

13

AIR QUALITY

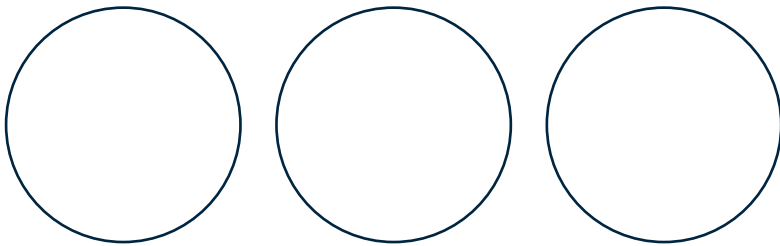


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13 AIR QUALITY

This section summarises the results of the Air Quality Assessment undertaken for the Ensham Central Project. The detailed Air Quality Assessment is presented in Appendix F.

13.1 INTRODUCTION

A detailed *Air Quality Assessment (Appendix F)* has been undertaken by Katestone Environmental. It has been prepared to address air quality issues associated with the project, including those described in the EIS Terms of Reference and raised by stakeholders during the EIS consultation program. The assessment has been prepared in accordance with the requirements of the Environmental Protection Agency (EPA) and the Australian Greenhouse Office (AGO).

Construction and operation of the project will take place concurrently with, and adjacent to, approved Ensham mining operations. Consequently the cumulative air quality impacts of both the project and the approved Ensham mining operations have been assessed. This approach was adopted because air quality impacts of the project cannot be meaningfully assessed in isolation, given their close proximity to approved Ensham mining operations.

The air quality assessment considers dust emissions (particulate matter) from the project, potential odour issues from the underground ventilation shaft and greenhouse issues.

13.2 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 (Figure 13-1). There are no other sensitive locations in the vicinity of the project.

13.3 REGULATORY REQUIREMENTS

From an environmental perspective, particulate matter can be categorised by size and/or by chemical composition. The potential for harmful effects depends on both. The human respiratory system has a built-in defence mechanism that prevents particles larger than approximately 10 μm (ten one-thousandths of one millimetre) from reaching the more sensitive parts of the respiratory system. For this reason health impacts are determined primarily by the concentration of particles with aerodynamic diameters of less than 10 μm . These are referred to as PM₁₀. Other larger particles can be suspended in the air and can give rise to nuisance effects through soiling of clothes, building surfaces and other surfaces.

The total mass of particles suspended in the air is referred to as Total Suspended Particulate matter (TSP). This includes both particles in the PM₁₀ size range and larger particles up to approximately 30–50 μm in aerodynamic diameter. Particles larger than 30–50 μm settle out of the atmosphere quickly and are generally not considered to be air pollutants. However, these large particles still have the capacity to give rise to nuisance effects and the potential for this is measured by the dust deposition rate.

Epidemiological studies and community-based surveys have been used to define acceptable levels of dust concentration and dust deposition rates. These levels are reflected in the relevant

legislation and EPA guidelines. The goals and guidelines relevant to the project are reproduced in Table 13-1 and are discussed further in the *Air Quality Assessment (Appendix F)*. These goals and guidelines are applicable to dust levels at sensitive locations, such as residences. The table also contains the goals applicable to the measurement of odour.

**Table 13-1
Ambient Air Quality Goals Applicable to the Project**

Parameter	Averaging Period	Source	Value	Units
Total suspended particulates (TSP)	Annual	EPP Air goal	90	$\mu\text{g}/\text{m}^3$
PM ₁₀	24-hour	EPP Air goal	150	$\mu\text{g}/\text{m}^3$
	Annual	EPP Air goal	50	$\mu\text{g}/\text{m}^3$
Dust deposition rate	Annual	Advice from the Queensland EPA	120	$\text{mg}/\text{m}^2/\text{day}$
Odour	1-hour	EPA Odour Guideline	0.5-2.5	ou

13.4 METEOROLOGY

The wind flows at a mine site are extremely important as dust emissions generally follow the wind flow. The *Air Quality Assessment (Appendix F)* provides a detailed description of the site meteorology and the data used in developing the description.

Locations that are downwind of the mine site will experience higher dust concentrations than sites upwind. Wind speed is also important for the magnitude of dust emissions from a mine site. Exposed dust sources, such as stockpiles or exposed land, will have higher dust emissions during strong winds than during light winds. During strong winds dust particles are more likely to be lifted by the wind and carried further off site than during light winds.

Moderate winds from the north-east to easterly sector are dominant during summer and spring in the vicinity of the Ensham Mine. In autumn and winter winds tend to be moderate and occur most frequently from the east to the south. Lighter winds are more likely to occur in the early morning compared with the rest of the day. The winds in the early morning are dominated by north-east to easterly winds with a significant southerly component. The later morning winds are dominated by easterly to southerly winds. The early afternoon winds are dominated by easterlies while in the evening the majority of winds are recorded from the north-east to easterly sector.

