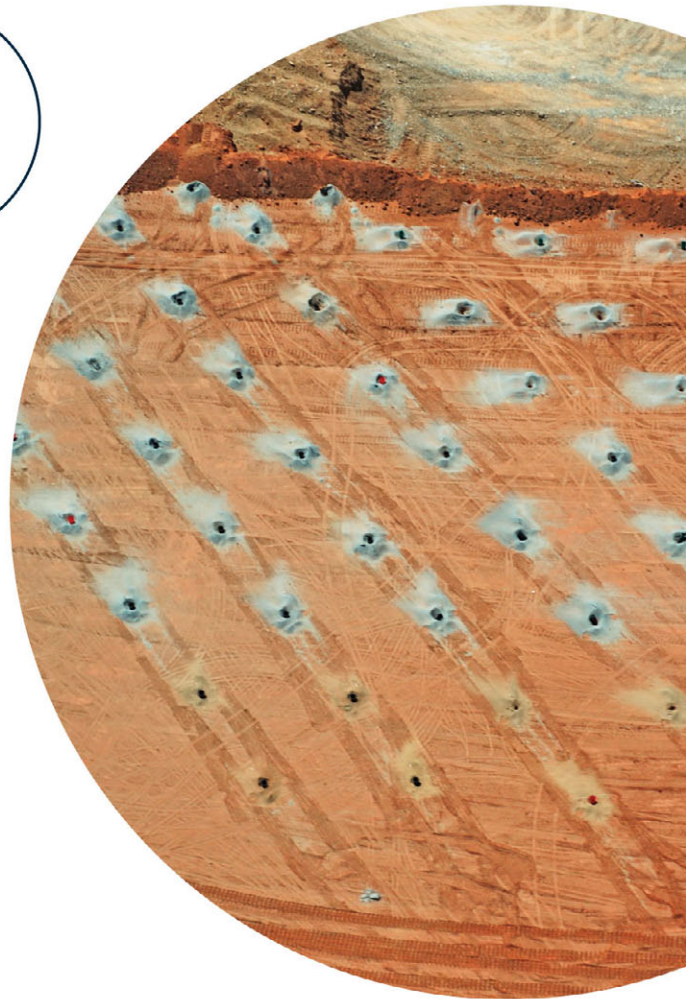
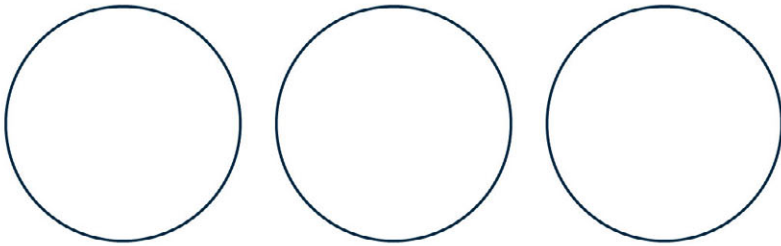


# 15

## BLASTING



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# 15 BLASTING

*This section summarises the potential impacts due to blasting associated with the Ensham Central Project. The detailed Blasting Assessment is presented in Appendix H.*

## 15.1 INTRODUCTION

A detailed assessment of blast impacts has been undertaken by Terrock Consulting Engineers. It has been prepared to address blasting issues associated with the project, including those described in the EIS Terms of Reference and raised by stakeholders during the EIS consultation program.

Blasting is a process necessary in coal mining to fragment and displace the rock overburden to enable the uncovering of the coal resource beneath. It may also be necessary to blast the coal itself and the interburden layers between the coal seams. The energy released during blasting produces vibration through the ground, as ground vibration, and through the air as airblast (overpressure).

The criteria for blasting impacts (specified in the EPA Guideline *Noise and Vibration from Blasting - EPA, 2004*) apply to individual blasts. The project Blasting Assessment therefore relates only to blasting impacts associated with the project. It does not consider impacts associated with the existing Ensham Mine, which are already regulated by the current Environmental Authority.

## 15.2 PROJECT SETTING

Ensham Mine and the project are located in a rural setting. The only sensitive locations are a number of isolated rural residences, the closest of which is located approximately 3 km from the closest Ensham Central Project open cut mining activity (Table 15-1 and Figure 15-1). There are no other sensitive locations in the vicinity of the project.

