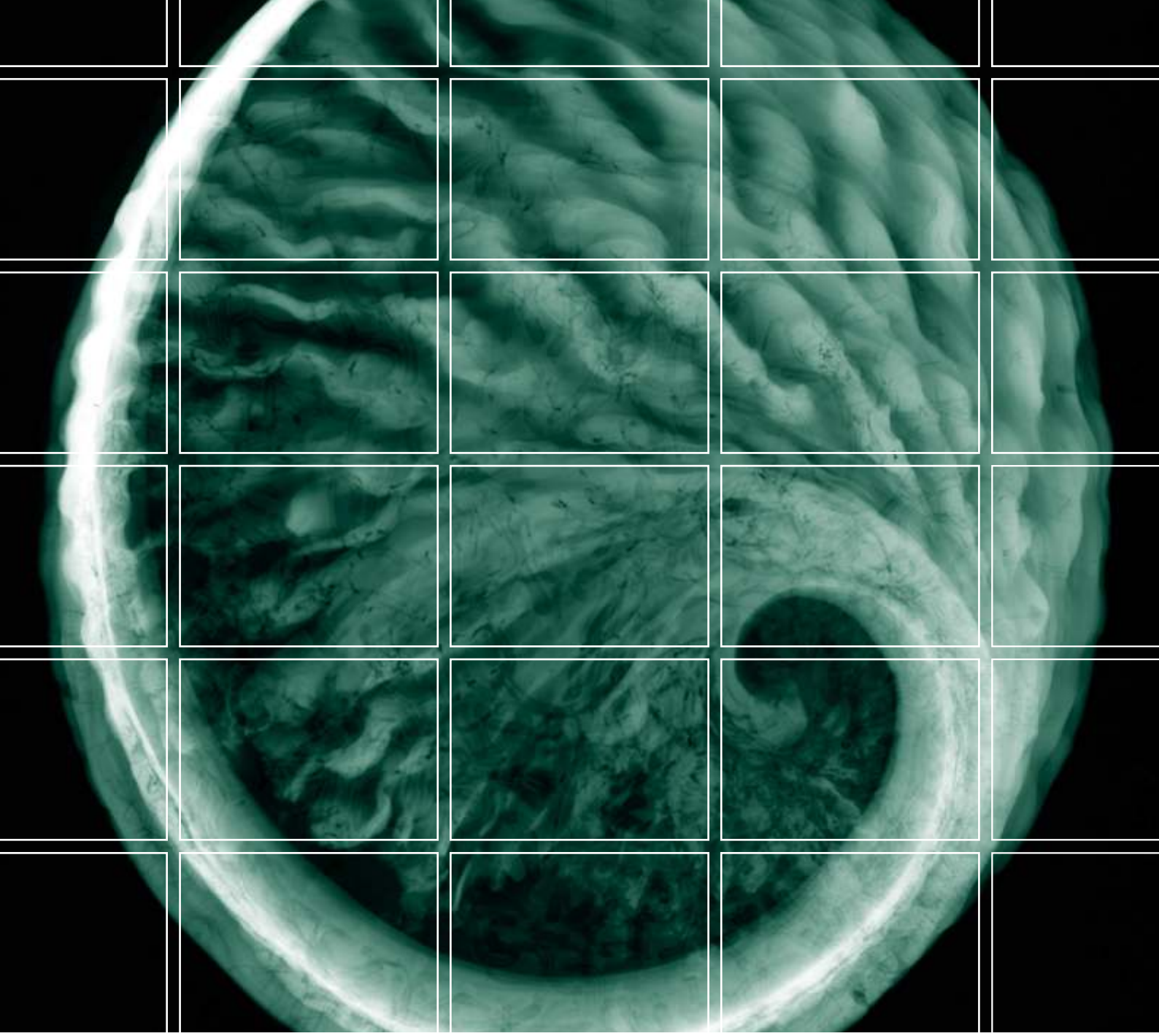

NRE No. 1 Colliery

Preliminary Assessment
Report

for Gujarat NRE Minerals Ltd

August 2009

0079383RP01 Final

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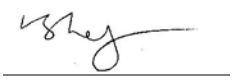
ERM

Approved by:	*Christine Allen*
Position:	Project Manager
Signed:	
Date:	*August, 2009*
Approved by:	*Mike Shelly*
Position:	Partner
Signed:	
Date:	*August, 2009*

Environmental Resources Management Australia Pty Ltd Quality System

FINAL REPORT

Gujarat NRE Minerals Ltd

NRE No. 1 Colliery
Preliminary Assessment Report

August 2009

Environmental Resources Management Australia
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EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) has been commissioned by Gujarat NRE Minerals Limited (referred to as NRE) to prepare the Preliminary Assessment Report (PAR) and Project Application for the consolidation of its existing operations, a continuation of current mining operations and upgrade of associated surface facilities at NRE No. 1 Colliery in the Southern Coalfield (the 'Project'). These documents are being submitted to the Department of Planning (DoP) to request the Director-General's requirements (DGRs) for the Project. Subsequent to receipt of the DGRs, an Environmental Assessment Report (EAR) will be prepared and submitted to the Minister for Planning to seek project approval under Part 3A of the EP&A Act.

NRE proposes to continue its underground coal mining operation at NRE No. 1 Colliery, and take coal production above the current levels to a historical maximum of 3 mtpa over a period of up to 20 years. The unwashed coal will be trucked to Port Kembla Coal Terminal (PKCT) for shipment to India. The project includes upgrade of existing surface infrastructure and construction of some new surface infrastructure.

The Project Application Area (PAA) is located approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW. It covers approximately 6,858 ha, encompassing Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 1575. The coal resources in the PAA comprise the Bulli, Balgownie, Cape Horn, Hargraves and Wongawilli seams, in descending stratigraphic order. The Cape Horn and Hargraves seams are too thin to be of economic interest for mining.

Mining

Mining is proposed in three seams. It is proposed to continue development of the Bulli seam in the V Mains and a new mining area in the western part of CCL 745 ('Bulli West') using first workings. First workings leave the overlying strata fully supported and achieve 'zero' subsidence. Following completion of first workings in the Bulli seam at the V Mains, the retained panels of coal will be extracted by pillar extraction, which results in subsidence. Secondary pillar extraction of the Bulli West area does not form part of this proposal.

It proposed to mine the Balgownie seam using the "cut and flit" first workings mining method, used for mining thin coal seams (less than 1.5 m thick). The cut and flit mining method results in a higher resource recovery rate than conventional continuous miner development. It achieves 'zero' subsidence. Mining of the Bulli seam will constitute a continuation of existing operations. Mining of the Balgownie seam is anticipated to commence in 2011.

Mining of the Wongawilli seam will be a progression of the current drivage into the Wonga Mains progressing into the Wonga East (2010) and the Wonga West Area (2013). Extraction from the Wongawilli seam will be by first working and the retreating longwall method of secondary extraction. This results in surface subsidence.

Consultation

NRE has a history of consultation and information sharing with the local community, government agencies and other stakeholders regarding operations at NRE No. 1 Colliery. Ongoing consultation and information sharing with these groups has occurred during the Project planning and preliminary assessment phases and will continue throughout the EA process and Project implementation.

Feedback received to date indicates that the local community generally recognise positive economic and employment contributions of the Project. However there are concerns about potential impacts on the local community. Key issues raised relate to potential impacts of dust, noise and traffic associated with surface operations at the Russell Vale Site and coal haulage to PKCT.

The overall aim of consultation is for NRE to establish long-term relationships with key stakeholders, to facilitate and enable their inputs to be considered in the Project design, planning and implementation.

Environmental, Social and Economic Considerations

A preliminary risk assessment of issues was undertaken to identify the key risk areas upon which the EA should be focussed, along with areas unlikely to be impacted by the Project and which therefore require only limited additional assessment. Potential impacts will be fully assessed as part of the EA. The EA will also outline measures to manage any adverse environmental impacts identified in association with the Project.

In summary the key environmental considerations identified in this preliminary assessment for the Project are:

- *subsidence*
- *infrastructure and surface improvements*
- *surface water;*
- *groundwater;*
- *air quality*

- *greenhouse gas;*
- *acoustics*
- *ecology;*
- *heritage (indigenous and non-indigenous);*
- *traffic and transport; and*
- *socio-economic* considerations.

These issues will be addressed in greater detail in the EAR. The potential impacts of the Project on other environmental aspects, including visual amenity, waste management and hazards will be addressed to a lesser extent in the EAR.

1 INTRODUCTION

1.1 BACKGROUND

Gujarat NRE Minerals Ltd (NRE) seeks approval for the consolidation of its existing operations, a continuation of current mining operations and upgrade of associated surface facilities at NRE No. 1 Colliery in the Southern Coalfield (the 'Project'). This includes upgrade of existing surface infrastructure and construction of some new surface infrastructure. NRE No. 1 Colliery is located at Russell Vale, to the west of Bellambi, in the Illawarra region of New South Wales (NSW). A locality map is presented as *Figure 1.1* and the Project Application Area (PAA) is shown in *Figure 1.2*. The PAA represents the colliery holding which includes a number of sub leases between NRE and surrounding mine operators. Surface lease areas are shown in *Figure 1.3*.

The Project will have an estimated capital investment value of *$250 million*. It will include the following activities:

- continued westward development of the existing "Wonga mains" drivage from Russell Vale to access underground working areas;
- multi-seam (Bulli, Balgownie and Wongawilli seams) coal extraction, ramping up to coal production of up to 3 million tonnes per annum (mpta) with a projected mine life of at least 20 years. This will involve:
    - extraction from the Wongawilli seam by first workings with the continued development of the "Wonga Mains" drivage;
    - longwall mining of the Wongawilli seam in the 'Wonga East' area, beneath previously mined Balgownie and Bulli seam workings;
    - extraction from the Balgownie seam by first workings beneath the existing mined out Bulli seam longwalls in the 'Wonga West' area, using the 'cut and flit' mining method (anticipated to have no direct subsidence impacts);
    - extraction of Wongawilli seam coal from beneath the previously mined Bulli seam workings in the 'Wonga West' area, by longwall mining;
    - continued development and extraction of the Bulli seam from the 'V Mains' area by first workings and selected pillar extraction; and
    - first workings in the Bulli seam in the 'Bulli West' area (anticipated to have no direct subsidence impacts);

- upgrade of existing mine infrastructure and services, including surface conveyors and coal handling infrastructure, coal sizing, screening, crushing and load-out facilities, site noise and dust controls and a stockpile for run-of-mine (ROM) coal;

- refurbishment of existing ventilation shafts and power and water supply arrangements;

- installation of a new ballast and bulk materials supply borehole within an area of existing surface leasehold at No.5 Shaft, to deliver materials underground;

- installation of new gas drainage borehole(s) within an area of existing surface leasehold;

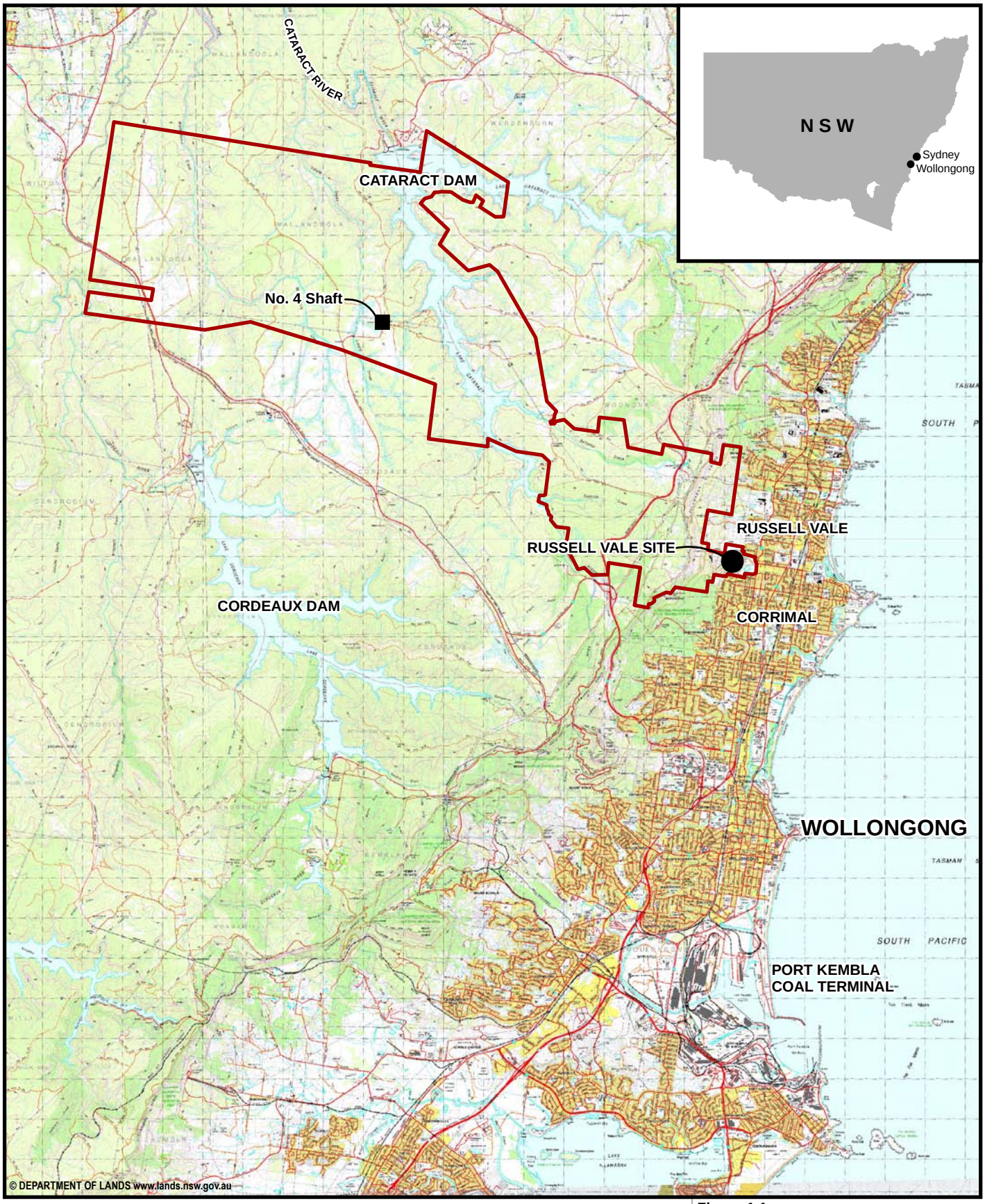
- continued road haulage of the unwashed coal to Port Kembla Coal Terminal (PKCT) for overseas export, using the existing haulage route; and

- trucking fleet upgrades with current best practice suspension and braking systems and full wet weather covers.