The majority of winds are light to moderate between 2 to 5 m/s.

13.5 EXISTING AIR QUALITY

Existing dust levels in the vicinity of the Ensham Mine have been quantified based on dust deposition monitoring undertaken in the vicinity of the mine from 1998 to 2003, and PM₁₀ monitoring undertaken as part of the EIS process from January to March 2005. Figure 13-1 shows the location of dust monitoring stations. The results of PM₁₀, dust deposition rate and meteorological monitoring indicate the following:

- Ambient concentrations of PM₁₀ are low. They are below ambient air quality goals at the nearest residence downwind of the existing Ensham Mine and at the background monitor located upwind of the mine. On average, the dust concentration at monitoring sites was found to be 4.5 $\mu\text{g}/\text{m}^3$ higher downwind of the Ensham Mine.

- Long-term monitoring data collected by the mine indicates that long-term dust deposition rates due to mining activities are low and are below the deposition guidelines at the nearest residences downwind of the Ensham Mine.
- The monitoring study has provided useful information for characterising background dust levels. Based on monitoring, the following background dust levels were used in this air quality assessment:
 - 24-hour average PM₁₀ concentration 27 µg/m³;
 - annual average PM₁₀ concentration 14 µg/m³;
 - annual average TSP concentration 28 µg/m³; and
 - annual average dust deposition rate 30-50 mg/m²/day.

Gaseous and odorous emissions are minimal and have not been monitored.

13.6 PREDICTION METHODOLOGY

The *Air Quality Assessment (Appendix F)* combines detailed information on mining activities, local and regional meteorology and existing air quality to estimate the potential cumulative effect of the project and future activities of the Ensham Mine on ambient dust levels. Estimated dust levels are compared with the EPA's air quality goals to ensure that adverse impacts on health and amenity will not occur.

The *Air Quality Assessment (Appendix F)* provides a detailed description of the assessment methodology.

13.6.1 Estimation of Emissions

Dust emissions associated with the project include the following:

- Dust emissions associated with open cut mining, including clearing of vegetation, extracting and transporting large quantities of overburden and coal, blasting, coal processing and stockpiles; and
- Dust emissions associated with underground mining, including dust from the transport of coal from the underground mine via conveyor, and stockpiling and transport. Dust emissions associated with this aspect of the project are likely to remain relatively constant throughout the life of the underground mine.

Three dust emission scenarios have been chosen to represent the likely impacts from mining activities. These scenarios are based on the expected activities that will occur across three future mining years with the highest potential for causing off site impacts. These are Year 4, Year 8 and Year 12.

Dust emissions have been estimated based on detailed data on the proposed mining activities and recognised dust emission factors.

Greenhouse gas emission rates have been calculated from emission factors published by the AGO (AGO, 2004) and diesel, electricity and coal extraction rates for the life of the project.

13.6.2 Dispersion Modelling

The modelling assessment has been undertaken using the United States EPA's Integrated Source Complex (ISC3Prime) model. This model is commonly used throughout Australia for air quality impact assessment studies of mining activities and was chosen as being the most suitable

dispersion model for this site. The model was used to estimate dust levels at the nearest residences to mining activities.

Odour emissions from the ventilation shaft of the underground mine have been modelled using the Australian Regulatory dispersion model, AUSPLUME. This model is used extensively throughout Australia for odour impact assessment studies.

13.7 IMPACT ASSESSMENT

13.7.1 PM₁₀ 24-Hour Average

An assessment of ground-level concentrations of PM₁₀ was undertaken based on 24-hour average predictions and testing of those predictions against measured dust levels at the Ensham Mine and other Australian mines. This assessment indicates that ground-level concentrations of PM₁₀ are unlikely to exceed the *EPP Air* goal at the nearest residences. Additional detail is provided in *Appendix F*.

13.7.2 PM₁₀ Annual Average

Predicted annual average ground-level concentrations of PM₁₀ at each of the nearby residences are shown in Table 13-2 for each of the three assessment years. Figure 13-2 shows a contour plot of predicted annual average ground-level concentrations of PM₁₀ for the mine including a background level of 14 $\mu\text{g}/\text{m}^3$. These predictions are envelopes which enclose the indicated contour levels for the entire life of the mine. Thus the 60 $\mu\text{g}/\text{m}^3$ annual average PM₁₀ envelope shows the maximum size of the area affected by concentrations of PM₁₀ 60 $\mu\text{g}/\text{m}^3$ and higher over the entire life of the mine.

No exceedances of the annual average *EPP Air* goal for PM₁₀ are predicted at neighbouring residences, even with the inclusion of a conservative background level of 14 $\mu\text{g}/\text{m}^3$.

