4.1.5.2 Land Use

Land uses surrounding the Project include the following (**Figure 4.8**).

- Agriculture – principally grazing of sheep and cattle, with some areas of cropping. Agricultural activities are principally undertaken in cleared areas on undulating hills.
- Nature conservation and forestry – these land uses are principally restricted to areas of steep slopes and areas unsuitable for other land uses.
- Residential and rural residential – Majors Creek and surrounding areas include areas of rural residential and residential land use.
- Mineral exploration.

The Proponent contends that the Project would not be inconsistent with these surrounding land uses.

4.1.6 Surrounding Community

4.1.6.1 Introduction

Information presented in the following sub-sections has been obtained from census data produced by the Australian Bureau of Statistics from the 2006 Census. The Census data relate to the census statistical area of Braidwood State Suburb (**Figure 4.9**) and NSW as a whole.

4.1.6.2 Population and Population Growth

Table 4.4 presents a summary of the 2006 population statistics for the Braidwood State Suburb (referred to hereafter as 'Braidwood') and for NSW as a whole.

The Census data indicate that the proportion of persons aged 14 years and younger in Braidwood (19.0%) was similar to the proportion for NSW as a whole (19.8%). By contrast, people aged 15 to 24 years in Braidwood (7.7%) represented a smaller percentage of the population than NSW as a whole (13.3%). Similarly, the proportion of people in Braidwood between the ages of 25 and 54 years (38.5%) was less than the proportion for NSW a whole (42%). Finally, the proportion of people aged over 55 years in Braidwood (34.8%) is significantly higher than for NSW as a whole (24.8% respectively).

This data indicates that a greater proportion of people aged over the age of 55 live within Braidwood than in NSW as a whole. In addition, the lower proportion of adults aged between 25 and 54 in Braidwood compared with NSW as a whole, combined with similar proportions of those aged 14 or under suggest that, on average, families within Braidwood are larger than in NSW as a whole.

This may be the result of the lower cost of living or other factors attracting or retaining young families and retirees to Braidwood.