The Project Application Area (PAA) comprises Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 1575. Extensive underground mining has been undertaken within the PAA, dating from the mid 19th Century, however a substantial volume of high quality coking coal reserves remain with some thermal coal as a by-product. An aerial photograph of the PAA is presented in *Figure 1.2*.

Pursuant to provisions of *State Environmental Planning Policy – Major Projects 2005*, the Project requires approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Environmental Resources Management Australia Pty Ltd (ERM) has been commissioned by NRE to prepare the Preliminary Assessment Report (PAR) and Project Application for the Project. These documents are being submitted to the Department of Planning (DoP) to request the Director-General's requirements (DGRs) for the Project. Subsequent to receipt of the DGRs, an Environmental Assessment Report (EAR) will be prepared and submitted to the Minister for Planning to seek project approval under Part 3A of the EP&A Act.



Legend

Project Application Area

Figure 1.1

Location of the Project Application Area

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS03_R0	
Date:	12/11/2008	Drawing size: A4
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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Maps and figures contained within this document may be based on third party data, may not be to scale and is intended for use as a guide only. ERM does not warrant the accuracy of any such maps or figures.

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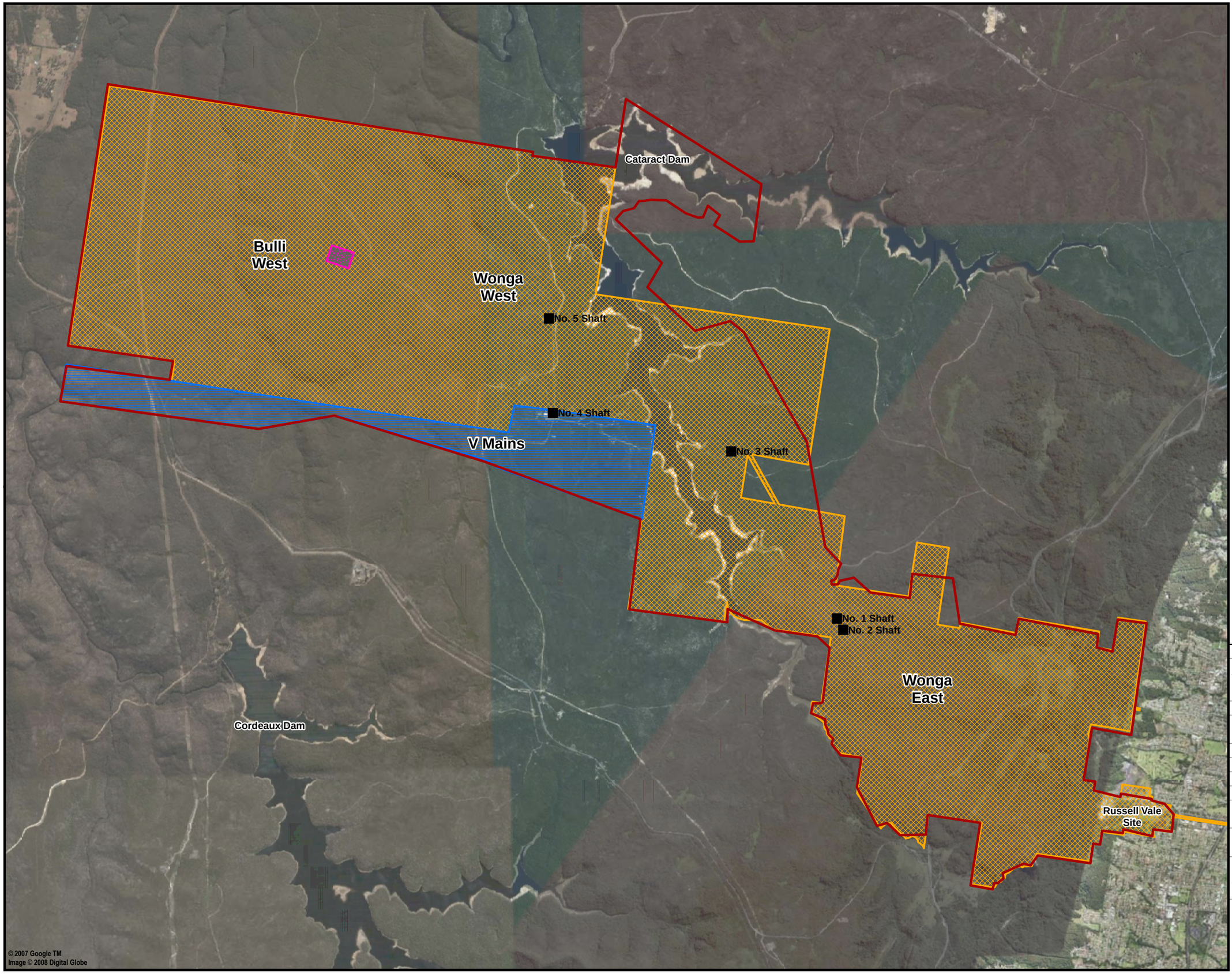

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Project Application Area

Lease Boundaries

CCL745

ML1575

MPL271

Figure 1.2

Project Application Area and Mining Tenements

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS05_R0	
Date:	14/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
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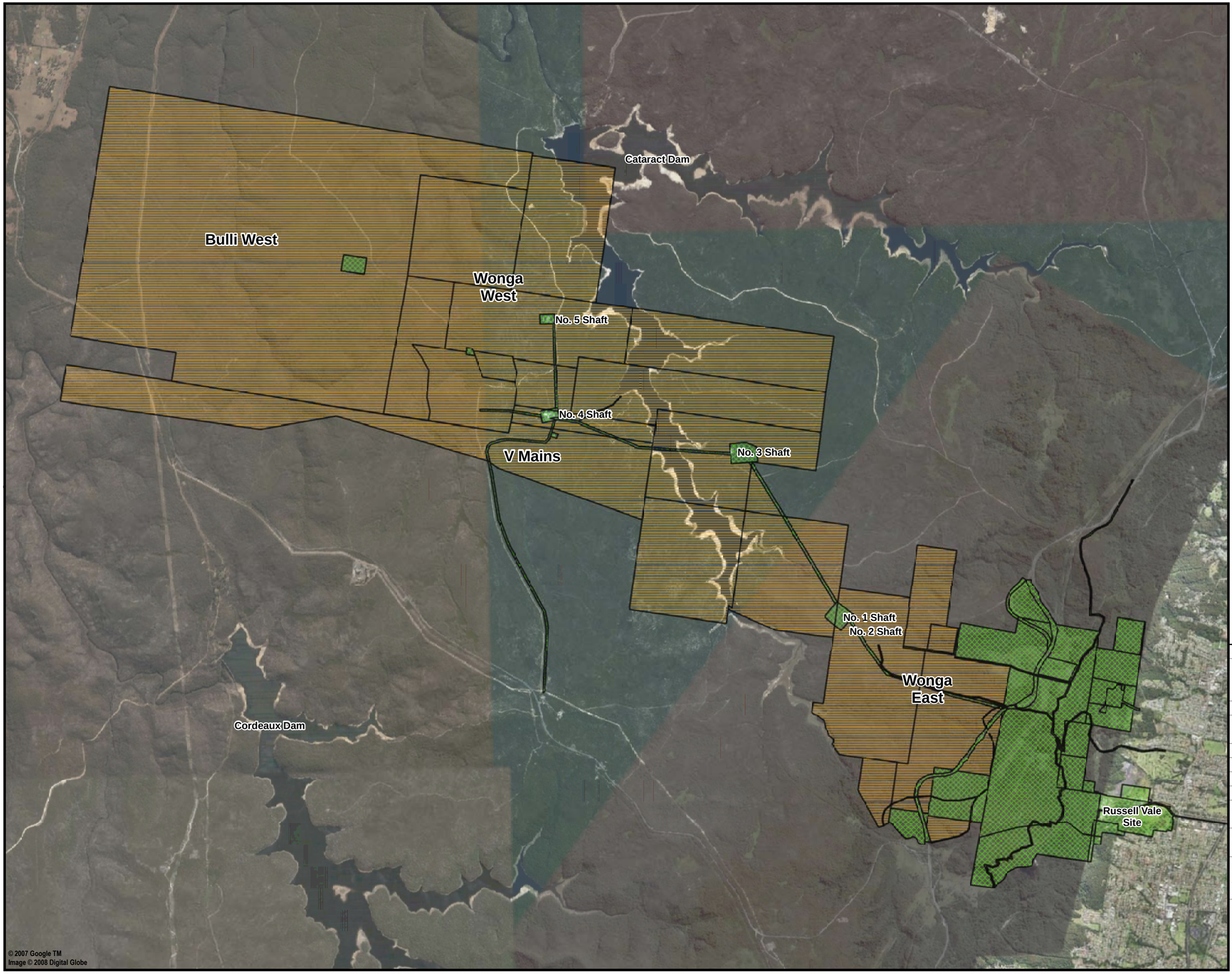

Legend

- Surface Lease
- Underground Lease

Figure 1.3

Surface Lease Areas

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS08_R0	
Date:	09/01/2009	Drawing size: A3
Drawn by:	JF	Reviewed by: MK
Scale:	Refer to Scale Bar	

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1.2 PROJECT PROPONENT

NRE (previously named India NRE Minerals Ltd) is a public company, which was listed on the Australian Stock Exchange (ASX code: GNM) on 10 July 2007. NRE own and operate NRE No. 1 Colliery.

NRE is a subsidiary company of Indian based, Gujarat NRE Coke Limited. The core business of Gujarat NRE Coke Limited is processing and marketing metallurgical coke. It is India's largest independent manufacturer of low ash metallurgical coke and one of the world's largest and fastest growing merchant coke producers. In addition to its interests in NRE No. 1 Colliery, Gujarat NRE Coke Ltd:

- owns the NRE Avondale Colliery (not currently operating) and owns and operates NRE Wongawilli Colliery (former Elouera Mine), both of which are located within the Illawarra region, south of the PAA;
- operates the Bhachau coal coking plant in Gujarat, India, which imports coking coal from its Australian coal mines and manufactures coke for the high demand Indian and Western markets;
- has investments in resource prospecting companies involved in base metal exploration, including for coal, gold, magnetite and iron-ore;
- operates a steel mini-mill in Gujarat that recycles steel scrap for the production of steel reinforcing bars;
- plans to set up a new coking plant in Karnataka, India; and
- plans to set up power plants adjacent to its Bachhau facility, that will utilise the waste heat generated by the coking ovens; and
- operates a number of wind turbines to generate "green" power.

1.3 HISTORY OF NRE NO. 1 COLLIERY

The South Bulli Coal Mining Company commenced mining on the slopes of the Illawarra Escarpment at NRE No. 1 Colliery (formerly the South Bulli Mine) in the mid 19th Century. Continuous mining has been a feature of the PAA since 1887 and surface facilities have operated at their current location at the 'Russell Vale Site' since this time.

With the advent of more sophisticated mining methods in the 1960s, workings progressed further west of the Illawarra Escarpment. Subsequently, four ventilation shafts (Shaft Numbers 1, 2, 3 and 5) and a shaft to provide personnel and materials access to the workings (No. 4 Shaft) were sunk to the west of the escarpment. Mining beneath the catchment and stored waters of Cataract Dam commenced in early 1990's.

In August 2004, production temporarily ceased and the mine was placed on care and maintenance until 3 December 2004 when it was sold to NRE by Bellpac Pty Ltd. Mining recommenced at NRE No. 1 Colliery in July 2005. The coal washery ceased operation in March 2003, and all product coal is now transported unwashed to Port Kembla Coal Terminal for shipment to India.

NRE are currently mining in the Bulli coal seam in the 311, "O" and "P" panel areas. Current coal production is estimated at 1 mtpa. Current development includes the construction of three new portal entries to the Wongawilli seam at the Russell Vale Site, and upgrade of site traffic controls and water management infrastructure. A subsidence management plan (SMP) is being prepared which will be submitted to the Department of Primary Industries (DPI) to gain approval for first workings and pillar extraction from the V Mains. Production from the V Mains is predicted to commence in mid 2009. Works extending beyond August 2010 in the V-mains area will be considered in the EAR.

1.4 PURPOSE OF THIS REPORT

This PAR was prepared with the aim of ensuring that all relevant environmental and socio-economic matters are identified and considered in the Environmental Assessment (EA) process. Specifically it has been prepared to:

- describe the key components of the Project;
- identify the planning provisions that apply to the PAA;
- identify the potential environmental, social and economic implications associated with the Project and provide a preliminary justification for the proposed focus of the EA;
- provide sufficient information for the relevant agencies to make an informed decision on the items they wish to see addressed in the EA; and
- support the Project Application to gain the DGRs under Clause 75(F) of the EP&A Act for the preparation of an EA.