**Table 15-1  
Distance to Nearest Residences**

<b>Residence No.</b>	<b>Distance to Closest Project Blasting Area (m)</b>
94	3,800 – 3,100
88	6,200 – 4,600
35	5,700 – 4,800
73A	7,700 – 6,300
73B	7,600 – 6,300
68	7,600 – 6,600
75	8,100 – 7,100
87	8,800 – 7,200
86	10,300 – 8,600
32A, B, C	8,800 – 7,400
83	11,200 – 10,400

### 15.3 REGULATORY REQUIREMENTS

The EPA Guideline *Noise and Vibration from Blasting (EPA, 2004)* lists the following criteria, which are used to set criteria in conditions of Environmental Authorities for mining operations:

Noise criteria:

- a) The airblast overpressure must not be more than 115 dB (Linear) peak for nine out of any ten consecutive blasts, and
- b) The airblast overpressure must not exceed 120 dB (Linear) peak for any blast.

Vibration criteria:

- a) The ground-borne vibration must not exceed a peak particle velocity of 5 mm/s for nine out of ten consecutive blasts, and
- b) The ground-borne vibration must not exceed a peak particle velocity of 10 mm/s for any blast.

These criteria are applicable at sensitive locations, such as residences. The criteria in the *EPA Guideline (EPA, 2004)* are designed to limit annoyance and discomfort. The ground vibration levels at which cosmetic damage to houses, such as hairline cracks in plasterboard and masonry, begin to occur, are well above these criteria. *British Standard 7385: Part 2: 1993* contains structural damage criteria set to prevent cosmetic damage to structures occurring. Table 15-2 lists these criteria.

**Table 15-2  
Transient Vibration Guide Values for Cosmetic Damage (British Standard 7385: Part 2:1993)**

Line	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above.	
2	Unreinforced or light framed structure. Residential or light commercial type buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz.	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

### 15.4 BLAST MONITORING & CURRENT BLAST IMPACTS

#### 15.4.1 Methodology

The proponent has monitored ground vibration and airblast from blasting associated with current Ensham mining operations at Residence No.'s. 35, 68 and 87 (Figure 15-2). The monitoring program was initiated in response to feedback from concerned neighbours. Monitoring was undertaken over a number of months, as detailed in Table 15-3. As explained in Section 15.5, the monitoring data is useful for the purpose of predicting impacts from the project.

A regression analysis, using data from monitored blasts, was undertaken to estimate airblast and vibration levels from current blasting at other neighbouring residences. The methodology and results of the regression analysis are detailed in the *Blasting Assessment (Appendix H)*.

### 15.4.2 Results

Table 15-3 lists the peak ground vibration (PPV) and peak airblast (PAV) levels, together with distances from the blast for each blast type. The levels listed in this table are the highest levels measured at each residence.

**Table 15-3  
Monitoring Summary**

Residence No. and Date of Blasting	Blast Type	Peak Particle Velocity (mm/s)	Distance (m)	Peak Airblast (dB)	Distance (m)
35 23/09/04-05/02/05	Pre-strip	0.86	5,200	128.6	5,280
	Overburden	0.81	5,200	113.8	3,600
	Pre-split	-	-	-	-
68 03/10/04-14/08/05	Pre-strip	1.8	11,300	110.8	11,300
	Overburden	1.99	9,000	108.3	9,000
	Pre-split	1.79	9,000	119.0	10,250
87 30/06/04-22/08/04	Pre-strip	1.2	10,800	nr	nr
	Overburden	0.95	12,200	nr	nr
	Pre-split	1.05	12,600	nr	nr

nr – not recorded

Monitoring has shown that peak vibration levels from blasting associated with current Ensham mining operations are below the criteria in the *EPA Guideline (EPA, 2004)* at the three residences monitored. However, from the regression analysis it may be reasonably concluded that the ground vibration levels at Residence Nos. 32A, 32B, 32C and 94 may have exceeded 5 mm/s for some blasts.

Monitoring results show measured exceedences of the 120 dB airblast criterion at Residence No.'s. 35 and 68. The regression analysis indicates that there are likely to have been similar exceedences at other neighbouring residences as a result of blasting from current operations.