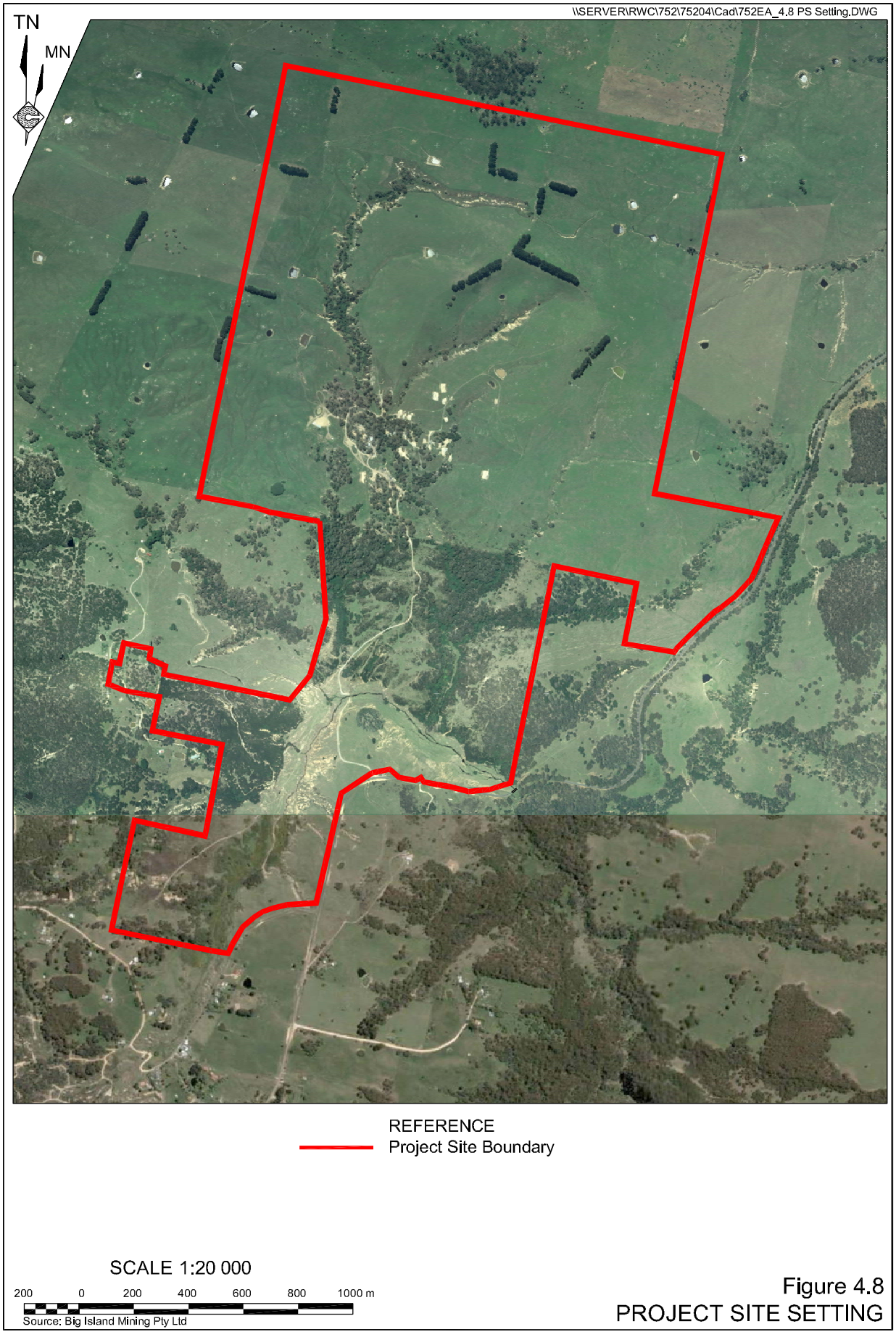

Figure 4.8
PROJECT SITE SETTING

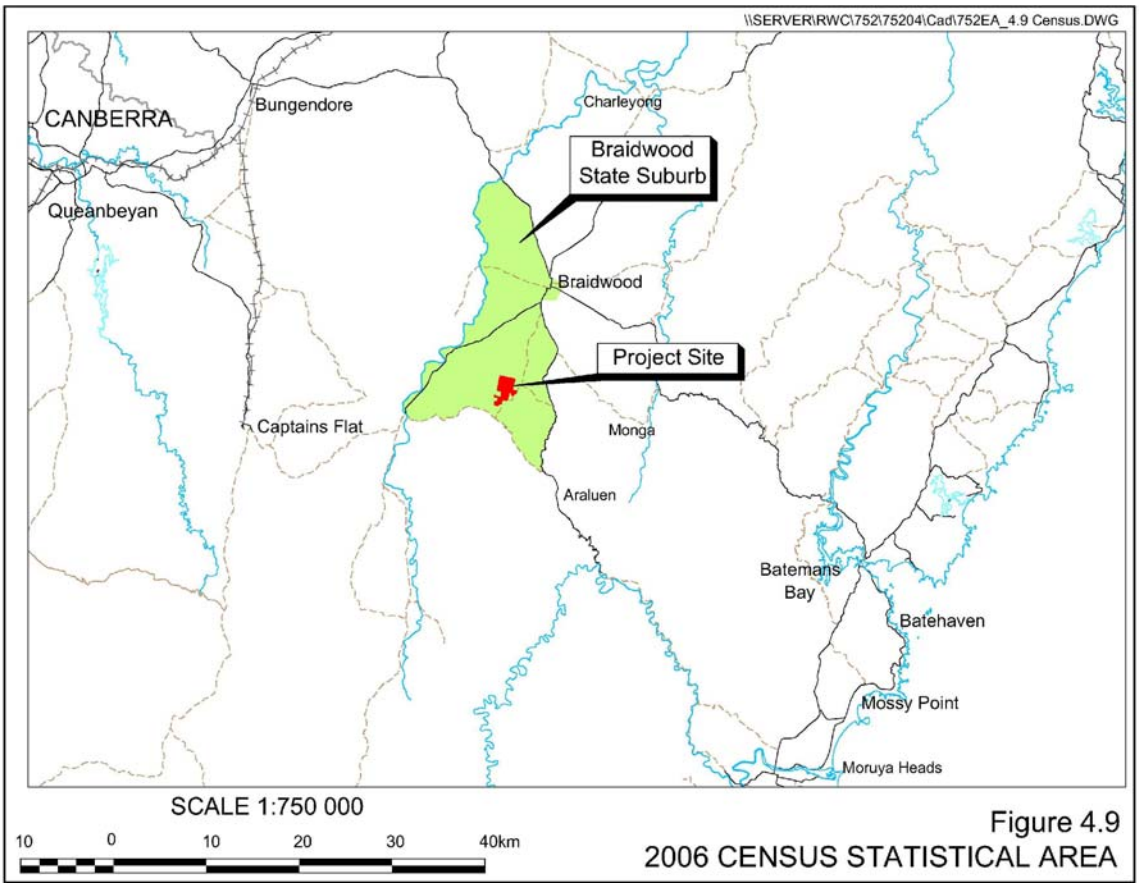

Table 4.4
2006 Census Population Statistics

		Braidwood		NSW	
	Age Groups	**Persons**	**Percentage**	**Persons**	**Percentage**
Children	0-4 years	108	7.4%	420 431	6.4%
	5-14 years	170	11.6%	878 483	13.4%
Studying or Working	15-24 years	113	7.7%	871 717	13.3%
	25-54 years	565	38.5%	2 753 219	42%
Approaching Retirement or Retired	55-64 years	224	15.3%	719 551	11%
	65 years and over	286	19.5%	90 5778	13.8%
	Total Persons	**1 466**		**6 549 178**	
Source: Australian Bureau of Statistics - 2006 Census					