1.5 REPORT STRUCTURE

This PAR is structured as follows:

Chapter 1 Introduction provides a background to the project, the proponent and this report;

Chapter 2 Project Description describes the activities for which approval is sought;

Chapter 3 Planning and Approvals Considerations identifies planning provisions which apply to the PAA and any other approvals which may be required;

Chapter 4 Consultation outlines stakeholder consultation undertaken to date and the proposed strategy and actions for ongoing consultation throughout the assessment phase;

Chapter 5 Environmental, Social and Economic Considerations briefly describes the existing environment in which the PAA is set, identifies potential Project risks to the existing environment and sets out the proposed scope of assessment to be undertaken for the EA; and

Chapter 6 Conclusions provides concluding statements with respect to the preliminary assessment outcomes.

2 PROJECT DESCRIPTION

2.1 SUMMARY

NRE proposes to seek approval to consolidate existing approvals and to continue its underground coal mining operation at NRE No. 1 Colliery, and to increase coal production to a maximum of 3 mtpa over a period of up to 20 years. The unwashed coal will be trucked to PKCT for shipment to India. Project components are described in this chapter, and a summary is provided in *Table 2.1*.

Table 2.1 Project Summary

Project Component	Existing Operations	Proposed Changes to Operations
Underground Mining	Bulli seam: pillar extraction in the Wonga West area and first workings in the "O" & "P" panel area, which will move into the V Mains following SMP approval (estimated June 2009).	Bulli seam: continued first workings and pillar extraction in V Mains and first workings in the 'Bulli West' area.
	Balgownie seam: no current production.	Balgownie seam: first workings cut and flit mining in Wonga West.
	Wongawilli seam: ongoing drivage of Wonga Mains development roadways from Russell Vale Site.	Wongawilli seam: continuation of Wonga Mains first workings and longwall mining in Wonga East and Wonga West.
ROM Coal Production	Approximately 1 mtpa.	Increase to a maximum of 3 mtpa.
Coal Handling	ROM coal is conveyed from underground to the surface stockpile area, reclaimed for sizing and conveyed to bins for truck load-out.	Coal handling facilities will be upgraded.
Product Coal Transport	Trucked to PKCT for shipment to India.	Continue trucking to PKCT along existing haul route, for shipment to India.
Surface Stockpiles	ROM coal stockpile.	ROM coal stockpiling area will be upgraded.
Coal Reject Management	Waste rock is re-used on-site e.g. as road surface and as a clean structural fill material.	There will be no fines as no coal washing is proposed.

Project Component	Existing Operations	Proposed Changes to Operations
Water Management	On-site water storages and treatment systems. Water demand is met by town water, raw water from Cataract Dam and/ or treated water recycled from mine dewatering, captured stormwater runoff and bath-house. Off-site discharge to Bellambi Gully from the Russell Vale Site in accordance with Environment Protection Licence No. 12040.	Continued use and, where required, upgrade or modification of existing water management infrastructure.
Employment	Operation: 320 permanent staff, 75 contractors (approx.)	Operation: 350 permanent staff (approx.) Construction: 65 (short-term)
Hours of Operation	Underground Mining: 24 hours/ day, 7 days/ week	Underground Mining: 24 hours/ day, 7 days/ week
	Surface Facilities: 24 hours/ day, 7 days/ week	Surface Facilities: 24 hours/ day, 7 days/ week
	Coal Haulage to PKCT: 6.30am-5.30pm (Mon-Sat)	Coal Haulage to PKCT: increase in hours of haulage to be determined through environmental assessment.

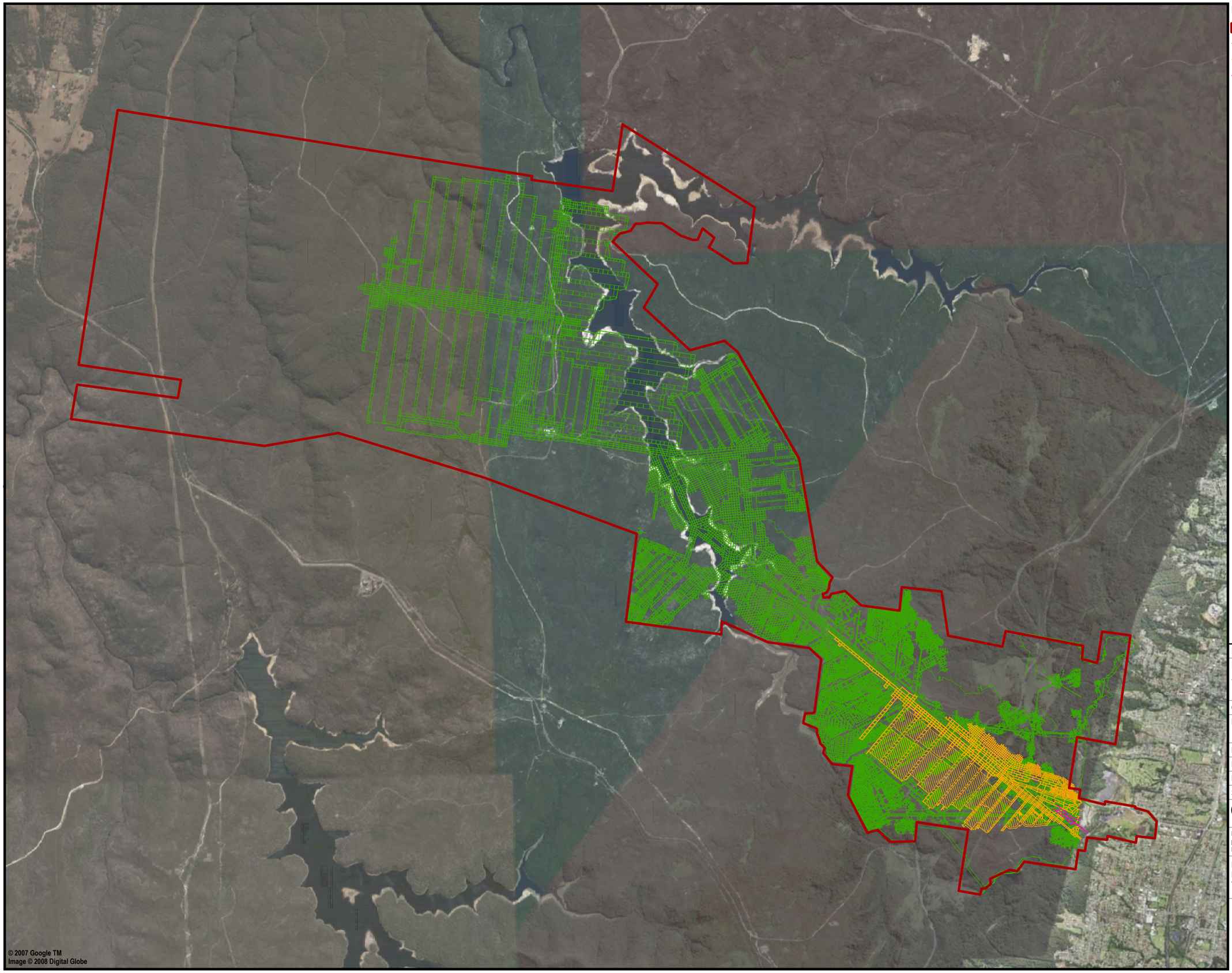

Figure 2.1

Existing Workings Within the Project Application Area

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS02_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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0 490 980 1,470 m

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2.2 *PROJECT APPLICATION AREA*

2.2.1 *Location And Mining Tenements*

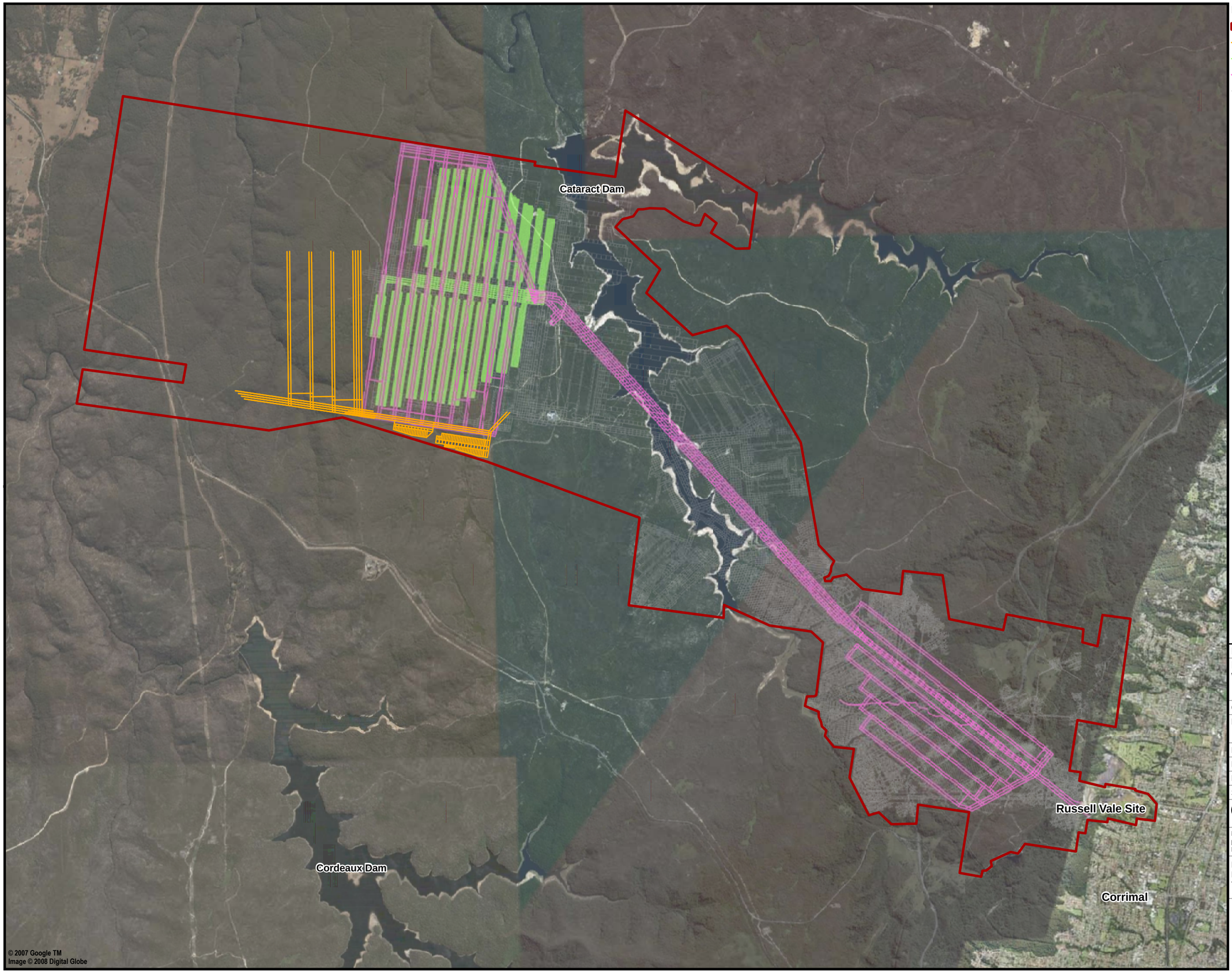
The PAA is approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW. It covers approximately 6,858 ha, encompassing CCL 745, MPL 271 and ML 1575. CCL 745 is valid until 30 December 2023, MPL 271 until 9 May 2012 and ML 1575 until 18 October 2010. An aerial photograph showing the PAA and mining tenements is presented in *Figure 1.2*. Areas of mining tenements that have been sub-let to other mining companies are not included in the boundary of the PAA. Areas of the colliery holding which have been sub-leased from other mining companies are included in the PAA. Existing and proposed mine workings are shown in *Figure 2.1 and 2.2*.

2.2.2 *Description*

The PAA comprises an extensive underground area, the majority of which is covered by native bushland and Cataract Dam, with perennial creeks, ephemeral tributary streams and upland headwater swamps. Cataract Dam constitutes one of metropolitan Sydney's potable water supplies. Consequently, a large part of the PAA (which lies within its catchment) is designated as a *Schedule 1 Restricted Access Area (Metropolitan Special Area)* under the *Sydney Water Catchment Management Act 1998*. It is managed by the Sydney Catchment Authority (SCA). In accordance with the SCA *Special Areas Strategic Plan of Management 2007*, this land is managed with the aim of protecting water quality and providing high quality raw water in reservoirs, by protecting ecological integrity and natural and cultural values.

Infrastructure above the proposed mining area includes a Telstra fibre optic cable, electrical transmission lines and roads.

NRE has surface leases at the Russell Vale site and six other surface sites, being the No. 4 Shaft, MPL 271 and four ventilation shaft sites (No. 1, 2, 3 and 5 Shafts). A number of surface leases also exist for various infrastructure easements across the PAA. A brief description of surface sites is provided below and their locations are indicated on *Figure 1.3*.



Legend

- Project Application Area
- Proposed Bulli Workings (Indicative)
- Proposed Balgownie Workings (Indicative)
- Proposed Wongawilli Workings (Indicative)
- Existing Workings

Figure 2.2

Existing and Indicative Proposed Workings

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS04_R0	
Date:	05/01/2009	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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0 500 1,000 1,500m

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Legend

Project Application Area

Figure 2.3

Russell Vale Site Layout - Existing

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_PL_GIS06_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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Russell Vale Site

The Russell Vale Site occupies approximately 100 ha at the eastern extent of CCL 745, within the Wollongong suburb of Russell Vale, adjacent to the suburb of Bellambi. It is on freehold and leasehold land on the lower slopes of the Illawarra Escarpment. Site access is via the Princes Highway, at its intersection with Bellambi Lane. Surface infrastructure at the Russell Vale Site is shown in *Figure 2.3* and includes:

- administration offices and amenities;
- maintenance workshops;
- car parking areas and internal sealed and unsealed roads;
- two portal entries, one for men and materials and another for the belt road which conveys coal to the surface;
- three new portal entries (currently under construction), for a new high capacity coal conveyor system, a rubber tyre vehicle transport road and a track road for rail mounted transports, respectively;
- run-of-mine (ROM) stockpile area and reclaim tunnel;
- a belt conveyor from the belt portal to the ROM stockpile area;
- breaker building and conveyor to the truck load-out bins;
- truck load-out facilities;
- vehicle wash;
- weigh bridge;
- water treatment and management facilities; and
- fuel storage facilities.