**Table 13-2
Predicted Annual Average Ground-Level Concentrations of PM₁₀ (µg/m³) (Includes Background of 14µg/m³)**

Residence No.	Year 4	Year 8	Year 12
26A	17.1	17.2	16.9
26B	17.0	17.1	16.8
26C	17.0	17.1	16.8
27	19.2	18.8	18.1
32A	21.3	20.3	19.4
32B	21.0	20.1	19.2
32C	21.0	20.1	19.1
35	21.6	20.3	19.5
44	22.7	21.2	20.3
68	28.2	31.0	30.9
73A	29.0	32.5	34.4
73B	28.8	32.6	34.1
75	27.4	30.3	30.4
83	20.9	22.4	23.6
86	20.9	22.5	23.9
87	22.0	24.1	25.9
88	29.8	34.5	38.9
89	18.1	18.6	18.3
94	27.2	30.4	33.5
95	19.7	20.5	21.6
98	21.0	22.2	23.5
99	18.1	18.9	19.4
100A	18.6	19.5	20.2
100B	18.6	19.6	20.2
102A	15.9	16.2	16.4
102B	16.2	16.5	16.7
112	15.3	15.4	15.2
EPP Air Goal	50		

13.7.3 Total Suspended Particulate Matter

Predicted annual average ground-level concentrations of TSP at each of the nearby residences are shown in Table 13-3 for each of the three assessment years. Figure 13-3 shows predicted annual average ground-level concentrations for the entire life of the mine including a conservative background level of 28 µg/m³ and using envelope contours as described in Section 13.7.2.

No exceedances of the TSP goal are predicted at residential locations, even with the inclusion of a conservative background level of 28 µg/m³.

Table 13-3
Predicted Annual Average Ground-Level Concentrations of TSP ($\mu\text{g}/\text{m}^3$) (Includes Background of $28\mu\text{g}/\text{m}^3$)

Residence No.	Year 4	Year 8	Year 12
26A	31.6	31.7	31.4
26B	31.5	31.6	31.3
26C	31.5	31.6	31.3
27	34.1	33.5	33.0
32A	36.8	35.4	34.5
32B	36.4	35.1	34.3
32C	36.3	35.1	34.3
35	36.7	35.3	34.6
44	38.1	36.1	35.4
68	43.7	47.2	46.0
73A	44.6	49.2	49.3
73B	44.3	49.2	49.2
75	42.7	46.4	45.5
83	35.5	37.5	38.5
86	35.4	37.6	39.0
87	36.7	39.5	41.4
88	45.8	52.2	54.7
89	32.3	32.9	32.8
94	42.4	46.8	50.3
95	34.2	35.1	36.3
98	35.5	37.1	38.3
99	32.3	33.3	33.8
100A	32.9	34.1	34.7
100B	33.0	34.2	34.7
102A	30.0	30.4	30.5
102B	30.3	30.6	30.8
112	29.4	29.5	29.3
EPP Air goal	90		

13.7.4 Dust Deposition at Residences

Predicted annual average dust deposition rates at each of the nearby residences are shown in Table 13-4 for each of the three assessment years. Figure 13-4 shows predicted annual average dust deposition rates for the entire life of the mine including a conservative background level of $50 \text{ mg}/\text{m}^2/\text{day}$ and using envelope contours as described in Section 13.7.2.

No exceedances of the EPA's recommended goal are predicted outside the site boundary, even with the inclusion of a conservative background level of $50 \text{ mg}/\text{m}^2/\text{day}$.

**Table 13-4
Predicted Annual Average Dust Deposition Rate (mg/m²/day) (Includes Background of 50 mg/m²/day)**

Residence No.	Year 4	Year 8	Year 12
26A	54.3	54.4	54.0
26B	54.3	54.3	53.9
26C	54.3	54.3	53.9
27	57.8	56.8	56.1
32A	62.1	59.3	58.1
32B	61.5	59.0	57.9
32C	61.3	58.9	57.8
35	59.4	58.7	57.7
44	63.1	59.7	58.9
68	62.9	66.5	65.3
73A	63.5	68.6	68.6
73B	63.3	68.8	68.3
75	61.9	65.6	64.6
83	55.6	57.4	58.5
86	55.4	57.2	59.0
87	56.6	59.1	61.6
88	66.6	72.7	76.2
89	52.2	52.6	52.5
94	59.9	63.4	67.3
95	54.1	54.6	55.4
98	54.6	55.7	56.5
99	52.4	52.8	53.1
100A	53.2	54.1	54.8
100B	53.2	54.2	54.9
102A	51.0	51.2	51.2
102B	51.1	51.3	51.4
112	50.9	51.0	50.9
EPA Guideline	120		

13.7.5 Dust Deposition in Cotton Growing Areas

Stakeholders have raised the issue of the potential effect of dust on cotton farming. There are areas in the vicinity of the project that are used for cotton farming and will be subject to dust from the mine from time to time (Figure 13-4). The magnitude of dust deposition rates on cotton growing areas has been assessed to identify whether there are any areas that may be adversely affected by the project.