Finally, in the 2001 census the Braidwood State Suburb (Census Collection Districts 1170702, 1170704 and 1170707) recorded a population of 1 302 people. When compared with the 2006 recorded population of 1 466 people, this suggests an annual net growth rate of approximately 33 people or 2.5%. This compares with an annual growth rate for NSW as a whole of 0.8%.

4.1.6.3 Employment, Occupation and Industries

Table 4.5 presents the employment statistics from the 2006 Census. This data indicates that the unemployment rate in Braidwood on the date of the census was 3.5%, considerably lower than for NSW as a whole (5.8%).

Table 4.5
2006 Census Employment Statistics

	Braidwood		NSW	
	Persons	**Percentage**	**Persons**	**Percentage**
Employed				
Full-time(a)	379	54.8%	1 879 628	59.2%
Part-time	241	34.8%	842 713	26.5%
Employed, away from work(b)	27	3.9%	187 103	5.9%
Hours worked not stated	21	3.0%	83,578	2.6%
Total	*668*	96.5%	2 993 022	94.2%
Unemployed, looking for				
Full-time work	18	2.6%	115 165	3.6%
Part-time work	6	0.9%	67 994	2.1%
Total	*24*	3.5%	183 159	5.8%
Labour Force Participation				
Total labour force		692		3 176 181
Total Persons		1 466		6 549 177
Labour force participation		47.2%		48.5%
Source: Australian Bureau of Statistics - 2006 Census				

Table 4.6 presents a summary of the 2006 Census statistics relating to industry of employment. This data indicates "Retail", "Agriculture, forestry and fishing" and "Public administration and safety" employs 11%, 10.9% and 10.0% of the workforce respectively. State-wide, these industries employed 8.9%, 3.5% and 6.6% of the workforce. For NSW as a whole, the principal industries of employment were "Manufacturing" and "Construction" employing 12.9% and 11.7% of the workforce respectively. This data reflects the importance of Braidwood as a regional services centre with an important agricultural industry and limited manufacturing and construction. No respondents within Braidwood indicated employment within the mining industry.

4.1.6.4 Income

Table 4.7 presents income statistics provided in the 2006 Census. That data indicates that median individual, family and household incomes in Braidwood were between 17% and 31% lower than NSW as a whole. This may be attributable to the fact that, typically, wages and salaries available for workers in rural areas are lower than other areas within the State.

4.1.6.5 Majors Creek Community Profile

It is acknowledged that Census statistics present a limited view of the community. In addition, the statistics presented are dominated by residents who live in areas such as Braidwood and surrounding communities that may not be directly impacted by the Project. As a result, the following presents a profile of the Majors Creek community based on anecdotal information provided to or obtained by Marcom Communication who were engaged by the Proponent to consult with the Majors Creek community.

Table 4.6
Industry Employment Statistics

	Braidwood		NSW	
	Persons	**Percentage**	**Persons**	**Percentage**
Agriculture, forestry & fishing	73	10.9%	55 532	3.5%
Mining	0	0.0%	18 322	1.2%
Manufacturing	43	6.4%	202 434	12.9%
Electricity, gas, water & waste services	8	1.2%	23 079	1.5%
Construction	49	7.3%	183 998	11.7%
Wholesale trade	12	1.8%	87 166	5.6%
Retail trade	78	11.7%	140 058	8.9%
Accommodation & food services	61	9.1%	86 433	5.5%
Transport, postal & warehousing	37	5.5%	111 898	7.1%
Information media & telecommunications	8	1.2%	40 119	2.6%
Financial & insurance services	9	1.3%	68 253	4.3%
Rental, hiring & real estate services	8	1.2%	25 360	1.6%
Professional, scientific & technical services	28	4.2%	115 503	7.4%
Administrative & support services	11	1.6%	43 167	2.7%
Public administration & safety	67	10.0%	103 620	6.6%
Education & training	60	9.0%	67 250	4.3%
Health care & social assistance	58	8.7%	67 856	4.3%
Arts & recreation services	11	1.6%	21 311	1.4%
Other services	30	4.5%	63 176	4.0%
Inadequately described/Not stated	18	2.7%	45 913	2.9%
Total	**669**		**1 570 448**	
Source: Australian Bureau of Statistics - 2006 Census				