The Russell Vale site is bounded by the Princes Highway to the east, with residential areas of Russell Vale and Corrimal to the east and south respectively. Native bushland extends west of the site.

An emplacement area is located to the north and encompasses the Russell Vale Golf and Social Club. The emplacement area is not owned by NRE and is controlled by a separate consent.

No. 4 Shaft

The No. 4 Shaft and associated facilities are approximately 10 km north west of the Russell Vale Site and surrounded by native bushland within the SCA Metropolitan Special Area. The No. 4 Shaft is a downcast shaft for men and materials. Site facilities include a winder, offices, bath-house, stores, workshop, car parking area, water management facility, sewage treatment plant, electrical sub-station and explosives magazine.

MPL 271

MPL 271 is unused. The site has previously had consent for the construction of a ventilation shaft and may be used for such purposes in the future.

Ventilation Shafts

There are four ventilation shafts within the PAA, as shown on *Figure 1.2*. No. 3 Shaft is a downcast shaft and No. 1 and No. 5 Shafts are both upcast shafts. The site of No. 5 Shaft also includes a compressed air facility, power and water delivery pipeline to underground. No. 2 shaft has been decommissioned.

2.3 DESCRIPTION OF THE RESOURCE

More than 300 million tonnes of coking coal resources remain within the PAA in the Bulli, Balgownie and Wongawilli seams. The Bulli seam is 0 to 490 m below the ground surface and has been extensively mined for more than 120 years within CCL 745. The Balgownie seam is approximately 8 to 10 m beneath the Bulli seam and has been worked sporadically up until the 1970's. The Wongawilli seam lies 22 to 25 m below the Balgownie seam. The Wongawilli seam has been mined by longwall methods at other collieries in the Southern Coalfield, however there has been no systematic production from the Wongawilli seam at NRE No. 1 Colliery. Only the lower 2.0 to 3.5 m of the Wongawilli seam is considered suitable for mining in the PAA. Two minor seams, the Cape Horn seam and the Hargraves seam, lie between the Balgownie and Wongawilli seams, but are too thin and too high in ash to be of economic significance. Seam thicknesses are summarised in *Table 2.2*.

Table 2.2 Seam Thickness

	Bulli[1]	Balgownie	Wongawilli[2]	
			Full seam	Mining Section
Minimum (m)	<1.4	<0.5	8	2.0
Maximum (m)	>2.8	1.5	11	3.5
Average (m)	2.01	1.3	9.75	3.0

1. The Bulli seam has highly variable spot thicknesses.
2. Only the lower 2.0 m to 3.5 m of the Wongawilli seam will be mined.

Coking coal from NRE No. 1 Colliery is amongst the best in the world due to its strong coking properties, low phosphorous (<0.005ppm), sulphur and ash content, high calorific value, good fluidity and reflectance and suitability for direct feed into coke ovens. It is well suited to production of high quality metallurgical coke.

2.4 TECHNICAL PROJECT DESCRIPTION

2.4.1 Mining

Bulli Seam

Current workings in the Bulli seam include pillar extraction in the Wonga West area ("200" longwall series in the south and "300" longwall series in the north), first workings in the "O" and "P" Panels in the central portion of the site (between Wonga East and West) and the "S" main drivage to the east of the 200 longwall series.

It is proposed to continue development of the Bulli seam in the V Mains and a new mining area in the western part of CCL 745 using first workings. First workings will involve development of 5.5 m wide (approximate) headings or roadways within the coal seam, and interconnecting cut-throughs. These will provide access to the coal resource, mine ventilation and corridors for personnel and material movement within the seam and coal conveyor network.

First workings will be developed using continuous miners with integrated roof and rib bolting rigs. The roadway roof will be supported by installation of steel roof bolts into the stone above the coal seam, and by pillars of coal which are left behind. Coal will be transported from the continuous miners to the conveyor system via shuttle cars.

First workings leave the coal pillars intact and the overlying strata fully supported and results in 'zero' subsidence, which is defined by the Department of Primary Industries (DPI) as vertical downward movement of the ground surface that is less than or equal to 20 mm.

Following completion of first workings in the Bulli seam at the V Mains, the retained pillars of coal will be extracted by a remote controlled continuous miner, utilising a mining method known as pillar extraction. The coal will be continuously removed from the working face by a series of conveyors that transfer the coal to the surface. Once pillars are removed, the unsupported strata collapses into the resulting void which is known as a goaf. Collapse of overlying strata into the goaf results in surface subsidence.

An SMP is currently being prepared for the V-mains workings. The SMP is expected to be submitted early in 2009. Works in the V-mains carried out beyond 2010 will be considered in the EA.

Following development of the V-mains area, development of the 'Bulli West' area (located to the west of 'Wonga West') is proposed via first workings. Secondary pillar extraction of the Bulli seam in the 'Bulli West' area does not form part of this proposal.

Balgownie Seam

There are no current workings in the Balgownie seam. It proposed to mine the Balgownie seam using the "cut and flit" mining method, used for mining thin coal seams (less than 1.5 m thick). Cut and flit is a system of underground mining whereby a continuous miner is used to develop a panel by cutting out a designated length of roadway (up to 15 m), before driving ('flitting') to another working face in a predetermined sequence. A mobile roof bolting machine then moves into the first panel and installs roof support, whilst the continuous miner cuts another length of up to 15 m in another roadway, and so on. The continuous miner loads the coal onto a shuttle car for transport to a conveyor belt which conveys it to the surface. Relatively small pillars of coal are formed between the roadways, and these pillars are retained, thereby limiting subsidence of the overlying surface.

The cut and flit mining method results in a higher resource recovery rate than conventional continuous miner development activities. As the coal pillars remain intact and there is no secondary extraction it achieves 'zero' subsidence.

Wongawilli Seam

Current workings in the Wongawilli seam constitute the "Wonga Mains" drivage. The development of this roadway has begun at the Russlle Vale site and will connect the proposed "Wonga East" and "Wonga West" longwall areas.

Proposed first workings in the Wongawilli seam will be developed using the same methodology as for the Bulli seam. Following the completion of first workings, the retained panels of coal will be extracted by the retreating longwall method of secondary extraction. This mining method uses an electrically powered mechanical shearer which passes back and forth across the width of the longwall panel cutting the coal. The coal is continuously removed from the working face on to a series of conveyors that transfer the coal to the surface. As the face is cut away, both the shearer and the hydraulic roof supports advance for the next shear, and the unsupported strata behind the longwall face collapses forming the goaf. This results in surface subsidence that can be predicted using mathematical and empirical models developed by the monitoring of previously extracted areas.

2.4.2 Gas Drainage

Gas drainage is required to reduce the coal seam's in-situ gas content to a level below the outburst threshold, and to maintain an atmosphere within the workings that is safe for the workforce and does not adversely impact operations. Gas drainage may be pre-drainage (where gas is removed from the coal seam prior to mining) or post-drainage (where gas is removed after the mining). Depending on the gas content, either or both of these methods may be used at NRE No. 1 Colliery.

Existing gas drainage infrastructure will be utilised for the Project, with some new gas drainage boreholes installed as necessary, connecting the mine workings to the surface. Gas drainage works will be conducted in seam. Any new gas drainage boreholes will be installed within NRE's existing surface lease areas. Gas from the boreholes will initially be vented to the atmosphere. NRE are currently investigating options for beneficial gas re-use, including use for power generation, however gas re-use does not form part of this Project and will form a separate application when a gas utilisation strategy is finalised.

2.4.3 Ventilation

Ventilation of underground areas will be provided by use of existing ventilation shafts within the PAA. Where necessary, these shafts will be deepened and refurbished to meet mine ventilation requirements and connected with the deeper Balgownie and Wongawilli seam workings.

2.4.4 Personnel and Material Access/ Egress

Personnel and materials will continue to access the working mine areas via the No. 4 Shaft and winder and the portals at the Russell Vale site. No. 4 Shaft is the primary access for personnel. A new ballast and bulk materials supply borehole will be established above the proposed mining area within existing surface lease at No.5 Shaft, to deliver materials underground. Underground movements will be along existing and proposed roadways.

2.4.5 Processing

In accordance with the existing operation, ROM coal will be transported from the working face to the surface at the Russell Vale Site via an underground belt conveyor/ vibrating feeder complex. From the belt portal, the coal is conveyed via an overland belt conveyor to the ROM stockpile area. The belt conveyor is partially enclosed, to reduce dust emissions. All surface conveyors and site noise and dust controls will be upgraded. The ROM stockpile area will be upgraded to accommodate an increased amount of ROM coal.

A reclaim tunnel equipped with vibratory feeders at the ROM stockpile area loads the ROM coal onto a reclaim conveyor that transfers the coal into the breaker building, where coal is sized on a vibratory screen to a nominal 50 millimetres. In addition, a mobile screen is used on the ROM stockpile as a pre-screening facility to avoid overloading the breaker. Coal sizing, screening and crushing facilities will be upgraded as part of the Project. After removal of the oversize material in the breaker, the sized coal is conveyed to one of two truck load-out bins via an existing 600t capacity surge bin. Management of the small quantities of oversize material produced from the screens and breaker will be set out in the EA.

No change to current coal handling and processing arrangements are proposed, however existing infrastructure will be upgraded to improve operational efficiency and minimise impacts on the environment and local community.

2.4.6 Product Transport

In accordance with existing operations, unwashed coal will continue to be loaded into trucks for haulage to PKCT and loading into ships. Trucks are currently dispatched between 6.30am and 5.30 pm, Monday to Saturday.

PKCT has lodged an application to increase its hours of operation. NRE trucking hours will be reviewed for this Project, having regard to the new operating hours of PKCT, the acoustic assessment and project traffic generation. Trucking hours, truck numbers and production rates in the PKCT application were indicative and have not been confirmed for this project. For example the PKCT report assumed a production rate of 3.6 mtpa where as this application seeks to increase production to 3 mtpa. Final trucking hours for this Project will take into account the Project requirements, the results of acoustic/traffic assessments and the potential impacts on the amenity of adjacent residential areas.

Truck load-out facilities and the trucking fleet will be upgraded for this Project as the tonnage throughput and production increases.

2.4.7 Associated Infrastructure

Power

No changes to the existing power supply arrangements are proposed at surface sites. The underground power supply will be refurbished.

Telecommunications

No changes to the existing telecommunications arrangements are proposed.

Water Supply And Management

Water demands at the Russell Vale Site are met by town water supplied by connection to Wollongong's reticulated water supply and by recycled water from stormwater harvesting and mine dewatering.

Water demands at No. 4 Shaft are met by raw water purchased from SCA and pumped directly from Cataract Dam or trucked in by road tanker (in dry times) and by recycled water captured and treated on-site, from the bath house, car parking area and roofs.

Surplus ground water is pumped from the mine workings to the surface at the Russell Vale Site and at No. 4 Shaft, and treated and reused within the surface water management system.

Recycled water is used for a range of non-potable uses at the surface and underground including dust suppression, vehicle wash, fire fighting and road cleaning. Existing water supply infrastructure will be refurbished as part of the Project. A water balance will be prepared as part of the EA.

Stormwater And Sewage

The stormwater collection network at the Russell Vale Site directs 'dirty' runoff (e.g. from the stockpile area and unsealed roads) to a series of site dams for settling, prior to entering an on-site stormwater control dam for primary treatment. From here it is pumped to on-site water treatment facilities. The treated water is either reused on-site or discharged to Bellambi Gully in accordance with conditions of Environment Protection License (EPL) 12040.

At the No. 4 Shaft, stormwater runoff from the workshop which has been routed though oil interceptors is directed to the site's main collector dam for recycling. Where possible all stormwater on site is recycled, for example in spray irrigation. All other stormwater runoff not recycled on-site is diverted off-site in accordance with conditions of Environment Protection License (EPL) 12040. Off site discharges are dependent on climatic conditions.

Three water discharge points are identified within the Environment Protection License (EPL) 12040:

- a concrete weir on energy dissipater in Rath's Gully;
- an outlet pipe located in the square concrete sump located west of the coal stockpile area; and
- waste water that seeps through the dam wall immediately downstream of the stormwater dam.

Sewage generated at the Russell Vale Site is disposed of via connection to Wollongong's reticulated domestic sewage disposal system. At the No. 4 Shaft, sewage is collected and treated at an on-site sewage treatment plant, which is designed to handle wastes from an equivalent population of 1,000 people. It is disposed of by evaporation and transpiration.

2.5 CONSTRUCTION

Construction will occur at the Russell Vale Site associated with proposed upgrades to surface infrastructure, and at the proposed site of the ballast and bulk materials supply borehole. Throughout the life of the Project, short-term construction activities will occur in conjunction with establishment of new gas drainage boreholes. Construction of boreholes may require some minor earthworks and land clearing this will be minimized by siting them adjacent to existing mine infrastructure.

The EAR will identify proposed construction works including construction site locations, staging and method, materials and equipment to be used and the construction timeframes. Assessments of the environmental implications of the project will include assessment of potential impacts of construction activities, including noise, dust, traffic and ecological impacts.

2.6 *WORKFORCE*

NRE No. 1 Colliery currently employs approximately 320 full-time staff and 75 contractors. The Project will increase the number of full-time employees to 350. In addition an estimated 65 persons people will be employed during the construction phase.

2.7 *PROJECT TIMING AND SCHEDULE*

Once the necessary approvals are in place, construction will begin for surface infrastructure upgrades. Mining of the Bulli seam will constitute a continuation of existing operations. Mining of the Balgownie seam is anticipated to commence in 2011 and mining of the Wongawilli seam longwalls in 2012. *Table 2.3* summaries the timing of proposed works.