Dust deposition rates have been found to be below thresholds that may cause an adverse impact on cotton. *Appendix F* provides additional detail.

13.7.6 Odour

A detailed odour impact assessment study has been undertaken for emissions from the underground mine ventilation shaft. A conservative approach has been taken to provide a robust basis for siting the underground mine ventilation shaft. The odour assessment has found that the EPA's guideline of 2.5 odour units (ou) will not be exceeded if the ventilation shaft is sited more than 1,500 m from the nearest residences. All neighbouring residences are located further than 1,500 m from the proposed underground mining operations and consequently the project is not predicted to give rise to odour concentrations that would exceed the EPA's guideline.

13.8 GREENHOUSE

13.8.1 Introduction and Greenhouse Gas Assessment

Greenhouse gases such as carbon dioxide have been implicated in gradual global climatic changes. An assessment of greenhouse gas emissions has been undertaken in accordance with the AGO's recommendations and is detailed in the *Air Quality Assessment (Appendix F)*. Full fuel-cycle emissions have been presented. Greenhouse gas emission rates have been calculated from emission factors published by the AGO and from estimates of diesel, electricity and coal extraction rates. Greenhouse gases such as carbon dioxide have been implicated in gradual global climatic changes.

The major sources of greenhouse gas emissions that occur as a result of open cut and underground coal mining activities are:

- release of carbon dioxide and methane in coal seam gas;
- combustion of diesel in mining equipment (e.g. haul trucks) and blasting; and
- electricity consumption.

Coal mined from the Ensham Mine has relatively small amounts of coal seam gas compared with other coals in Australia. Consequently, greenhouse gas emissions from the mined coal will be relatively small. Over the life of the project, the Ensham Mine is estimated to emit 9.1 Mt of CO_{2e} equivalent (CO_{2e}) due to the consumption of electrical energy and diesel and the release of coal seam gases. Table 13-5 provides a breakdown of these emissions. About 40% of emissions are associated with the coal seam gases.

Table 13-5
Estimated Total Greenhouse Gas Emissions from the Ensham Coal Mine and Ensham Central Project (Mt CO_{2e})

Carbon dioxide equivalent emissions – Ensham Mine Open Cut				Carbon dioxide equivalent emissions – Ensham Central Project Underground				Total
Mine gas	Diesel	Electricity	Sub total	Mine gas	Diesel	Electricity	Sub total	
2.75	2.58	1.68	7.01	0.87	0.275	0.90	2.05	9.06

13.8.2 Greenhouse Minimisation Strategies

The following greenhouse gas minimisation strategies will be implemented:

- Selection of fuel efficient motors.

- Adoption of a mining method which uses large equipment and economies of scale to significantly reduce greenhouse emissions. In particular, use of draglines, where possible, to minimise truck and shovel operations.
- Extracting and transporting coal and overburden efficiently, minimising the number of trips and fuel consumption.
- Recycling of refrigerants in equipment and air conditioning.
- Segregation of waste into recycling materials and general waste.
- Minimising burning of vegetation.
- Greenhouse awareness training at induction.
- Development and maintenance of an inventory of emissions and sinks.
- Energy conservation and greenhouse audits in accordance with the requirements of the National Greenhouse Challenge Plus annual progress reports.
- Compilation of an annual National Pollutant Inventory (NPI) report.

13.8.3 Relevant Protocols and Agreements

The proponent is currently preparing an application to become a signatory to the AGO Greenhouse Challenge Plus. As a signatory, the proponent will be required to produce an annual progress report to be submitted to the AGO. It is anticipated that the proponent will be a signatory by 1 July 2006.

The annual progress report will contain sufficient information for the AGO to understand the proponent's ability to minimise greenhouse gas emissions. As a member, the proponent will provide:

- details of its emissions inventory;
- a measurement of emissions intensity based on key performance indicators;
- any changes to the proponent's organisational structure; and
- a public statement which will be published on the AGO website.

13.9 MITIGATION MEASURES

The dust control measures outlined in Table 13-6 will be incorporated into Ensham mining operations.

**Table 13-6
Dust Mitigation Measures**

Source	Control Procedures
Areas Disturbed by Mining	Disturb only the minimum area necessary for mining. Reshape, topsoil and rehabilitate completed overburden emplacement areas as soon as practicable.
Haul Road Dust	All roads and trafficked areas will be maintained and watered using water carts to minimise the generation of dust. All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas. Obsolete roads will be ripped and revegetated.