Table 4.7
Income Statistics 2006

	Braidwood	NSW
Median individual income ($/weekly)	382	461
Median family income ($/weekly)	971	1 181
Median household income ($/weekly)	711	1 036
Source: Australian Bureau of Statistics - 2006 Census		

Majors Creek is a small village with approximately 200 residents and approximately 80 others who own land in the village but live elsewhere. The community has been described as a close knit community. Many residents have lived in the village for a significant period of time and it has been suggested that all local residents know one another. There is a strong sense of community, with residents participating in several events as a community. Annual community events include: New Year's Day Picnic – which will celebrate its 150th anniversary in 2012, Community Christmas Party and the Music at the Creek Folk Festival held in November most years. Other social events are advertised on a community noticeboard on the Majors Creek Road at the entrance of the village.

Communal facilities present in Majors Creek include:

- St Stephen's Church;
- the community hall; and

- a community recreation ground which includes basketball courts, tennis courts, a playground and an oval.

While sporting facilities are available in Majors Creek, the majority of formal sporting activities are conducted through sporting associations in Braidwood.

Several community committees and organisations exist in order to advance and develop the community, these include:

- Majors Creek Progress Association;
- Majors Creek Volunteer Bushfire Brigade;
- Majors Creek Recreation Reserve Trust;
- Majors Creek Country Women's Association; and the
- Majors Creek Community Liaison Committee.

Residents also participate in other community institutions in neighbouring areas.

The main commercial venture within the village is the Majors Creek Hotel. However, there are several other home businesses operating including:

- a bed and breakfast;
- electrical service;
- IT service; and
- animal protection service.

The village relies on Braidwood and other larger centres for shopping and access to services such as banks, child care, medical centre, libraries, schools and government services.

Despite a limited number of employment opportunities within the village, it is contended that almost all adult residents are employed, retired, stay-at-home parents or students. A number of residents of Majors Creek are professionals who commute outside the village to work. Professionals in the village range from tradespeople and farmers, to artists, educators, journalists, doctors and scientists.

4.2 NOISE AND BLASTING

4.2.1 Introduction

The Director-General's Requirements (DGRs) issued by the Department of Planning require that the *Environmental Assessment* include an assessment of "**Noise and Blasting**". The DGRs specify that the assessment include "*construction, operational and road traffic noise*".

Based on the risk assessment undertaken for the Project (see Section 3.3), specific noise and blasting related impacts that may result as a consequence of the Project (without the implementation of the safeguards, controls and mitigation measures presented in this section) include the following.

- Increased noise levels associated with Project activities causing annoyance, distractions, ie. amenity impacts.
- Sleep disturbance as a result of maximum noise levels.
- Structural damage to buildings and structures.
- Nuisance/amenity impacts on surrounding landowners / residents.
- Reduced yield / availability of water from affected groundwater bores.

The DGRs require that the noise and blasting assessment refer to the

- *NSW Industrial Noise Policy (EPA, 2000);*
- *Environmental Criteria for Road Traffic Noise (EPA, 1999);*
- *Interim Construction Noise Guideline (DECC, 2008);*
- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990); and*
- *Assessing Vibration: A Technical Guideline (DEC, 2006).*

A Noise and Blasting Assessment was undertaken by Spectrum Acoustics (Spectrum) to address the DGRs and assess the impact of the Project on the local environment. The assessment was completed by Dr Neil Pennington (PhD, B.Sc (Physics), B.Math (Hons)) of Spectrum. This section of the *Environmental Assessment* provides a summary of the assessment report which is presented in full as Part 1 (Volume 1) of the *Specialist Consultant Studies Compendium* and referred to hereafter as "Spectrum (2010b)[1]". The following sub-sections describe and assess the existing noise environment, identify the relevant noise and blasting assessment criteria and describe the noise attenuation and other controls, safeguards and mitigation measures proposed by the Proponent. Additionally, the assessment of the residual noise and blasting related impacts following the implementation of these safeguards and mitigation measures are presented.

4.2.2 Existing Environment

Background noise levels surrounding the Project Site are typical of a rural environment with minor contributions from transport noise and domestic activities. The principal sources of noise that contribute to background noise levels include:

- traffic on Majors Creek Road and the streets of Majors Creek;
- farm equipment such as tractors and cultivators;
- domestic activities such as lawn mowers and chainsaws;
- insect noise such as cicadas, especially during spring and summer months;
- livestock and other farm and native animals; and
- wind through vegetation.