Table 2.3 Timing of proposed works

Mining Domain	Start	Finish
Bulli Seam		
200's & 300 - Longwall series	Current	FY12
O Panel - First workings	Current	FY09
P Panel - First workings	Current	FY11
S Main drivage	FY09	FY09
V Mains - First workings and pillar extraction	FY09	FY11
V Main Lift - Secondary extraction	FY11	FY14
Bulli West – First workings	Dependent on V-mains but is expected to commence post FY09	
Balgownie Seam		
Balgownie Seam Extraction – Cut and flit mining	FY11	FY15
Wongawilli Seam		
Wonga Mains drivage	Current	FY15
Wonga West Mains drivage	FY13	FY21
Wong East LW Domain – First workings	FY10	FY13
Wonga West LW Domain – First workings	FY13	FY21
Wonga East – Longwalls	FY11	FY14
Wonga West - Longwalls	FY15	FY21

2.8 REHABILITATION

A mine closure plan was developed as part of the Mining Operations Plan (MOP) for NRE No.1 Colliery. This plan will be reviewed and resubmitted as part of the EAR. It is NRE's intention to consider areas that become surplus to needs for rehabilitation as mining works progress.

3 PLANNING AND APPROVALS CONSIDERATIONS

3.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requires approval of the Commonwealth Minister for the Environment for actions that may have a significant impact on matters of National Environmental Significance. The site is not a world heritage property, a natural heritage place, Ramsar wetlands of international importance, nor a Commonwealth marine environment, nor does the proposal include nuclear actions. The potential impacts on Commonwealth listed threatened species and communities will be considered in the EAR. The proposal will be referred to the Commonwealth Minister for the Environment, Heritage and the Arts if it is deemed to include a controlled action.

3.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) details the approval of major infrastructure and other significant 'projects'. It applies to:

"… the carrying out of development that is declared under this section to be a project to which this Part applies:

(a) by a State environmental planning policy, or

(b) by order of the Minister published in the Gazette" (Section 75(b)).

State Environmental Planning Policy Major Projects (SEPP MP) 2005 defines certain developments that are major projects under Part 3A of the EP&A Act and to be determined by the Minister for Planning. As the proposal is for the purpose of coal mining, has a capital investment value of more than $30 million and would employ more than 100 people, it is a project to which Part 3A applies.

The EAR, which assesses the likely impact of a project on the environment, will be prepared in accordance with Section 75(F) of *the EP&A Act*.

3.3 PROTECTION OF ENVIRONMENT OPERATION ACT 1997

Section 48 of the *Protection of Environment Operation Act 1997 (*POEO) Act requires scheduled activities listed in Schedule 1 to hold a premises-based environment protection licence. The mine currently operates under EPL No. 12040. It is expected that the project will necessitate a revision of the existing license. A review of the existing licences will be completed to accommodate the proposal.

3.4 THREATENED SPECIES CONSERVATION ACT 1995

Projects determined by a statutory authority of the NSW State Government, are required to be assessed in accordance with the EP&A Act, as amended by the *Threatened Species Conservation Act 1995 (*TSC Act). The potential impacts on threatened species will be considered in accordance with the requirements of the TSC Act and the EP&A Act.

3.5 STATE ENVIRONMENTAL PLANNING POLICY (MINING AND EXTRACTIVE INDUSTRIES)

State Environmental Planning Policy (Mining and Extractive Industries) allows underground mining as an activity permitted with consent. The Policy includes specific matters for consideration including, provisions to assess compatibility of activities with adjacent land use (Clause 12), natural resource management and assessment of greenhouse gas emissions (Clause 14), optimising resource recovery (Clause 15), transport of materials (Clause 16), and rehabilitation (Clause 17). These matters will be addressed in the EAR.

3.6 DRINKING WATER CATCHMENTS REGIONAL ENVIRONMENTAL PLAN NO.1

The Drinking Water Catchments Regional Environmental Plan (REP) No. 1 applies to land within the hydrological catchments that contribute to Sydney's drinking water supply. It aims to create healthy water catchments that will deliver high quality water whilst sustaining diverse and prosperous communities.

A large part of the PAA is designated as a *Schedule 1 Restricted Access Area (Metropolitan Special Area)* under the Sydney Water Catchment Management Act 1998 and is managed by the Sydney Catchment Authority (SCA). Consequently DWCREP No. 1 applies. The minister may take into account Clauses 25 and 26 of the DWCREP No. 1, in deciding whether or not to approve the project under Part 3A.

Clause 25 states that "*any development or activity proposed to be carried out on land to which this plan applies should incorporate any current recommended practices and performance standards endorsed or published by the Sydney Catchment Authority that relate to the protection of water quality.*"

Clause 26 states that "*A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the hydrological catchment unless:*

a) it has considered whether the proposed development will have a neutral or beneficial effect on water quality, and

b) *it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality."*

3.7 LOCAL PLANNING CONTROLS

3.7.1 Wollongong Local Environmental Plan1990

The Russell Vale Site is zoned 4(c) Extractive Industrial under the Wollongong LEP 1990. The site is recognised in the LEP as a mine site (the South Bulli Colliery) where mining and ancillary activities are permitted with consent. Clause 24 identifies that a Development Consent is not required for this site for the extraction of coal; however this is superseded by the Major Projects SEPP. The balance of the PAA that is within the Wollongong Local Government Area (LGA) is zoned 7(a) Environment Protection. The Russell Vale site is listed as an item of Environmental Heritage (refer *Section 5.11*)

Relevant provisions of the LEP and any relevant parts of Wollongong DCP will be addressed in the EAR.

3.7.2 Wollondilly Local Environmental Plan 1991

A small section of the PAA is within Wollondilly LGA and is zoned 5(c1) (Special Uses (Water Catchment) Zone) under the Wollondilly LEP 1991. Relevant provisions of the Wollondilly LEP will be addressed in the EAR.

4 CONSULTATION

4.1 INTRODUCTION

NRE has a history of consultation and information sharing with the local community, government agencies and other stakeholders regarding operations at NRE No. 1 Colliery. Ongoing consultation and information sharing with these groups has occurred during the Project planning and preliminary assessment phases and will continue throughout the EA process and Project implementation.

4.2 CONSULTATION UNDERTAKEN TO DATE

4.2.1 Consultation with Government Agencies

An Executive Working Group has been established to deal with mining projects in the Southern Coalfield and includes representatives of the DoP, DPI, SCA, Department of Environment and Climate Change (DECC) and Department of Energy and Water (DWE). The Project team held meetings with the Executive Working Group on 20 June 2008 and 26 November 2008. The purpose of these meetings was to gain feedback on the Project and assessment approach and identify specific issues these agencies would like to see addressed. A preliminary Project description was distributed to attendees prior to the first meeting. Following the meeting the project was reviewed and a copy of the draft preliminary assessment report was provided to the Executive Working Group prior to the second meeting.

4.2.2 Community Consultation

Community information sessions facilitated by representatives of NRE and ERM were held on 30 April 2008 at the Russell Vale Community Hall and 18 October 2008 at Corrimal Community Centre. These sessions aimed to provide the local community with information about the Project and approvals process, identify persons interested in being consulted about the Project and identify community views relating to the Project. Session details were advertised in newsletters distributed to residents in the vicinity of the mine and the haul route.

An overview of the Project, assessment and approvals process and key issues to be investigated in the EA, details of the upcoming information session and details of where people could register interest in receiving correspondence regarding the project were included in a newsletter which was distributed to approximately 2,300 residences in October 2008.

Community feedback will be documented in the EAR. In summary, feedback received to date indicates that the local community generally recognise positive economic and employment contributions of the Project. However there are concerns about potential impacts on the local community. Key issues raised relate to potential impacts of dust, noise and traffic associated with surface operations at the Russell Vale Site and coal haulage to PKCT. Other issues raised related to:

- social and economic issues;
- environmental aspects including visual amenity, greenhouse gases, heritage, ecology, groundwater and surface water;
- the need for independent assessment, monitoring and regulation of operation;
- impacts on property values;
- post-mining rehabilitation;
- perceived health impacts association with coal dust;
- the need for regular communications with the local community; and
- ensuring that community views are listened to.

These issues will be assessed as part of the EA.

A dedicated 1800 (free call) number and email and postal address have been established through which the public can seek information or make comments about the Project. All enquires/ comments made are logged and will be documented in the EAR.

4.3 STRATEGY FOR ONGOING CONSULTATION

The overall aim of consultation is for NRE to establish long-term relationships with key stakeholders, to facilitate and enable their inputs to be considered in the Project design, planning and implementation.

4.3.1 Consultation With Government Agencies

The Project team will continue to liaise closely with relevant government departments and the Executive Working Group to ensure that the EA, technical reports and Project design meets key agency and statutory requirements. This will include face-to-face meetings, telephone conversations, e-mail and written correspondence.

Following lodgement of the PAR and project application the DoP will request that relevant government agencies outline the issues that they would like addressed in the EA. These individual agency requirements will form the basis of the DGRs.

4.3.2 Community Consultation

A Community Engagement Strategy will be developed to guide consultation throughout the EA process. The strategy will be designed to provide open and transparent communication and ensure:

- the local community and other stakeholders are aware of the Project and have access to information about the Project and its potential impacts on their lives, businesses and the local environment;
- multiple mechanisms are provided for participation of stakeholders in the EA process and for ongoing communication and feedback; and
- stakeholder issues and concerns are identified and appropriately managed.

Stakeholders will be identified on the basis of the potential direct and indirect impacts they may experience as a result of the Project, as well as their level of interest in the Project.

Community consultation tools to be used during the EA phase are likely to include:

- distribution of newsletters to provide information and invite comment; and
- continued operation of the 1800 information line and email address;
- a webpage linked to the NRE main site which provides Project information and contacts through which enquires can be made; and
- a further information session, held towards the end of the assessment phase, to provide an opportunity for discussion of assessment results and proposed mitigation measures.

If significant issues are raised, targeted consultation with relevant groups or residents would be conducted. This would potentially include phone conversations and establishment and liaison with a community project group comprised of community representatives. Details of consultation undertaken and outcomes will be included in the EAR.

Consultation with the local Aboriginal community is discussed in *Section 5.12.2*.

5 ENVIRONMENTAL, SOCIAL AND ECONOMIC CONSIDERATIONS

5.1 INTRODUCTION

Environmental, social and economic aspects with potential to be impacted by Project activities during construction and operations are identified in this chapter. The issues identification process was based on consultation undertaken with the community and government agencies (refer *Chapter 4*) and preliminary analysis of Project design, the existing environment and Project risks to the existing environment.

A preliminary risk assessment of issues was undertaken (refer *Section 5.17*) to identify the key risk areas upon which the EA should be focussed, along with areas unlikely to be impacted by the Project and which therefore require only limited additional assessment.

Potential impacts will be fully assessed as part of the EA. The EA will also outline measures to manage any adverse environmental impacts identified in association with the Project.

5.2 SUBSIDENCE

The term 'subsidence' is defined by the Mine Subsidence Board as the vertical distance that the ground surface lowers as a result of mining. In flat topography, the ground above an extracted area typically subsides between supported areas (e.g. chain pillars) to form 'troughs'. This results in ground tilts and strains and can cause cracking or localised buckling of strata. In addition, due to the geology and geomorphology of the Southern Coalfield, non-conventional subsidence effects including valley closure, upsidence and regional far-field horizontal displacement can occur as a result of underground mining.

Subsidence can lead to impacts on environmental parameters including surface water, groundwater, ecology and Aboriginal heritage sites as identified in this chapter.

Extraction from the Balwgownie seam by cut and flit mining and first workings within the Bulli and Wongawilli seams, will not result in downward movement of the ground surface greater than 20 mm i.e. zero subsidence. The extraction of longwalls in the Wongawilli seam and pillar extraction in the Bulli seam will potentially result in subsidence of overlying strata, to a lateral extent determined by a maximum 35^0 angle of draw from the secondary extraction.

The amount of subsidence that will occur in a particular area will be dependent on a number of factors including:

- panel and pillar widths;
- extracted seam thickness;
- depth of cover;
- nature of the overburden (lithology, bedding thicknesses, presence of geological structure and defects); and
- surface topography.

A detailed subsidence assessment will be conducted, including calculation of vertical subsidence, tensile strains, tilts and non-conventional subsidence likely to occur as a result of proposed mining. It will also include identification of potential impacts upon environmental features and overlying infrastructure likely to occur as a result of the predicted subsidence. The assessment will also take into account cumulative impacts resulting from subsidence caused by previous and proposed workings.

5.3 RISK MANAGEMENT ZONES

In 2006, in response to concerns about mine subsidence impacts on significant natural features in the Southern Coalfield, the NSW Government established an Independent Inquiry into underground coal mining in the Southern Coalfield. The preliminary findings and recommendations of the Independent Inquiry (2008) report into *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield* (DoP 2008) will be taken into account during the preparation of the EA. This includes identification of Risk Management Zones (RMZs) around all significant natural features on which to focus the EA and management of potential impacts.