The proponent initiated an investigation in response to these elevated ground vibration and airblast levels. This investigation is detailed in *Appendix H*. It concluded that a phenomenon known as "wavefront reinforcement" is causing elevated ground vibration and airblast levels. The investigation identified a number of changes to the blast design to eliminate the effects of wavefront reinforcement at neighbouring residences. The investigation also indicated that airblast levels are further elevated by the lack of stemming material in pre-split holes. The proponent has implemented a program to address these issues. Monitoring has been undertaken to assess the effectiveness of these measures. This monitoring (9 November 2005 to 31 January 2006) has shown that ground vibration and airblast levels at the monitored residences (Residence No. 32, 35, 68, 87 and 94) are now below the criteria in the *EPA Guideline (EPA, 2004)*. Given that the issues of wavefront reinforcement and stemming have now been effectively managed, the EIS does not consider them further.

### 15.5 PREDICTION METHODOLOGY

Blasting from the project will be restricted to the project open cut mining areas shown on Figure 15-1. The effects of blasting associated with the project will vary from current blasting because:

- Blasting will move closer to the residences to the west of the mine (Figure 15-1);
- There may be an increase in face heights and thereby hole depths and charge mass for pre-strip blasts in pit C-D, north of the river; and
- Blasts will be designed to specifically manage the issue of wavefront reinforcement and stemming will be placed in pre-split holes when appropriate.

Project ground vibration and airblast levels were predicted based on the regression analysis of blast monitoring data from the current Ensham mining operations. The regression analysis is based on the highest data points and consequently represents worst case predictions. The regression analysis excluded data points influenced by wavefront reinforcement. The data set was adjusted, as detailed in *Appendix H*, to account for the differences between the current operations and the project with respect to blast hole depths and charge mass.

## 15.6 IMPACT ASSESSMENT

### 15.6.1 Ground Vibration and Airblast

Figure 15-1 and Figure 15-2 present the predicted ground vibration and airblast levels at neighbouring residences.

Ground vibration and airblast levels are predicted to be generally below the criteria in the *EPA Guideline (EPA, 2004)* (Section 15.3). The only exception is Residence No. 94, which is predicted to be subject to ground vibration and airblast levels in excess of the criteria. However, potential exceedances of ground vibration and airblast criteria are only predicted to occur at this residence from blasts in the north-west limit of the project open cut operations (shown as a shaded area on Figure 15-1 and Figure 15-2). Further, these potential exceedances are only predicted to occur for a limited period at the end of the mine life, assuming that there are no additional controls on the blast design.

The *Blasting Assessment (Appendix H)* has identified a number of changes to the blast design that would serve to reduce ground vibration and airblast levels at Residence No. 94 to below the criteria. These changes include:

- Using 229 mm diameter drillholes;
- Splitting the charge mass into two with an inert deck 1.0 metre to 2.0 metres long in-between; and
- Considering removing the overburden in three passes rather than two.

These changes, if necessary, would only be required in the shaded area shown in Figure 15-1 and Figure 15-2. If monitoring at Residence No. 94 shows that these changes to the blast design are necessary, they will be implemented to ensure that there are no exceedances of the criteria at this residence.

As noted in Section 15.3, the ground vibration criteria in the *EPA Guideline (EPA, 2004)* are designed to limit annoyance and discomfort. The ground vibration level at which damage to houses and other structures begins to occur is significantly higher than these criteria. Consequently, the ground vibration levels predicted for the project are well below the level that would give rise to structural damage.

### 15.6.2 Flyrock

The risk of flyrock at Ensham Mine is currently managed by:

- a blast design appropriate for the hole diameter and charge mass;
- accurate implementation of the blast design by the shotfiring crew;

- establishment of an appropriate exclusion zone incorporating a proven safety margin;
- use of sentries to enforce exclusion zone; and
- clearance of the exclusion zone prior to firing.

These controls are incorporated into the current Standard Operating Procedure at Ensham Mine. The controls contained in this procedure will be adopted for the project to ensure that any risks associated with flyrock are managed.