[1] A report prepared by Spectrum Acoustics in March 2010 is also referred to in this report and is referenced as Spectrum (2010a).

Attended monitoring was undertaken by Spectrum at Residences 81 and 31 in March 2010 (**Figure 4.7**). This monitoring, undertaken during a drilling campaign within the Project Site, recorded an L_{Aeq} noise level of 26db(A) during the late afternoon (5:30pm – 6:00pm) and 25dB(A) during the late evening (9:30pm to 10:00pm) at Residence 81 (Spectrum, 2010a). Notably, on-site drilling operations were not audible at the time of monitoring and as such the measured noise levels provides a fair representation of background noise levels. Noise levels of 25dB(A) to 26dB(A) are typical of a quiet rural environment with some insect activity.

On the basis of the attended monitoring results obtained in March 2010 (Spectrum, 2010a) and the rural / village locality, none of the residences surrounding the Project Site and are likely to be currently subjected to significant noise-related impacts. It is therefore assumed that background noise levels (L_{A90}[2]) are currently at or below 30dB(A) at all residences during day, evening and night time periods.

Under the NSW *Industrial Noise Policy* (INP) (EPA, 2000), 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 Project. As such, a 30dB(A) L_{90} background level has been adopted for all residences surrounding the Project Site during the day, evening and night time.

4.2.3 Assessment Criteria

4.2.3.1 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 (construction) and operational stages of the Project and comparing those noise levels against the noise criteria established through reference to:

- the *Industrial Noise Policy* (INP) (EPA, 2000): for site operational noise and sleep disturbance;
- relevant sections of the *Interim Construction Noise Guideline* (DECC, 2009): for site establishment / construction noise criteria;
- *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999): for road traffic noise; and
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990 (ANZECC, 1990): for air overpressure and ground vibration generated by blasting.

4.2.3.2 Site Establishment Noise Criteria

Table 2 of the *Interim Construction Noise Guideline* (DECC, 2009) provides management levels for noise at residences and how they are to be applied. These noise management levels identify standard hours of operation (7:00am to 6:00pm) and non-standard hours of operation (6:00pm to 7:00am) and provide for differing noise criteria in each case.

[2] The noise level which is exceeded for 90% of the time at a given location.

The recommended construction noise criteria for standard and non-standard hours of operation are as follows.

- Standard hours of operation (7:00am to 6:00pm): background + 10dB(A) (40dB(A)).
- Non-standard hours of operation (6:00pm to 7:00am): background + 5dB(A) (35dB(A)).

It is noted that the DGRs refer explicitly to DECC (2009). However, advice provided by DECCW following the issuing of the DGRs indicates that construction noise criteria do not apply to mining projects. Based on this advice, all noise has been considered against the operational noise criterion (which is equivalent to the construction noise criterion for non-standard hours of operation).

4.2.3.3 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 residences surrounding the Project 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 Project 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.

4.2.3.4 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 Project would be 45dB(A). The sleep disturbance criterion only applies during the night time period.

4.2.3.5 Road Traffic Noise Criteria

Vehicle noise associated with vehicles operating within the Project Site is considered to be operational noise. However, vehicle noise associated with vehicle movements 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).

It is noted that the Project would result in additional traffic travelling on Majors Creek Road, Araluen Road and Captains Flat Road (between the Project Site and Braidwood) and Coghill and Wallace Streets (within Braidwood before joining the Kings Highway). These are all classified as local roads in accordance with the ECRTN and accordingly, the following $L_{Aeq(1hr)}$ road traffic noise criteria would apply to the Project.

- Day (7:00am to 10:00pm) – 55dB(A).
- Evening (10:00pm to 7:00am) – 50dB(A).

4.2.3.6 Blasting Criteria

The Department of Climate Change and Water (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 Project-related blasting.

- 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.

4.2.4 Assessment Methodology

4.2.4.1 Operational and Sleep Disturbance Noise Assessment

The anticipated Project-related construction, operational and sleep disturbance noise impacts have been established by Spectrum (2010b) using RTA Software's *Environmental Noise Model* to predict noise levels at residences surrounding the Project Site. The acoustical algorithms utilised by this software have been endorsed by all State environmental authorities. 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 crusher or rotary breaker. This information was then used to determine estimated noise levels at each of the surrounding residences for the following scenarios.

Scenario 1a: 24-hour Site Establishment - Excluding Bulk Earthworks

This scenario considers the noise likely to be generated by all site establishment activities, with the exception of bulk earthworks. These activities would be undertaken 24-hours per day. **Figure 4.10** illustrates the indicative locations of the following noise generating equipment that would be associated with Scenario 1a.