Source	Control Procedures
Minor Roads	Development of minor roads will be limited and the locations of these will be clearly defined. Minor roads which are used regularly will be watered. Obsolete roads will be ripped and revegetated.
Topsoil Stripping	Access tracks used by topsoil stripping machinery will be watered.
Topsoil Stockpiling	Long term topsoil stockpiles, not used for over six months, will be reshaped to promote pasture growth.
Drilling	Drills will be equipped with dust control technology, as appropriate.
Blasting	Weather conditions will be considered, where necessary, to manage dust emissions associated with blasting.
Raw Coal Bins	Automatic sprays, or other dust control mechanisms, will be used when tipping raw coal that generates excessive dust quantities.
Washplant	Spillage of material will be cleaned up as soon as practical to prevent dust.

As detailed in Section 21 – Environmental Management Plan, Ensham Mine has an existing community complaints handling protocol to respond to any complaints in relation to dust and conduct investigations, where necessary.

13.10 DUST MONITORING

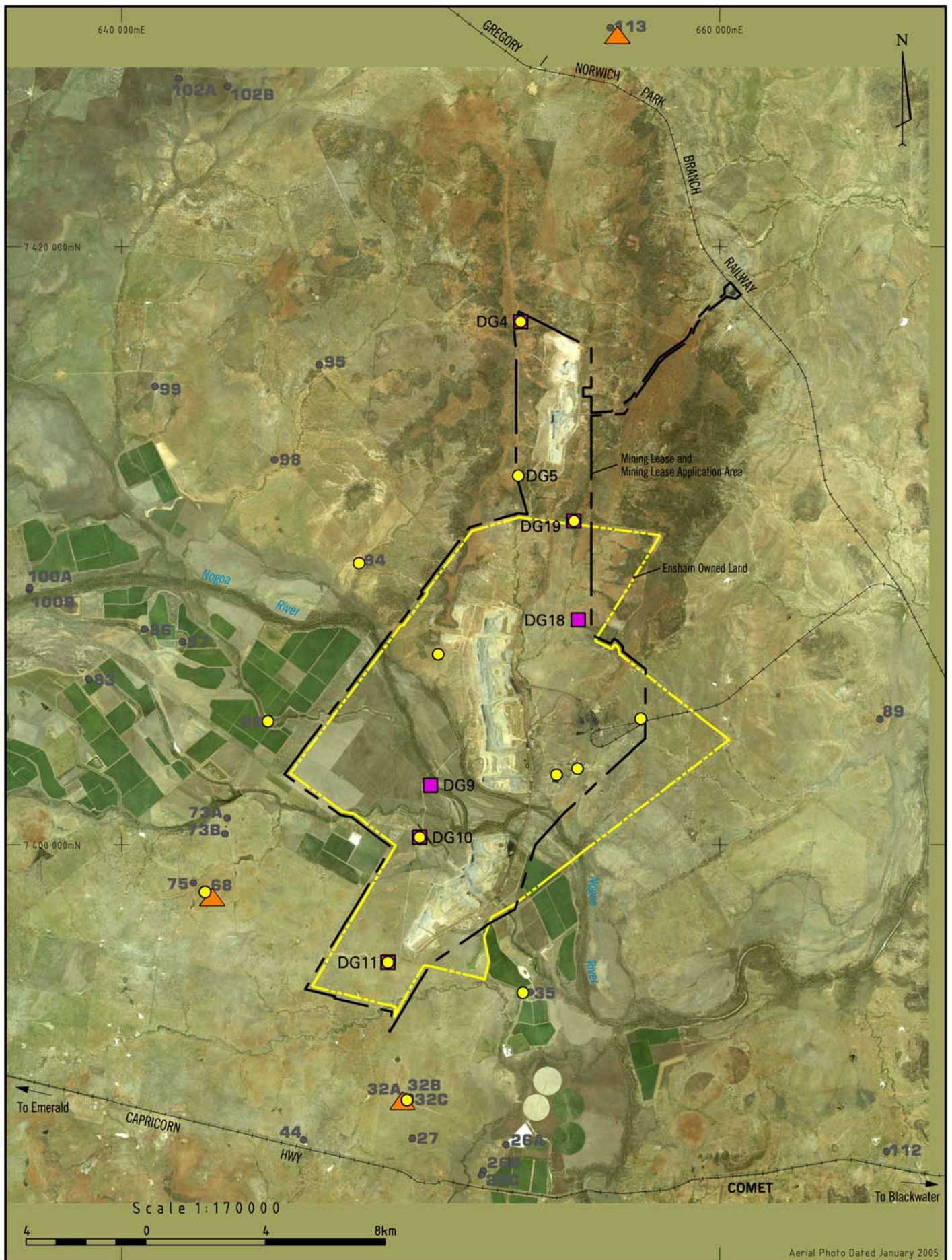
Ensham Mine has an established dust monitoring program for existing mining operations. This monitoring program will continue for the life of the project. The aim of the program is to monitor mine dust impacts and the compliance status of the mining operations in relation to the dust deposition limits contained in the proponent’s Environmental Authority.