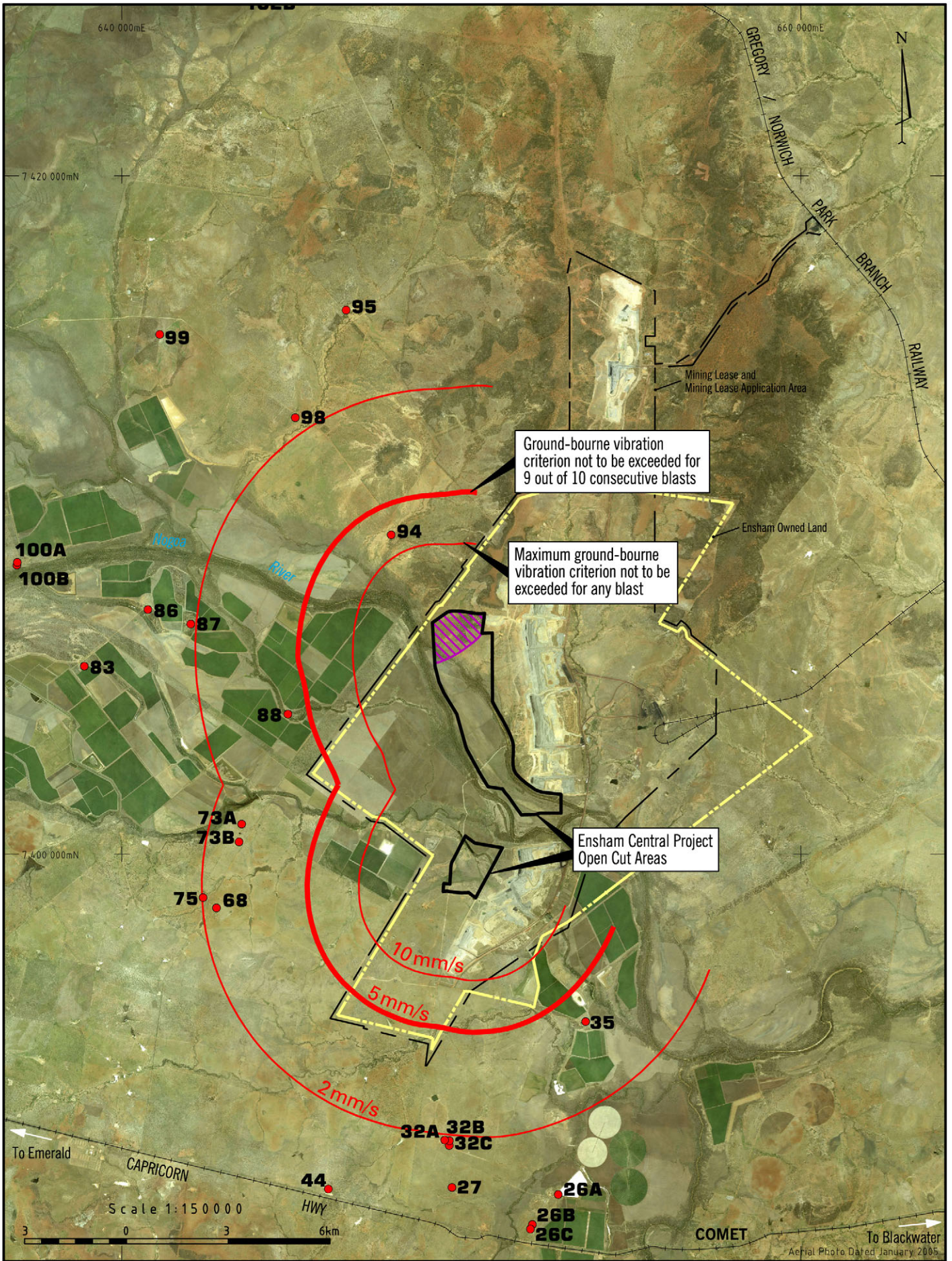
## **15.7 BLAST IMPACT MANAGEMENT**

The following blast management measures will be implemented for the project:

- Blast impacts will be monitored through ongoing consultation with neighbouring residents and through the existing complaints handling protocol.
- Blast monitoring will be conducted in response to any complaints from neighbouring residents and/or at the request of the EPA. Blast design and procedures will be revised to reduce blast impacts, in the event that monitoring indicates that the criteria outlined in the *EPA Guideline (EPA, 2004)* are being exceeded.
- Monitoring will be undertaken at Residence No. 94 for any blasting within the north-west limit of the project open cut operations. This area is shown in Figure 15-1 and Figure 15-2. Section 15.6.1 provides additional detail on this issue.

The flyrock management measures described in Section 15.6.2 will be implemented for the project.