- Operation of a crane to erect of processing plant framework and buildings.

- Operation of front-end loaders for miscellaneous movement of material around the Project Site.
- Operation of lighting plant and silenced generators.
- Operation of limited trucks and light vehicles for the movement of materials and personnel.
- Operations of other low noise level equipment such as fork-lifts, fuel trucks, welding equipment, etc.

These activities would be undertaken during the day, evening or night period, and therefore could be undertaken during inversion conditions.

Scenario 1b: Site Establishment and Initial Mine Development - Bulk Earthworks

This scenario considers the noise likely to be generated by the establishment of surface infrastructure and initial development of the box cut.

Figure 4.10 illustrates the indicative locations of the following noise generating equipment associated with Scenario 1b.

- Construction of surface infrastructure required for the underground mine, including a box cut, portal and decline, magazines, communication tower, fuel store, ventilation rise and power and water supply.
- Construction of a processing plant and office area which would include:
  - a Run-of-Mine (ROM) pad and temporary waste rock emplacement;
  - crushing and grinding, gravity separation and floatation circuits; and
  - Proponent and mining contractor site offices, workshops, laydown areas, ablutions facilities, stores, car parking, and associated infrastructure.
- Construction of a tailings storage facility.
- Construction of a water management system, including construction of eight dams and associated water reticulation system.
- Construction of a site access road and new intersection with Majors Creek Road.
- Construction of ancillary infrastructure, including soil stockpiles, core yards, internal roads and tracks and surface water management structures.

It is noted that the activities identified as part of this scenario would be undertaken during the period 7:00am to 6:00pm only and would be concurrent with the activities identified in Scenario 1a above. As a result, the noise assessment for Scenario 1b included noise sources identified in both Scenarios 1a and 1b.