The current location of dust deposition gauges is shown on Figure 13-1. Dust deposition gauges are sampled monthly in accordance with *Australian Standard AS3580.10.1-1991*. The program will be subject to periodic auditing, including a review of monitoring locations and a comparison of the monitoring results to the dust deposition limits contained in Ensham’s Environmental Authority.

The proponent will undertake additional dust monitoring in response to complaints and/or at the request of the EPA.

Greenhouse gas issues, including mitigating factors, are addressed separately in Section 13.8.

FIGURES



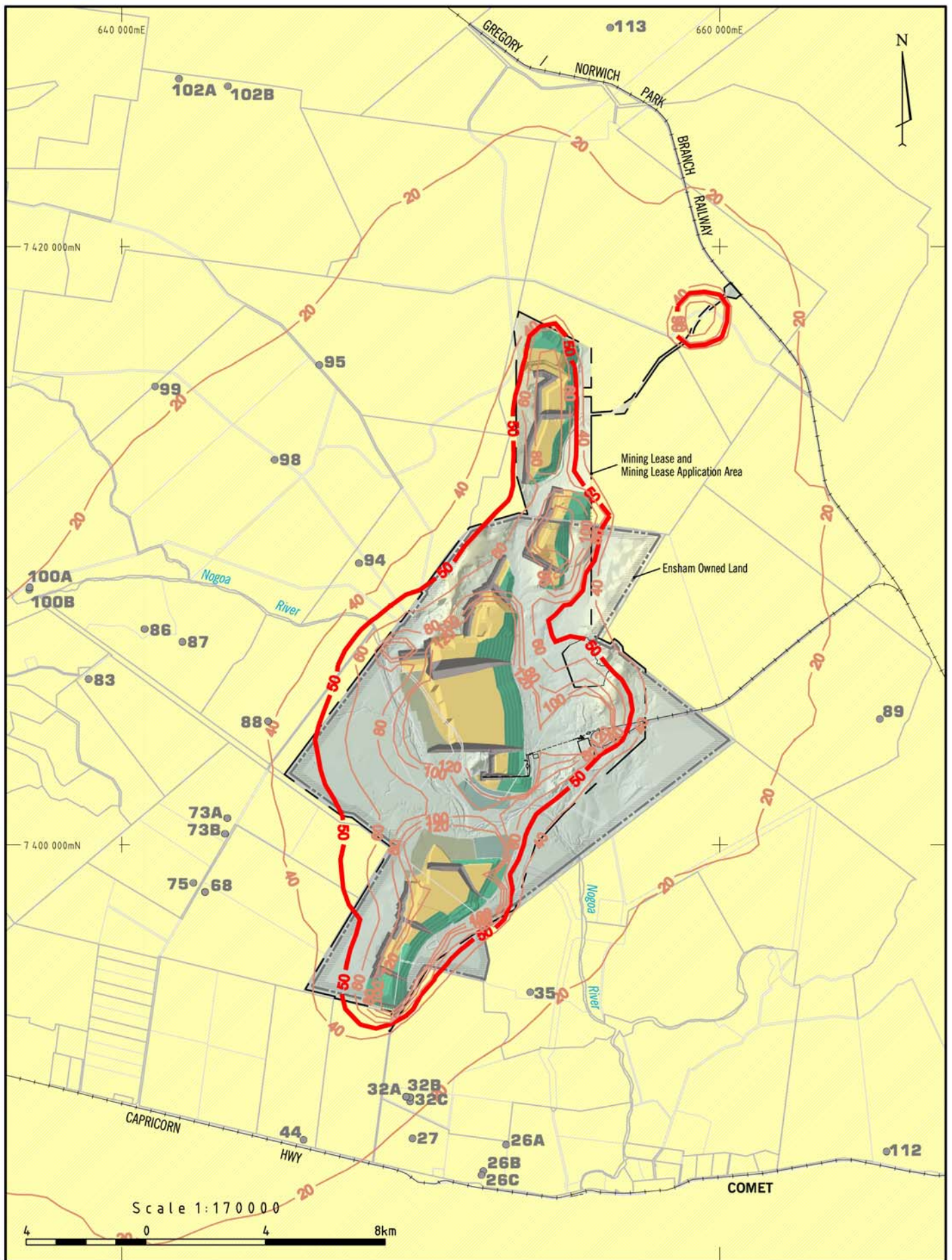
ENSHAM CENTRAL PROJECT

Dust Monitoring Locations

- Privately Owned Residence
- DG19 Dust Monitoring Location (Dust Deposition): 1998 - 2003
- ▲ Dust Monitoring Location (Dust Deposition, PM₁₀): January - March 2005
- Dust Monitoring Location (Dust Deposition): 2005/2006 - ongoing
- Ensham Owned Land
- - - Mining Lease and Mining Lease Application Area



