the "Newhaven" and Greylands" residences. It is noted that no further reasonable or feasible mitigation measures have been identified which could be implemented to reduce the predicted noise levels further.

The moderate exceedances of criteria, which fall within the noise management zone, are considered acceptable given:

- the reasonable or feasible mitigation measures have been identified and would be implemented;
- the predicted exceedances are only likely to occur under specific conditions, eg. severe inversion conditions only occur when the air temperature is $\leq 0^{\circ}\text{C}$, the relative humidity is near 100%, barometric pressure is high (stable atmosphere) and there is little or no cloud cover or air movement; and
- the predicted noise levels will ultimately decrease as surface earthworks requiring scrapers are completed and drilling activities move further to the west.





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Noise monitoring would be conducted monthly, rather than quarterly, during the first winter of longwall operations, ie. 2011 to determine the level of impact at the four potentially affected residences. Criterion exceedances would be mitigated or otherwise addressed through the development and implementation of an updated Noise Management Plan.

Scenario 2a and 2b

Figure 4B.36 presents noise contours generated by the noise modelling of Spectrum Acoustics (2009) for Scenario 2(b) under severe inversion and southeast wind conditions¹⁴. **Table 4B.31** presents the predicted noise levels of Scenario 2a at the nominated residential receivers on and surrounding the Mine Site under calm and noise enhancing conditions. The results presented in **Table 4B.31** apply the supplementary modelling results of Spectrum Acoustics (2009) (which include the noise mitigation measures presented in Section 4B.7.4).

Assuming the implementation of the proposed noise mitigation measures (see Section 4B.7.4), exceedances of the noise criterion would be restricted to a 2dB(A) exceedance at the “Bow Hills” and “Naroo” residences under severe inversion conditions, and a 3dB(A) (increasing to 5dB(A) when construction activities are undertaken in the Brine Storage Area) exceedance at the “Greylands” residence.

It is noted that no further reasonable or feasible mitigation measures have been identified which could be implemented to reduce the predicted noise levels further.

The moderate exceedances of criteria, which fall within the noise management zone, are considered acceptable given:

- i) the reasonable or feasible mitigation measures have been identified and would be implemented;
- ii) the predicted exceedances are only likely to occur under specific conditions, eg. severe inversion conditions only occur when the air temperature is $\leq 0^{\circ}\text{C}$, the relative humidity is near 100%, barometric pressure is high (stable atmosphere) and there is little or no cloud cover or air movement; and
- iii) the predicted noise levels will ultimately decrease as surface earthworks requiring scrapers are completed and drilling activities move further to the west.

As noted previously, noise monitoring would be conducted monthly during the first winter of longwall operations to determine the level of impact at the four potentially affected residences. Criterion exceedances would be mitigated or otherwise addressed through the development and implementation of an updated Noise Management Plan.

¹⁴ The contours supplied by Spectrum Acoustics (2009) and presented on **Figure 4B.36** are the unmitigated noise levels, ie. these do not incorporate the noise mitigation measures described in Section 4B.7.4 which are predicted to reduce received noise levels to the levels presented in **Table 4B.31**.