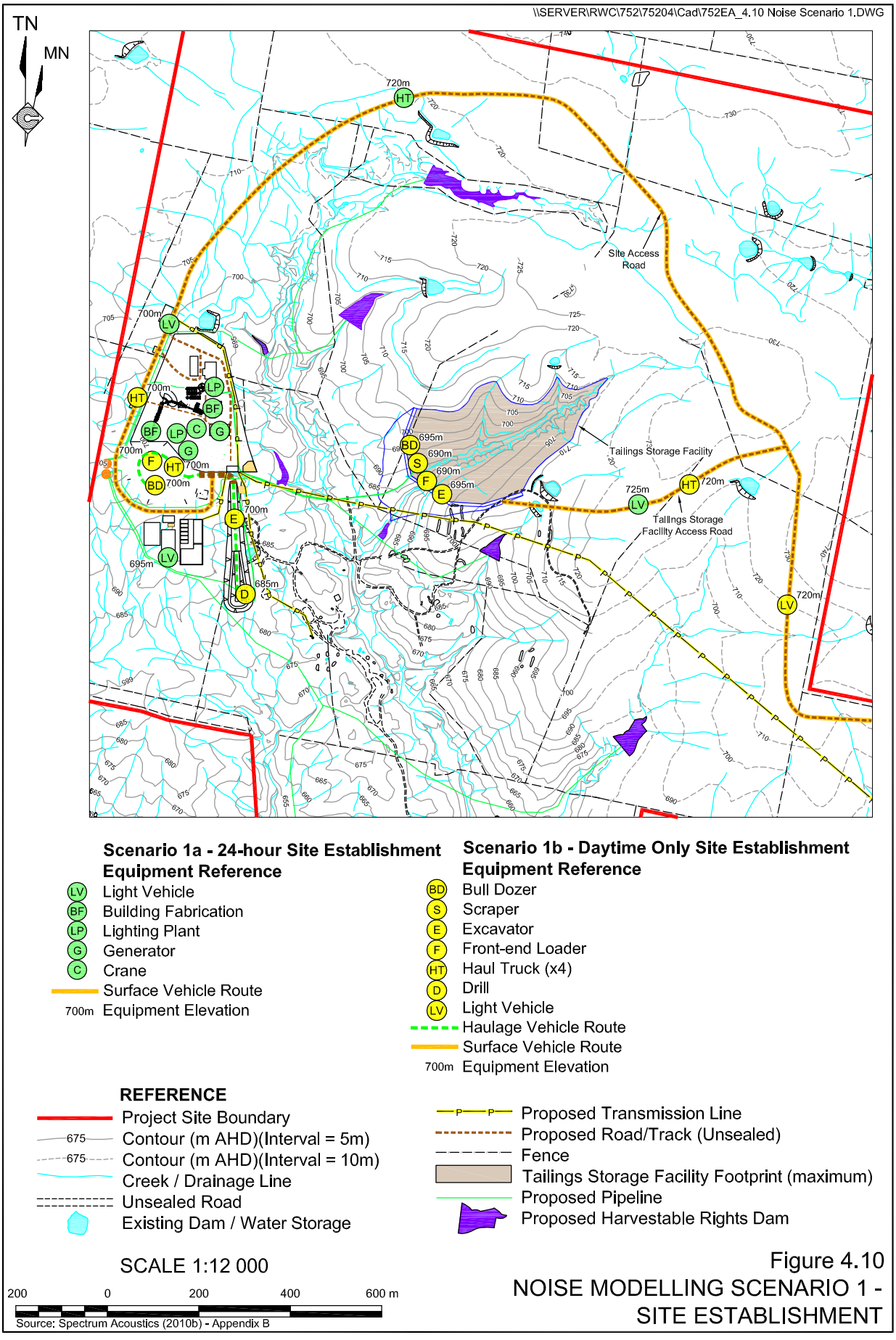

Figure 4.10
NOISE MODELLING SCENARIO 1 - SITE ESTABLISHMENT

Scenario 2: Project Operation

This scenario considers the noise likely to be generated by the mining, processing and internal transport operations associated with the operational phase of the Project. **Figure 4.11** illustrates the indicative locations of the noise generating equipment associated with Scenario 2. This scenario would involve the following activities.

- Continuous operation of a front-end loader (to manage stockpiles, blend the ore material and deliver it to the ROM bin), and campaign operations of a rock breaker, on the ROM pad and temporary waste rock emplacement.
- Movement of haul trucks between the box cut and the ROM pad / temporary waste rock emplacement.
- Processing operations including:
  - a crushing and screening circuit;
  - a primary ball mill for grinding; and
  - a gravity circuit and flotation circuit.
- Operation of equipment at the tailings storage facility including water pumps.
- Operation of heavy vehicles (road registered semi-trailer).
- Miscellaneous operations on the Project Site, including:
  - equipment maintenance within laydown areas and workshops; and
  - light vehicles movements to / from, and around the site.

The noise assessment initially assumes that all noise generating equipment would be operated simultaneously in the locations shown on **Figures 4.10** and **4.11** and that the sound power levels of all earthmoving equipment would correspond with the sound power levels presented in *Appendix A* of Spectrum (2010b). It is noted that the sound power levels identified in Appendix A of Spectrum, (2010b), and therefore incorporated into the noise assessment, take into account the proposed noise controls identified in Section 4.2.5.

Modelled Climatic Conditions

The INP requires assessment of winds when winds of less than 3m/s are recorded for more than 30% of a particular time period (day, evening or night) in a particular season (summer, autumn, winter or spring) from a particular direction. As noted in Section 4.1.3.5, and on **Figure 4.4**, the majority of all winds are at speeds in excess of 4.5m/s. However, Spectrum (2010b) note that winds from the north-northwest of less than 3m/s occur for more than 30% of the time during the night during autumn, winter and spring. As a result, north-northwest winds are a feature of the local environment.

Inversion conditions are a feature of the local environment. As a result, both winds from the north-northwest and temperature inversions have been modelled by Spectrum (2010b) for the mining operations scenario (Scenario 2)[3]. Three atmospheric conditions were modelled by Spectrum (2010b).

- *Calm (neutral) conditions:* 20^{o}C, 70% relative humidity (RH), no wind and -1^{o}C/100m vertical temperature gradient. Modelled for all scenarios.

[3] Inversion conditions have not been considered for Scenario 1b as these activities would only be undertaken between 7:00am to 6:00pm when inversion conditions are not likely to occur.