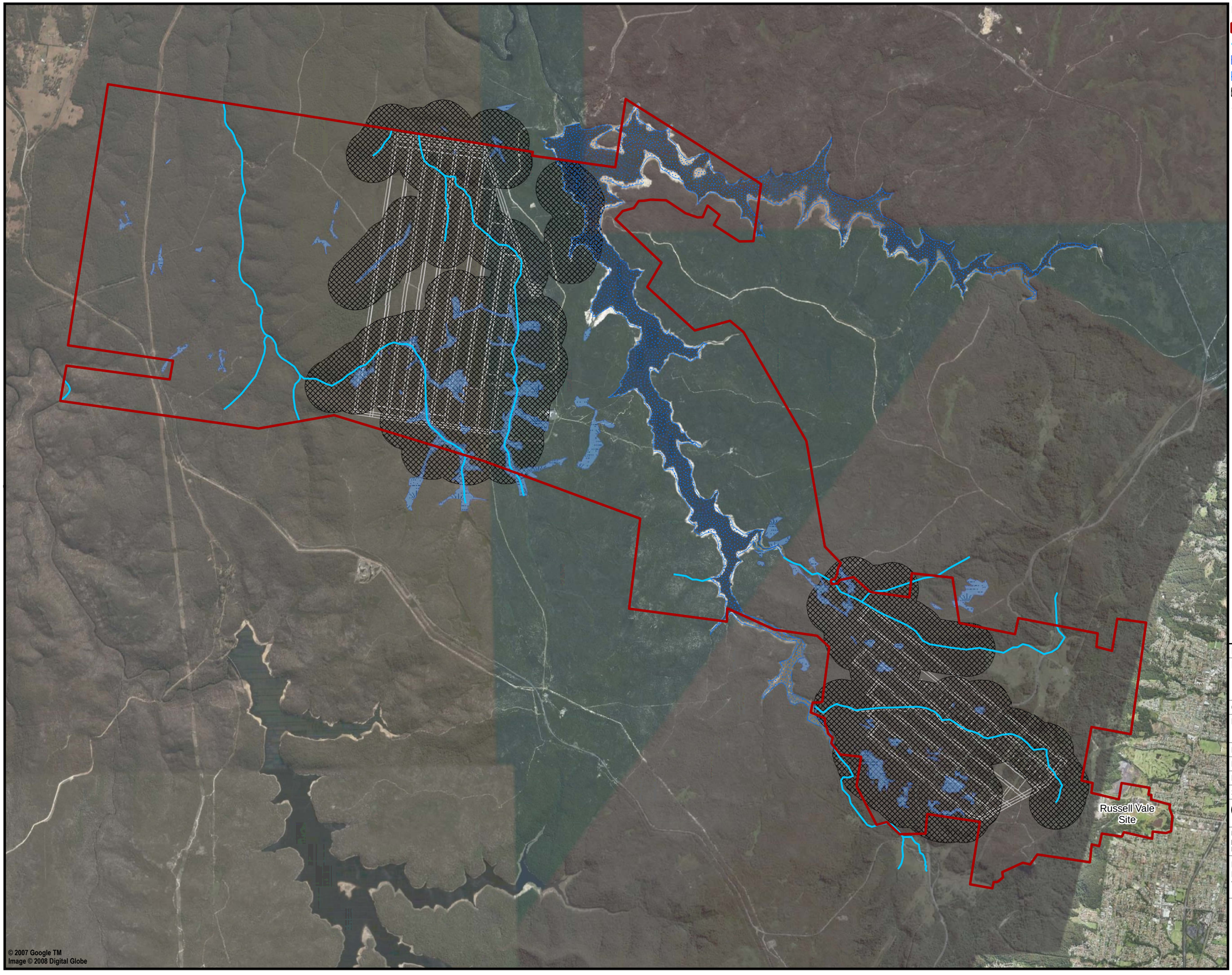
In line with the recommendations of the Inquiry Report, preliminary RMZs have been defined within the PAA and are presented in *Figure 5.1*. These incorporate third order streams or above (in the Strahler stream classification), significant cliff lines and valley infill swamps and land within 400m of these features. RMZs are defined above the proposed Wongawilli seam extraction areas and above the area of Bulli seam pillar extraction in the V Mains. Environmental impact assessment will be focused on the RMZs where the effects of subsidence are likely to impact. First workings in the Bulli seam in the 'Bulli West' area are expected to result in 'zero' subsidence, RMZs have therefore not been defined for this area.

Locations of sensitive features were identified by desktop assessment. This included analysis of aerial photographs and topographic mapping of the PAA and maps of stream orders and upland swamps in the Independent Inquiry report.

It is noted that no significant clifflines are identified in the PAA on the *Bulli 1:25 000 Topographic Series Sheet 9029-II-N (2nd Edition)*. Slope gradients are typically greatest in the vicinity of streams, so the 400 m setback from third order streams and above is considered sufficient to cover any cliff lines which may be present.

It was not possible to distinguish between headwater and valley infill swamps by desktop assessment, so all upland swamps were conservatively included in the preliminary RMZ mapping. Ground truthing is required to determine sensitivity of individual swamps in the PAA to subsidence impacts.

In accordance with the Inquiry a minimum of two years of baseline data will be available for all identified significant natural features prior to longwall extraction.



Legend

- Project Application Area
- 3rd Order Streams and Above
- Upland Swamp
- Cataract Dam
- Risk Management Zone
- Proposed Wongawilli Workings (Indicative)

Figure 5.1

Risk Management Zones

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_RMZ_GIS01_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

N

0 500 1,000 1,500m

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ERM

5.4 GEOLOGY, SOILS AND LANDFORM

5.4.1 Landform And Topography

Topography of the PAA (determined by reference to the *Bulli 1:25 000 Topographic Series Sheet 9029-II-N (2nd Edition)*) ranges from the gently sloping footslopes of the Illawarra Escarpment, to the steep face of the escarpment, to variable landforms across the Woronora Plateau west of the escarpment. This is typical of lands flanking the Illawarra Escarpment in the Wollongong region.

The majority of the ground surface area above the proposed mining area is on the westerly dipping plateau to the west of the escarpment, and ranges in elevation from around 240 to 400 m above the Australian Height Datum (AHD). In this area landforms include broad drainage depressions and uplands swamps, plateau surfaces, narrow to gently undulating crests and ridges, rugged steep slopes (Hazelton and Tille, 1990) and sandstone gorges incised by the deep valleys of the Cataract River and its tributaries. The topographic map does not show any significant cliff lines above the proposed mining area.

Local relief ranges from less than 40 m on plateau surfaces in the western part of the PAA, to 100-200m near the Illawarra Escarpment. Similarly, slope gradients vary from <10% to 20 to 50% on the Illawarra Escarpment.

Elevation at the lip of the escarpment is approximately 400 mAHD. The land slopes steeply from the top of the escarpment to the Russell Vale Site offices, which are at approximately 140 mAHD. From here the terrain slopes relatively gently to the east. The processing area is located on relatively flat land which has been modified by earthworks and ranges in elevation from approximately 30 to 70 mAHD.

Given that the majority of operations will be underground, minimal alterations to landform are predicted. Some subsidence related alterations to the level of the ground surface and consequent tilts, strain and cracking may occur, however these are unlikely to result in obvious changes to landform.

5.4.2 *Geology*

The PAA is located within the Southern Coalfield of the Sydney-Bowen geological basin. The stratigraphic series in the area is formed by a near-horizontal to gently folded succession of sandstones, shales, claystones and coal, of Permian to Triassic age. The north westerly plunging South Bulli Syncline is the dominant geological structure at NRE No. 1 Colliery. Major faults are characteristic of the Southern Coalfield.

According to the *Wollongong 1:250 000 Geological Series Sheet S1 56-9 (2nd Edition)*, the geology of the PAA east of the Illawarra Escarpment comprises Permian age Illawarra Coal Measures, underlain by units of the Shoalhaven Group. Typically the rock types which make up the Illawarra Coal Measures are lithic sandstone, shale, siltstone, tuffs and associated carbonaceous sediments. On the macro scale these rock types form laterally discontinuous interbedded sequences between the more laterally continuous coal seams. The coal reserves comprise the Bulli, Balgownie, Cape Horn, Hargraves and Wongawilli seams, in descending stratigraphic order. The Cape Horn and Hargraves seams are too thin to be of economic interest for mining.

Stretching west of the escarpment, the Permian deposits are overlain by units of the Triassic Narrabeen Group, comprising sandstone, siltsone, claystone, shale and tuffaceous claystone. Further west and extending across the majority of the PAA, these deposits are overlain by Hawkesbury Sandstone, characterised by quartz sandstone with some shale. There are some relatively small areas where the Hawkesbury Sandstone is overlain by the Liverpool sub group which comprises predominantly shale with some sandstone beds.

5.4.3 *Soil Landscapes*

According to the *Wollongong – Port Hacking 1:100 000 Soil Landscape Series Sheet 9029-9129,* a number of different soil landscape units are located across the PAA. The Russell Vale Site is on the Illawarra Escarpment soil landscape. The Warragamba and Hawkesubry soil landscapes occur to the west of the escarpment and the Lucas Heights and Maddens Plains soil landscapes are in the PAA to the east of Cataract Dam. A small area of the Gymea soil landscape occurs along the north eastern edge of Cataract Dam. The Bundeena soil landscape is present along Bellambi Creek.

The diversity of soil landscapes and landforms in the PAA means that the soil has variable properties. Soil types within the PAA include podzolic soils (yellow, red, lateritic and gleyed podzolic soils), lithosols, yellow soloths, yellow earths, brown earths, earthy sands, siliceous sands and leached sands (Hazelton and Tille, 1990). Acid peats are present in swamps and areas of poor drainage (Hazelton and Tille, 1990).

Soils of the PAA commonly developed from Hawkesbury Sandstone and are typically infertile and acidic with a high erosion hazard (DoP, 2008). Mass movement and rock fall hazards are characteristic of the Illawarra Escarpment, Warragamba and Hawkesbury landscapes. There is minimal rock outcrop on the Lucas Heights and Maddens Plains landscapes, however rock outcrop covers more than 25% of the land surface in other areas west of the escarpment.

5.5 LAND TENURE, LAND USE AND INFRASTRUCTURE/ SURFACE IMPROVEMENTS

5.5.1 Land Tenure and Ownership

As outlined in *Section 2.2*, the proposed mining area is within CML 745, MPL 271 and ML 1575, which are held by NRE. Mining leases are current until 2023, 2012 and 2010 respectively. Lease boundaries are shown on *Figure 1.2*.

The surface land is a combination of Crown Land (predominately owned by the SCA), utility easements and freehold and leasehold land held by NRE or private landholders. Tenure and ownership details of properties within the PAA will be detailed in the EA.

5.5.2 Land Use

Land use in the greater Wollongong region includes urban settlement, rural residences and commercial, agricultural, industrial and mining activity. The ground surface of the proposed underground mining area and surface sites west of the escarpment is predominantly zoned in the *Wollongong Local Environmental Plan 1990* for Environmental Protection, and is dominated by Cataract Dam, native bushland and the Illawarra escarpment. This land is managed by the SCA with the aim of protecting water quality. The Russell Vale Site is zoned for Extractive Industrial landuse and the easement along Mount Ousley Road is zoned as Main Roads. The Russell Vale Site is adjoined by Low Density Residential, Light Industrial and Main Roads zones.

The PAA has been used for mining-related activities, including underground mining, coal storage, processing and handling since the mid 19th century and this land use will continue for the current Project. The Project does not involve any change in land use of the site or surrounding areas. It does not require significant clearing or construction works or change to the original use of the site for mining activities.

5.5.3 Infrastructure

Surface areas are already serviced by all necessary infrastructure including potable water, power and telecommunications. As set out in *Section 2.4*, some upgrades to mine-related surface infrastructure are proposed.

The surface area of the PAA is traversed by public infrastructure including a Telstra fibre optic cable, customer access cables which provide external telephone and data services to No. 4 shaft, overhead electrical transmission lines, water supply pipelines, fire trails and public roads.

Ground movements from subsidence can impact surface infrastructure e.g. tilt power poles. Subsidence impacts on surface improvements and potential impacts of the Project on the capacity of existing services will be investigated as part of the EA.