FIGURE 13-1



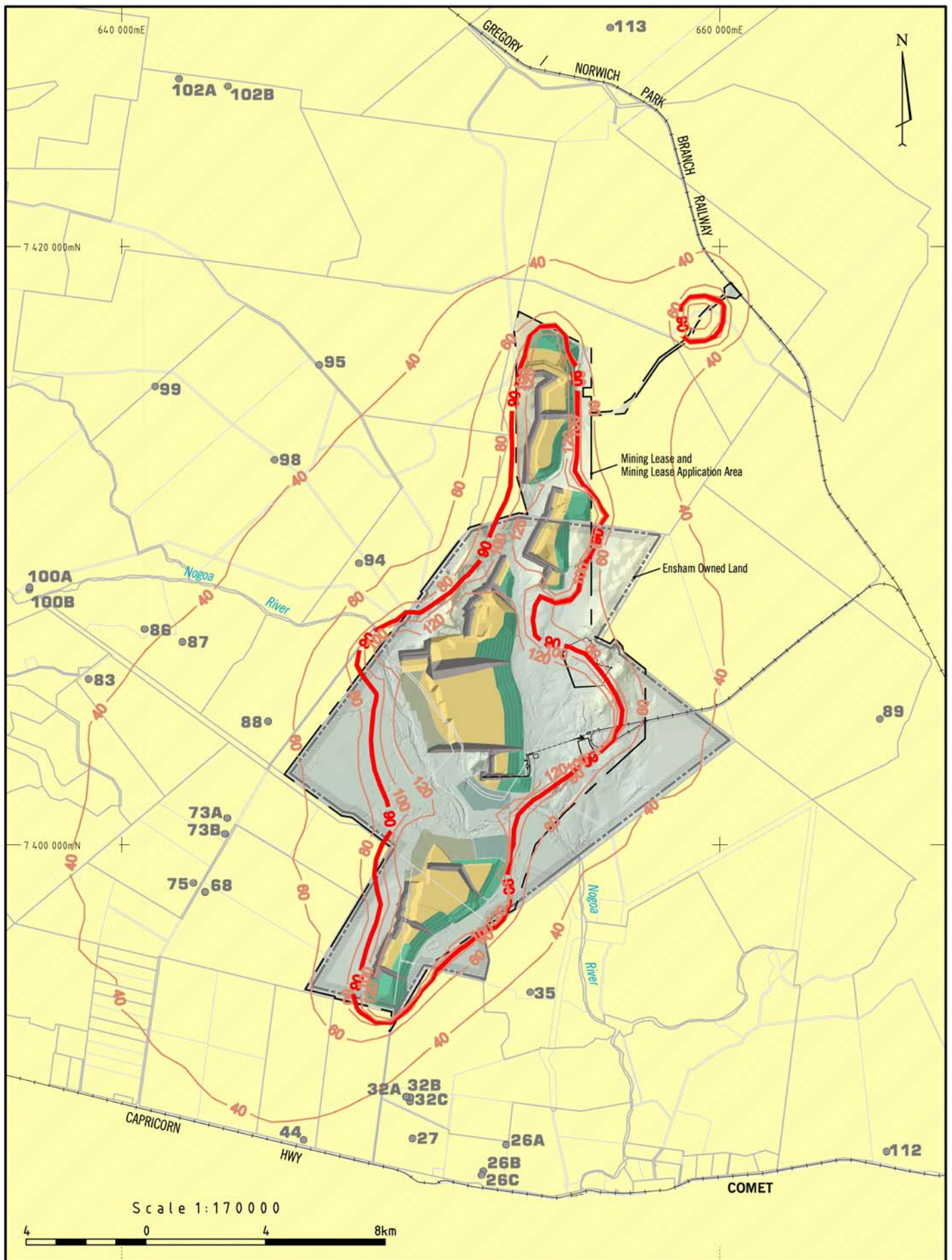
- Privately Owned Residence
- Ensham Owned Land
- Mining Lease and Mining Lease Application Area
- PM10 - EPP (Air) Goal - $50 \mu\text{g}/\text{m}^3$
- PM10

ENSHAM CENTRAL PROJECT

Mine Life Envelope
Annual Average PM_{10} ($\mu\text{g}/\text{m}^3$)
(including background levels)