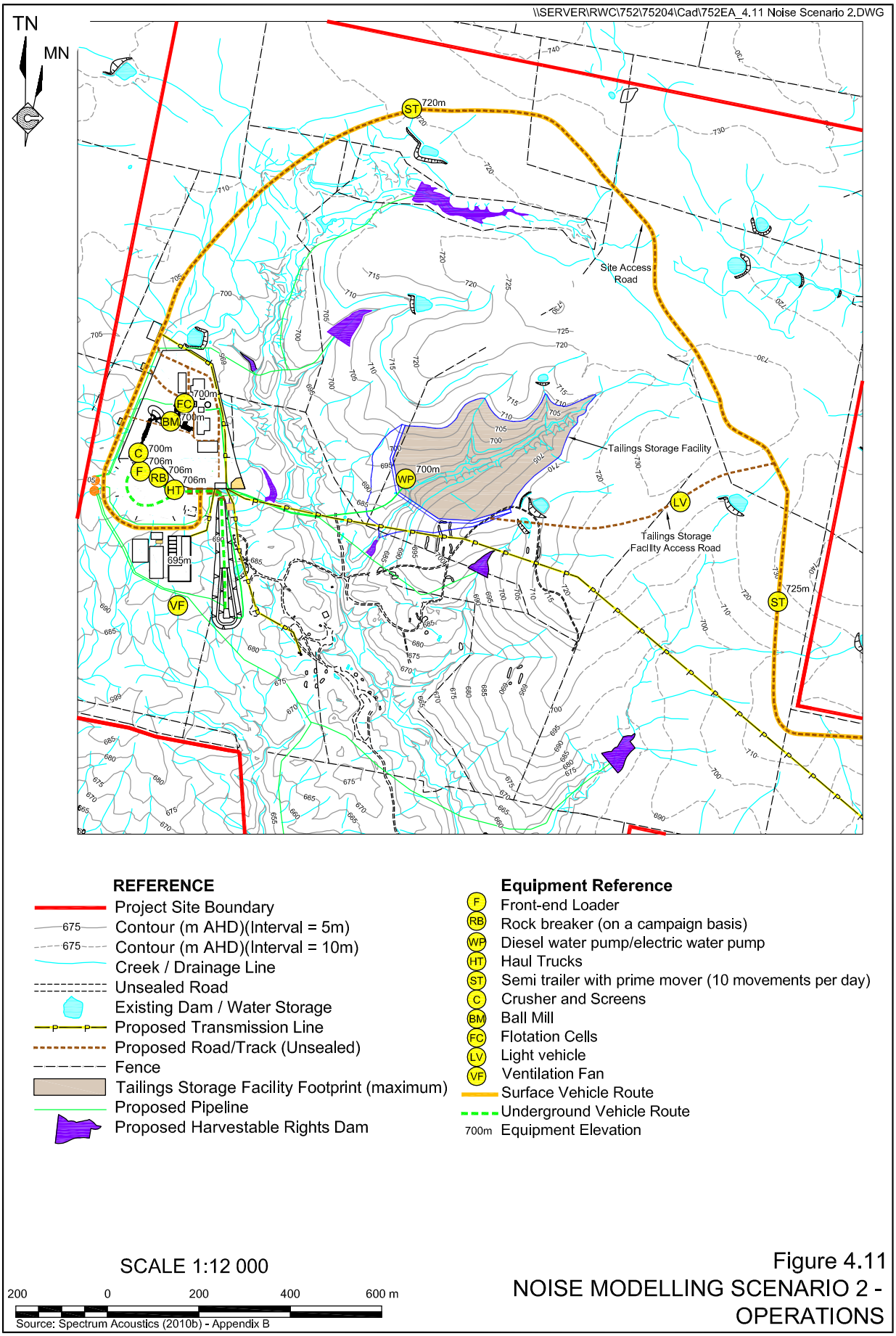

Figure 4.11
NOISE MODELLING SCENARIO 2 - OPERATIONS

- *Inversion conditions:* 5°C, 85% RH, inversion strengths of +4°C/100m. Modelled for Scenarios 1a and 2 only.
- *North-northwest winds:* 5°C, 80% RH, wind speed 3m/s from the north-northwest.

As the Proponent intends to operate the Project 24-hours per day, the potential for the Project to disturb sleep exists. As a result, Spectrum (2010b) modelled impact noise under the noise-enhancing atmospheric conditions discussed above using the sound power levels presented in *Appendix A* of Spectrum (2010b).

4.2.4.2 Road Traffic Assessment

Traffic generated by the Project on public roads 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 traffic noise. The equation used in that assessment assumes a triangular noise signal and as presented as Equation 1 of Spectrum (2010b).

4.2.4.3 Blasting Assessment

Blast overpressure and ground vibration levels have been predicted by Spectrum (2010b) using the following standard equations sourced from the United States Bureau of Mines.

Blast Overpressure

$OP = 165 - 24(\log_{10}(D) - 0.3 \log_{10}(Q))$ [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 (2010b) reports that analysis of 12 months of blast data for a coal mine in the Hunter Valley has shown this equation underestimates overpressure levels by up to 3dB(L) for small blasts (Maximum Instantaneous Change (MIC) 100kg to 400kg) and over-estimate by 1dB(L) for larger blasts (MIC >400kg). Given the small MIC values likely to be necessary for the Project, a plus 3dB(L) correction has been applied for the Longwall Project.

Blast Vibration

$$PPV = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6} \quad \text{, mm/s} \quad \text{(for hard rock)}$$

Where:

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