5.6 SURFACE WATER RESOURCES

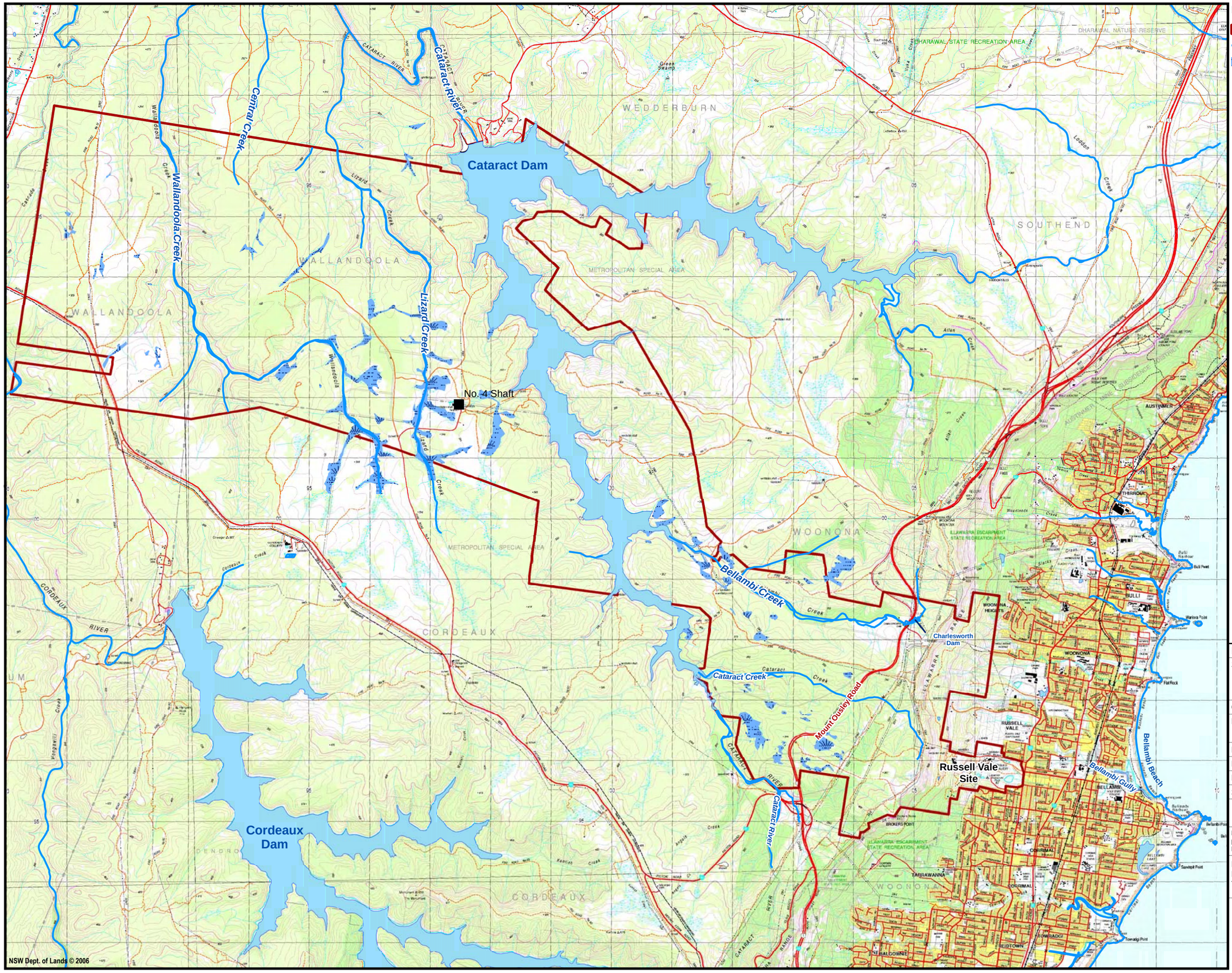
5.6.1 Existing Environment

Surface drainage of the PAA is generally divided by the Illawarra Escarpment. Land west of the escarpment, including the shaft sites and surface of the proposed underground mining area, drains to the Cataract River and Cataract Dam and forms part of the broader Upper Nepean and Hawkesbury Nepean catchments. Surface drainage is to Cataract Dam, perennial streams, upland swamps and ephemeral tributary streams (refer *Figure 5.2*). As indicated in *Section 2.2*, the majority of this land is within a Metropolitan Special Area. The Wonga Mains drivage and a small area of the proposed underground workings extend into the Dams Safety Committee Cataract Notification Area, which was declared under Section 369 of the *Mining Act 1992*.

Land east of the Illawarra Escarpment, including the Russell Vale site drains to Bellambi Gully, which flows east through urban areas of Russell Vale and Bellambi and discharges into the South Pacific Ocean at Bellambi Beach. Some sections of Bellambi Gully predominantly associated with urban development have been artificially channelised. Releases from the Russell Vale Site water management system are discharged directly to Bellambi Gully in accordance with the conditions of EPL No. 12040.

Watercourses of third order and above (according to the Strahler classification scheme) over the proposed underground mining areas include Cataract, Bellambi, Lizard and Wallandoola Creeks. Cataract and Bellambi Creeks flow in a westerly direction, under Mount Ousley Road and discharge into Cataract Dam. Charlesworth Dam is located across Bellambi Creek within the PAA. Wallandoola Creek, Lizard Creek and an unnamed tributary of the Cataract River, termed "Central Creek" have a generally northerly aligment and discharge into the Cataract River to the north of the PAA and upstream of Broughtons Pass Weir. Cataract Dam also discharges into the Cataract River upstream of Broughtons Pass Weir. Broughtons Pass Weir is SCA's point of transfer to water filtration plants at Macarthur and Prospect, to help supply Sydney's potable water.

Toward the headwaters of these creeks, the streams are generally shallow with poorly defined channels, a low bed gradient and upland swamp/ sedge areas are present. Further downstream, bed gradients increase, elongated pools are present and watercourses flow over areas of exposed sandstone bed rock and rock shelves. Deeply incised sandstone gorges flank the creeks at their downstream reaches. Cataract, Bellambi, Lizard and Wallandoola Creeks have been undermined, within and/ or upstream of the PAA.



Legend

- Project Application Area
- 3rd Order Streams and Above
- Upland Swamps

Figure 5.2
Surface Water Features

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_EC_GIS04_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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ERM

Numerous stream inspections and water sampling events have been carried out at waterways within and adjacent to the PAA. Relevant past studies are summarised in *Table 5.1*. Parameters measured in these studies include pH, redox potential, electrolytical conductivity, dissolved oxygen, temperature, major ions and metals.

Table 5.1 Records of Creek Inspections and Water Sampling

Waterbody	Sampler	Sampling Date
Lizard Creek	AWT ES&T Consulting	March 2001
	Seedsman Geotechnics	August-Sept 2001
	Geoterra	November 2001
	CardnoEcology Lab	June-November 2007
	ERM	July 2007- June 2008
	Geoterra	August 2008
Tributary of Lizard Creek	Geoterra	November 2001
	Ecoengineers	July 2006 – March 2008
Wallandoola Creek	Seedsman Geotechnics	August-Sept 2001
	Geoterra	November 2001
	CardnoEcology Lab	June-November 2007
	ERM	July 2007- June 2008
Wallandoola Creek tributary	CardnoEcology Lab	June-November 2007
Central Creek	Geoterra	November 2001
Cataract Dam seep	Seedsman Geotechnics	November 2001
Bellambi Creek	Geoterra	July – August 2008
Cataract Creek	Geoterra	July – August 2008

Monitoring identified that streams within the PAA typically have low pH, salinity and bicarbonate. Nutrient concentrations are elevated above ANZECC and ARMCANZ (2000) criteria at some locations. The majority of analysed metals are below detection limits, though moderately elevated levels of zinc, lead and iron have been recorded at some locations. In-stream iron oxide or hydroxide precipitate has been observed at several locations within the PAA. Water quality measurements from 2001 are similar to those measured post 2006.

Water quality and stream flows within the PAA have been influenced by a number of factors including rainfall and runoff, seepage from groundwater, upland swamps, bush fires and potentially by mine subsidence. Studies by Seedsman Geotechnics Pty Ltd (2001) and Geoterra (2002) did not identify any significant effects on stream flow, water quality or bed or bank stability over areas of Lizard Creek which could be attributed to mine subsidence.

5.6.2 Potential Project Impacts

Surface Operations

NRE has a number of measures in place to minimise impacts on off-site water resources including erosion and sediment controls and water treatment devices. Off-site discharges are controlled and monitored in accordance with EPL 12040. In addition, existing site water management infrastructure is currently being upgraded.

Existing site water management is designed to maximise use of recycled water and minimise demands on local water. No change to the current water supply arrangement set out in *Section 2.4.7* is proposed.

Other than small areas to be disturbed for construction of boreholes, no new surface areas will be disturbed. No modifications to water courses or bulk earthworks (and associated changes to drainage systems) are proposed. Therefore the proposed changes to surface operations are not expected to pose a significant risk to surface water resources.

Underground Operations

Potential impacts of subsidence (both conventional and non conventional) on surface water resources include:

- alterations to drainage paths and localised ponding caused by changes in topography;
- changes to runoff, potentially altering peak flow volumes and water levels and in-stream sediment loads;
- increased bank and channel erosion due to changed flow regime and/ or damage to riparian vegetation, with subsequent turbidity impacts, downstream sedimentation and possible overbank deposition;
- alteration to fluvial geomorphology, including pool and riffle sequences, pool depths, longitudinal connectivity and flooding behaviour;
- changes to surface water quality e.g. increased salinity, electrical conductivity and concentrations of iron oxides, manganese and other metals, reduced dissolved oxygen levels (Booth *et al.* 1998, Booth and Bertsch 1999, Sidle *et al*. 2000, DLWC 2001, Gill 2000 Stout 2003), increased acidity (The Ecology Lab, 2008) and growth of iron oxidising bacteria; and
- cracking and/ or uplift of stream beds, impacting hydrology (e.g. through loss of surface water/ flows), and water chemistry (e.g. through mixing of surface and ground water, weathering and leaching of minerals from bedrock and/ or release of strata and methane gases (Total Environment Centre, 2007)).

Surface water changes can in turn impact water users, amenity and the biota resident within the water (The Ecology Lab, 2008).

Aquifers and the groundwater/surface water interaction are poorly understood in the Southern Coalfield, however can be important for maintenance of stream flows and upland swamps. Potential impacts of subsidence on groundwater are discussed in *Section 5.7.2*.

5.6.3 Proposed Level And Scope Of Further Assessment

A surface water assessment will be conducted as part of the EA, including:

- characterisation of existing surface water (including stream bed geomorphology, flow, water quality and water users) over existing and proposed subsidence areas, including collation of existing monitoring data and further monitoring and inspection at Lizard, Wallandoola, Bellambi and Cataract Creeks and their tributaries;

- assessment of potential Project impacts (including off-site discharges and subsidence) on stream bed and bank geomorphology, flow, flooding and water quality in potentially affected streams and, as applicable, in upland swamps; including a Neutral or Beneficial Effect (NorBE) assessment for surface water flowing to Lake Cataract, Lizard Creek and Wallandoola Creek where they enter Cataract River, and Lizard Creek adjacent to No. 4 Shaft;

- assessment of the suitability of existing site erosion and sediment controls and water and wastewater management ;

- development of a water balance model for mine operations, which takes into account climatic variability and optimises reuse of recycled water and groundwater; and

- development of measures to avoid, mitigate, monitor and/or remediate potential impacts on surface water resources.

5.7 GROUNDWATER RESOURCES

5.7.1 Existing Environment

In general, regional groundwater can be contained within:

- unconfined aquifers within the moderate to high permeability shallow unconsolidated sediments, including soils and the underlying weathered bedrock, swamp land and alluvial deposits associated with stream channels;
- unconfined aquifers in association with consolidated rocks near the surface;
- confined aquifers in association with consolidated rocks located far enough below the ground surface that the groundwater is stored under pressures greater than atmospheric;
- perched, low yield water tables at the interface between the low permeability shales of the Ashfield and Mittagong Geologic Formations and the Hawkesbury Sandstone; and
- minor ephemeral, shallow perched water tables within upland swamps (however the water level and flows through the swamps are highly dependent on rainfall and shallow groundwater seepage from the adjoining basement outcropping areas).

Siltstones and claystones have low permeability and are considered to be aquitards and aquicludes. They typically impede groundwater exchange between adjacent strata.

Groundwater flow rates are higher in the moderate to high permeability shallow unconsolidated aquifer systems than low permeability deeper consolidated rocks like the Hawkesbury Sandstone. The groundwater system provides a base flow component to stream flow and can help maintain upland swamps. Groundwater seeps at relatively low rates into the receiving streams through fractures, bedding planes and joints primarily in sandstone, as well as on top of shale / sandstone interbeds. Groundwater also supports groundwater dependent ecosystems.

The groundwater quality is variable. In general, sandstone and shales of the Woronora Plateau do not provide good aquifers for utilisation of groundwater resources. Past sampling indicates that shallow groundwater in association with upland swamps is relatively fresh and acidic.

There are several existing piezometers in the vicinity of the PAA including:

- two shallow (0.77 to 1.8 m below the surface) piezometers in upland swamps associated with the Lizard Creek tributary which have been monitored since September 2007;
- two vibrating wire piezometers and one open standpipe piezometer, installed adjacent to previously mined longwall panels and the western shore of Cataract Dam in December 1992, August 1993 and November 1998 respectively; and
- two deep vibrating wire piezometers installed by BHP Billiton to the north of the PAA; no data is currently available for their construction or monitoring.

5.7.2 Potential Project Impacts

Key potential impacts of the Project on groundwater relate to subsidence and may include:

- increases in substrate permeability and localised declines in groundwater levels;
- temporary lowering of the groundwater surface, potentially recovering to its original level after maximum subsidence has developed at the particular location;
- cracking of perched aquifers, causing them to drain downwards, or downwards and sideways along bedding planes;
- enhanced groundwater seepage into surface water bodies, including generation of new seeps into streams;
- increased rate of recharge e.g. surface flows redirected underground;
- changes to groundwater flow pathways; and
- changes to water chemistry of shallow groundwater, or via mixing of water between aquifers with different water chemistries or aquifers and surface water.

Groundwater dependent ecosystems may be impacted by changes to groundwater systems. Otherwise, the potential impacts to groundwater are only an issue in areas where the aquifer is in connection with the surface drainage network or a prospective use exists for the groundwater.

As is typical for underground coal mines, groundwater inflows into the workings has implications for mine and water management. NRE's existing mine water management systems will be employed to manage groundwater inflows. There is potential for subsidence-induced disruptions to overlying aquifers to result in additional groundwater inflows which could pose a mine water management issue. Based upon considerable history of mining within the PAA this is not expected to be an issue.

5.7.3 Proposed Level And Scope Of Further Assessment

A groundwater assessment will be undertaken as part of the EA including:

- installation of new deep vibrating wire piezometers and shallow open standpipe piezometers (seven in total) in shallow bedrock, upland swamps and deep bedrock strata over or adjacent to existing and proposed subsidence areas;
- monitoring of groundwater level, pressure head and water quality at existing and new piezometers;
- characterisation of groundwater within the PAA, including collation of existing and proposed future monitoring data;
- groundwater modelling;
- assessment of potential Project impacts on groundwater levels, quantity and quality;
- investigation of groundwater inflows to mine workings will be conducted, especially in respect of neighbouring and abandoned mine workings which may be flooded; and
- development of measures to avoid, mitigate, monitor and/or remediate potential impacts on groundwater.

5.8 AIR

5.8.1 Existing Environment

Dust is potentially generated at the Russell Vale Site from coal conveying, stockpiling, processing and loading, drip dust from the vehicle wash, remediation and rehabilitation, exposed coal stockpiles and vehicle movements on unsealed surfaces. Emissions from other operational areas of the PAA predominantly relate to operation of plant and equipment (e.g. diesel usage), fugitive coal seam gas emissions and emissions from the ventilation systems.