FIGURE 13-2



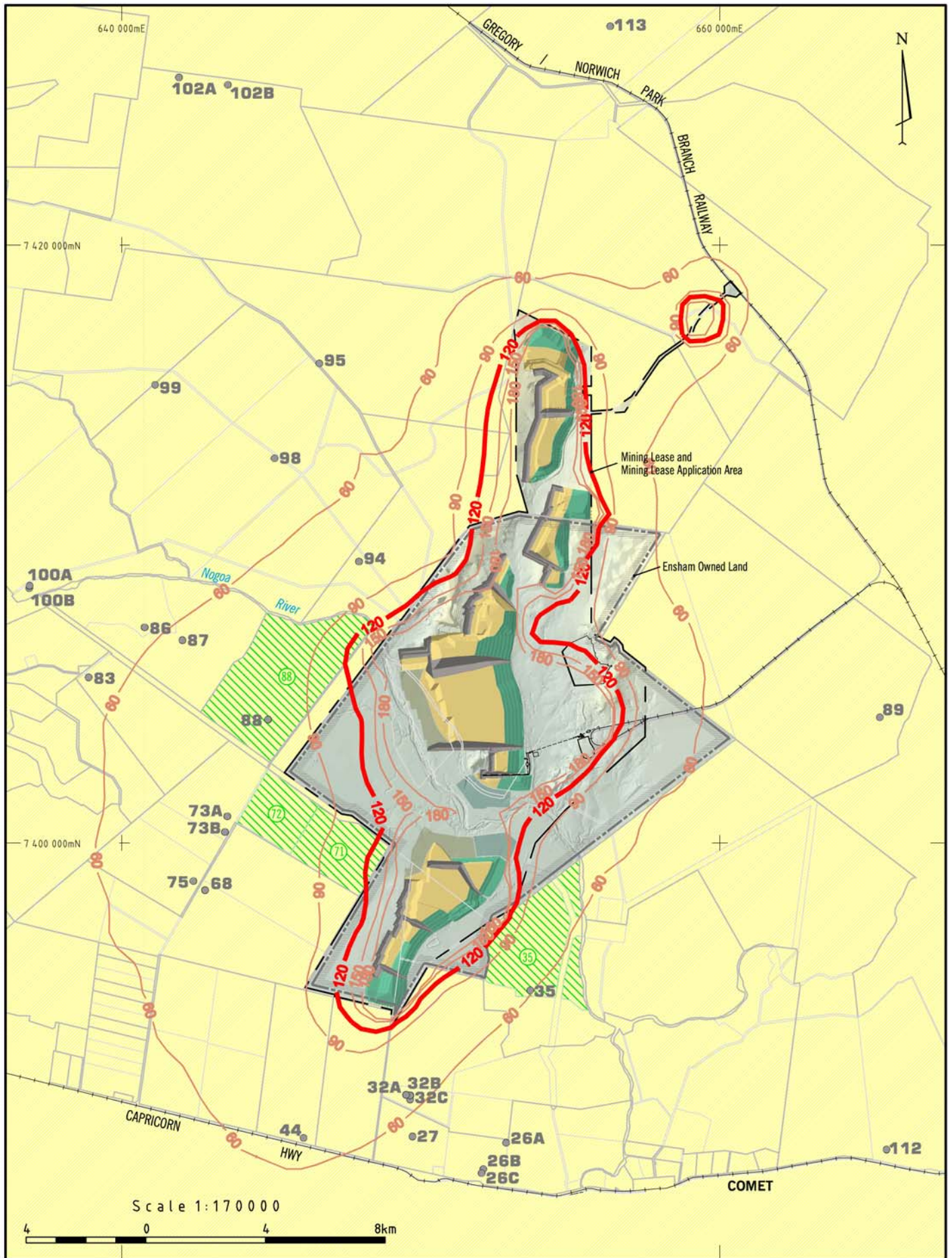
- Privately Owned Residence
- Ensham Owned Land
- Mining Lease and Mining Lease Application Area
- TSP - EPP (Air) Goal - $90 \mu\text{g}/\text{m}^3$
- TSP

ENSHAM CENTRAL PROJECT

Mine Life Envelope
Annual Average TSP ($\mu\text{g}/\text{m}^3$)
(including background levels)



FIGURE 13-3



- Privately Owned Residence
- Ensham Owned Land
- Mining Lease and Mining Lease Application Area
- Dust Deposition Rate - EPA Recommended Guideline - 120mg/m²/day
- Dust Deposition Rate
- ▨ Nearest Cotton Properties to Mining Areas

ENSHAM CENTRAL PROJECT

Mine Life Envelope
Annual Average Dust Deposition Rates (mg/m²/day)
(including background levels)



FIGURE 13-4