# FIGURES



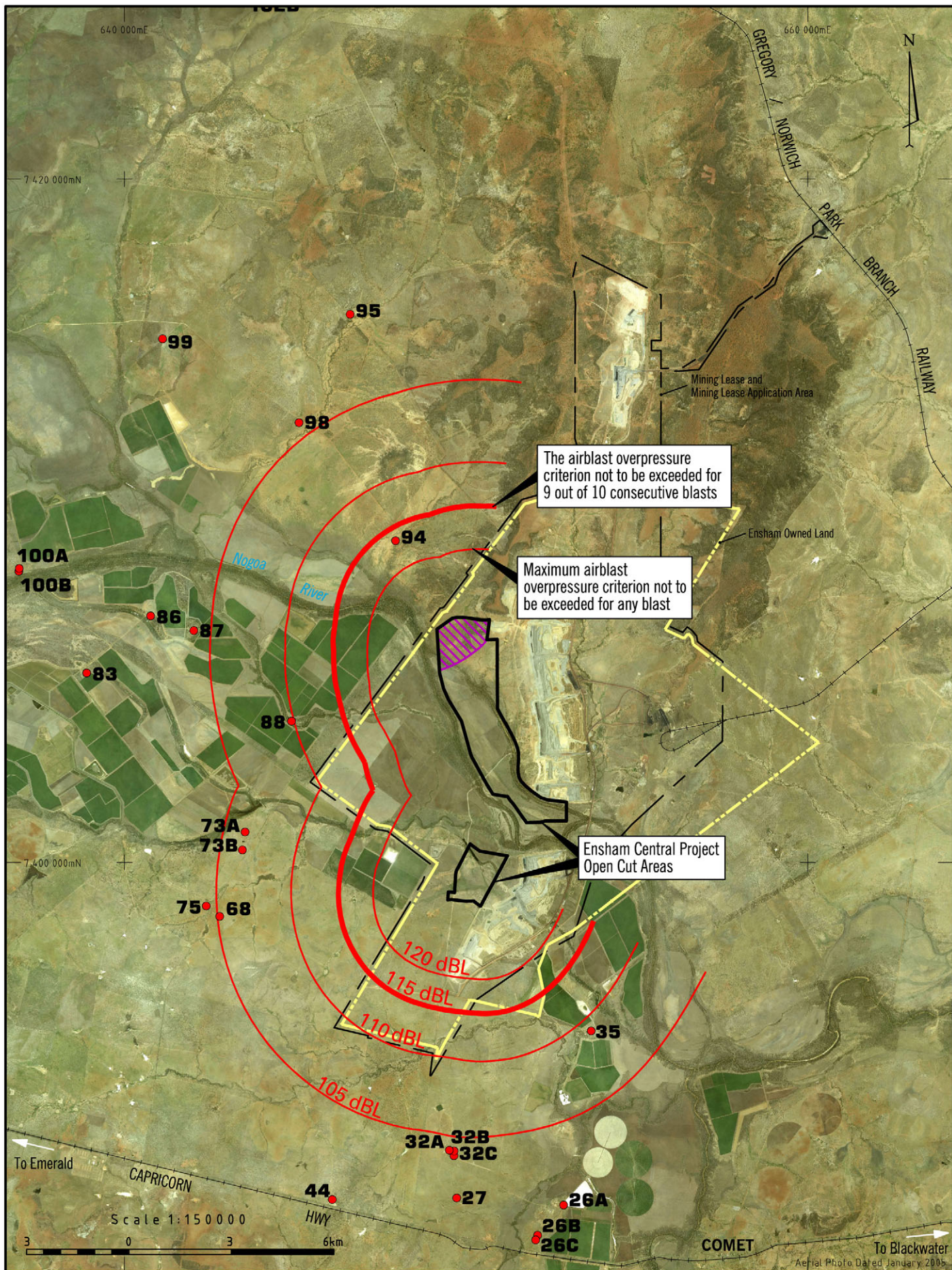
- Neighbouring Private Residence
- Ensham Owned Land
- Mining Lease and Mining Lease Application Area
- Ground Vibration
- EPA Criterion
- ▨ Area of potential blast mitigation

ENSHAM CENTRAL PROJECT

### Ground Vibration Predictions



**FIGURE 15-1**



- Neighbouring Private Residence
- Ensham Owned Land
- - - Mining Lease and Mining Lease Application Area
- Airblast
- EPA Criterion
- ▨ Area of potential blast mitigation

ENSHAM CENTRAL PROJECT

## Airblast Predictions