NRE currently monitor and manage dust emissions in accordance with the requirements of EPL No. 12040. This includes monthly monitoring of dust deposition at five dust monitoring gauges surrounding the Russell Vale Site. A number of measures are currently in place to manage air quality impacts of operations at NRE No. 1 Colliery, including:

- covers on surface conveyors and trucks hauling coal to PKCT;
- use of a water cart to suppress dust on internal roads and stockpiles as required;
- automatic/ manual fixed water sprays at active stockpiles and associated roads;
- sealed carparks, permanent internal roads and surface areas at the Russell Vale Site; and
- operation of a truck wash for all haul trucks.

5.8.2 Potential Project Impacts

Potential air quality impacts associated with the Project primarily relate to surface activities at the Russell Vale Site. This will include dust emissions from those sources identified above and short-term construction activities, and fugitive and ventilation system coal seam gas emissions. Greenhouse gas emissions are discussed in *Section 5.9*.

Given the relatively close proximity of residences to the Russell Vale Site (refer *Figure 1.2*), there is potential for site dust to adversely impact these receivers. Due to the remote location of the ventilation fans, vent emissions are unlikely to significantly impact surrounding land uses.

In addition to those mitigation measures discussed above, site dust controls will be upgraded as part of this Project to minimise potential impacts on nearby communities.

5.8.3 Proposed Level and Scope of Further Assessment

An air quality impact assessment will be undertaken for the EA in accordance with DECC (2005) A*pproved Methods for the Modelling and Assessment of Air Pollutants in New South* Wales. This is anticipated to include:

- desktop assessment to characterise existing air quality and meteorological conditions of the region, and geographical features of the site and surrounding area with potential to affect air dispersion;
- identification of emission sources and development of an emissions inventory for the Project;
- development of measures to be incorporated into the Project design and operations to mitigate the risks of adverse impacts;
- air dispersion modelling of emissions from the Project, for normal and worst-case conditions, to predict future ambient pollutant concentrations, taking into account existing baseline conditions and potential interactions with any emissions from existing and planned future facilities;
- assessment of whether predicted contaminant concentrations are acceptable, including comparison against relevant criteria; and
- development of additional monitoring and management measures to avoid, mitigate or offset potential air quality impacts.

No potential odour sources have been identified by this preliminary assessment. If any potential odour impacts are identified during the air quality assessment, they will be assessed in accordance with the DECC draft policy *Assessment and Management of Odour from Stationary Sources in NSW*.

5.9 GREENHOUSE GAS

In the context of this assessment, greenhouse gas (GHG) emissions refer to the six direct GHG regulated by the United Nations Framework Convention on Climate Change and the Kyoto Protocol. These are carbon dioxide (CO_2), methane (CH_4), nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

GHG emissions will result from activities associated with the Project that consume energy. This will predominantly be emissions from electricity consumption, CH_4 released from coal and rock strata (fugitive emissions of vented to the atmosphere via gas drainage boreholes and the ventilation system), and CO_2, nitrous oxide and CH_4 from combustion of fossil fuels for operation of diesel powered equipment.

As part of the EA, an assessment of GHG emissions will be undertaken in accordance with relevant legislation and guidance, including methodologies outlined in the Australian Greenhouse Office *Factors and Methods Workbook*. It will involve quantitative calculation of Project GHG emissions, interpretation of their impact and identification of GHG reduction and energy conservation measures to be implemented. Scope 1, 2 and 3 emissions will be calculated:

- Scope 1 direct emissions: from sources within the PAA as a direct result of Project activities e.g. emissions from underground, combustion of fossil fuels (e.g. diesel and fuel oil) in equipment used on-site and fugitive emissions;

- Scope 2 indirect emissions: from consumption of purchased electricity, steam or heat produced by another organisation; and

- Scope 3 indirect emissions: all other emissions that are a consequence of NRE's activities but are not from sources owned, or controlled, by NRE e.g. end-use combustion of the product coal and indirect emissions associated with the extraction of fuels to supply diesel and electricity.

5.10 ACOUSTICS

5.10.1 Existing Environment

Operational and transport noise generated from existing Russell Vale Site operations contribute to the existing acoustic environment in the vicinity of the site. This includes noise from plant and equipment used for coal handling, stockpiling, reclaim, processing and load-out, compressors, fans, pumps and site vehicle movements. Noise from coal trucks is a component of existing road noise on the existing coal haulage route to PKCT. Noise emissions associated with gas drainage equipment and ventilation infrastructure above the mining areas are limited in nature, and generally remote from sensitive receivers.

NRE implements a number of measures to reduce noise emissions, including imposition of speed limits on haul trucks on Bellambi Lane, minimal to no use of compression braking, modern design of truck bodies to reduce body rattle and drivers code of conduct.

5.10.2 Potential Project Impacts

There are residences immediately adjacent to the Russell Vale Site boundaries, to the north, east and south, with the nearest sensitive receiver located within 100 m of the stockpiling and load-out areas. Noise from operations has the potential to impact the surrounding sensitive receivers

The likely noise generating activities include those activities identified in *Section 5.10.1* and are predominantly associated with operation of fixed and mobile plant and transport of product coal. Noise controls and the trucking fleet will be upgraded as part of the Project. Additional coal haulage and extension of operating hours may increase noise levels experienced at sensitive receivers

There will also be minor short-term noise impacts associated with construction activities and upgrades to surface infrastructure.

5.10.3 Proposed Level And Scope Of Further Assessment

An acoustics impact assessment will be undertaken as part of the EA, in accordance with DECC (2000) *Industrial Noise Policy* (INP), DECC (2004) *Environmental Noise Control Manual* and DECC (1999) *Environmental Criteria for Road Traffic Noise*. This is anticipated to include:

- quantification of existing noise levels in the receiving environment and characterisation of existing influences on the local noise climate, local meteorological conditions with potential to affect noise propagation, and ground contours of the surrounding land;
- determination of Project specific noise criteria to maintain amenity for the surrounding land uses;
- identification of noise sources, equipment sound power levels and operating times and locations for noise generating plant and equipment;
- quantitative modelling of noise emissions from the facility (for normal and worst-case scenarios, including calm and worst-case meteorological conditions in terms of noise propagation), to predict future noise levels at sensitive receivers during day, evening and night-time periods, taking into account existing baseline conditions and potential interactions with noise from existing and planned future facilities;
- assessment of whether predicted construction, operation, road traffic and cumulative noise levels are acceptable; and
- development of monitoring and management measures to avoid, mitigate or offset potential noise impacts. For example upgrading truck braking systems and better designed truck bodies to reduce noise.

5.11 ECOLOGY

5.11.1 Existing Environment

Overview

The majority of land overlying the proposed mining area is within a Metropolitan Special Area. Access to this Area is restricted and it has a relatively low level of vegetation disturbance. It is predominantly covered by dry sclerophyllous woodland and forest, interspersed with upland swamps and watercourses. There are some areas of heath and rainforest (DoP, 2008). Native vegetation has previously been cleared at areas of existing infrastructure, including at the Russell Vale site, shafts and along access tracks.

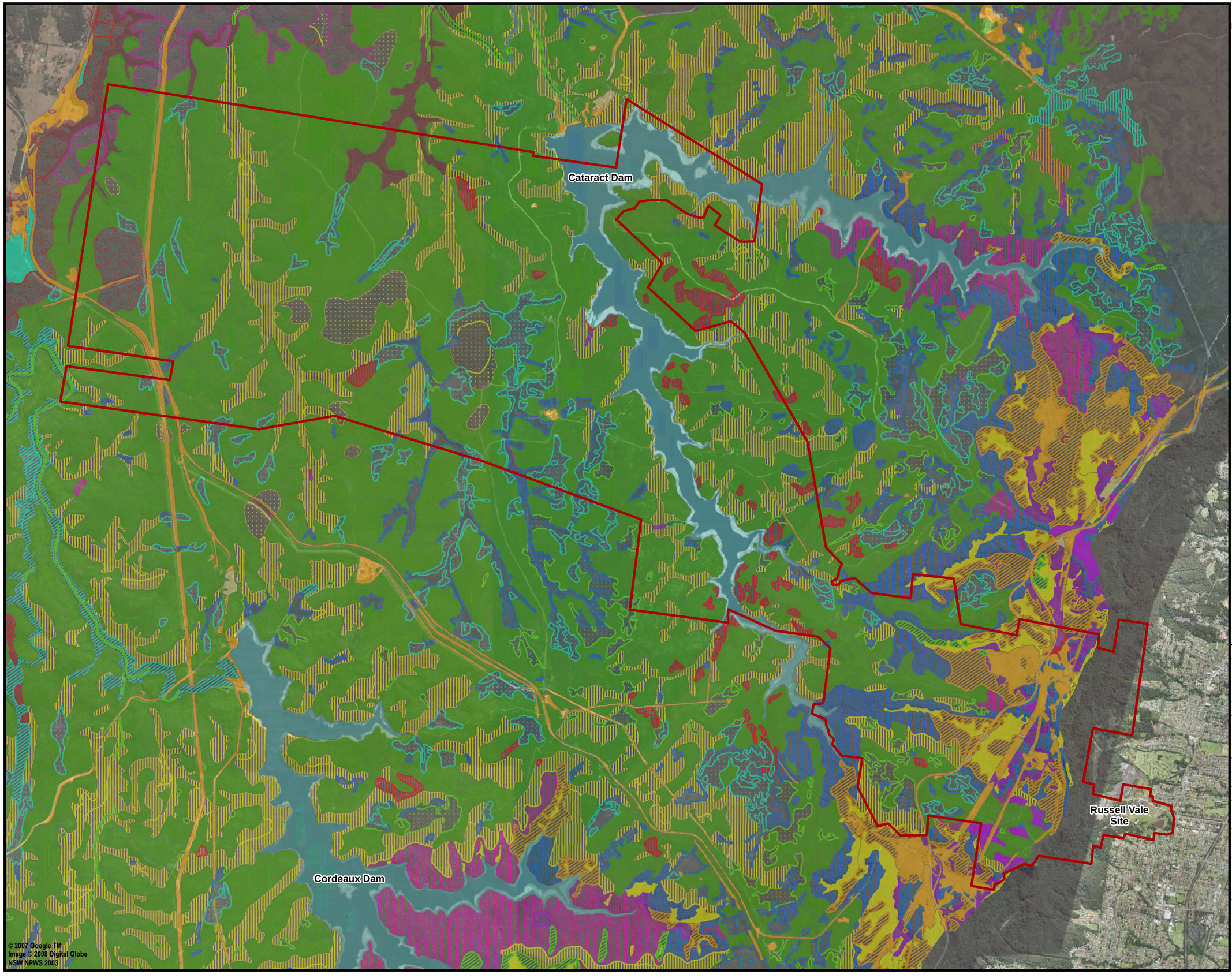
The Southern Coalfields underlie a region of high conservation value, which will form part of the proposed State and National 'Alps to Atherton' Conservation Corridor announced by the NSW Environment Minister in 2007 (DECC, 2007).

Vegetation Communities and Fauna Habitat

Mapping of vegetation communities undertaken by NPWS (2003) is reproduced in *Figure 5.3* and indicates that the PAA is predominantly covered by Exposed Sandstone Scribbly Gum Woodland and Upland Swamps: Fringing Eucalypt Woodland. DECC (2007) mapped significant swamp clusters (considered to provide large contiguous areas of habitat) in the Southern Coalfield. The 'Wallandoola Creek significant swamp cluster' extends across part of the PAA.

Areas of ecological sensitivity identified within the PAA (when considering potential impacts of subsidence) are waterways, upland swamps, areas of rocky habitat and endangered ecological communities. These areas all provide habitat for a variety of flora and fauna, including potential habitat for a number of threatened species. A map showing areas of potential ecological sensitivity is provided in *Figure 5.4*. It is noted that the 50 m buffer zone around waterways encompasses areas considered to potentially contain rocky habitat i.e. expected to occur within relatively steep areas, often in association with creeklines. Areas of ecological sensitivity identified in *Figure 5.4* lies within the RMZs defined on *Figure 5.1*.

There are a variety of aquatic environments in the region. Aquatic surveys undertaken at streams in the local area have recorded a range of macroinvertebrates and native fish and freshwater crayfish species (DECC, 2007; Cardno Ecology Lab 2003, 2005, 2008; Ecowise, 2005). These surveys included Lizard Creek, Wallandoola Creek, Cataract River and tributaries of Wallandoola Creek and Cataract Dam.



Legend

- Project Application Area
- Artificial Wetlands
- Cleared
- Coachwood Warm Temperate Rainforest
- Cumberland Shale Hills Woodland
- Cumberland Shale Plains Woodland
- Escarpment Blackbutt Forest
- Escarpment Edge Silvertop Ash Forest
- Exposed Sandstone Scribbly Gum Woodland
- Highlands Shale Tall Open Forest
- Moist Blue Gum-Blackbutt Forest
- Moist Coastal White Box Forest
- Moist Gully Gum Forest
- Nepean Sandstone Gully Forest
- O'Hares Creek Shale Forest
- Regenerating Vegetation
- Rock Pavement Heath
- Rock Plate Heath-Mallee
- Sandstone Gully Apple-Peppermint Forest
- Sandstone Gully Peppermint Forest
- Sandstone Riparian Scrub
- Silvertop Ash Ironstone Woodland
- Tall Open Blackbutt Forest
- Tall Open Gully Gum Forest
- Tall Open Peppermint-Blue Gum Forest
- Transitional Shale Dry Ironbark Forest
- Transitional Shale Open Blue Gum Forest
- Transitional Shale Stringybark Forest
- Upland Swamps: Banksia Thicket
- Upland Swamps: Fringing Eucalypt Woodland
- Upland Swamps: Sedgeland-Heath Complex
- Upland Swamps: Tea-Tree Thicket
- Upper Georges River Sandstone Woodland
- Water
- Weeds and Exotics
- Western Sandstone Gully Forest

Figure 5.3

Vegetation Communities (NPWS, 2003)

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_EC_GIS03_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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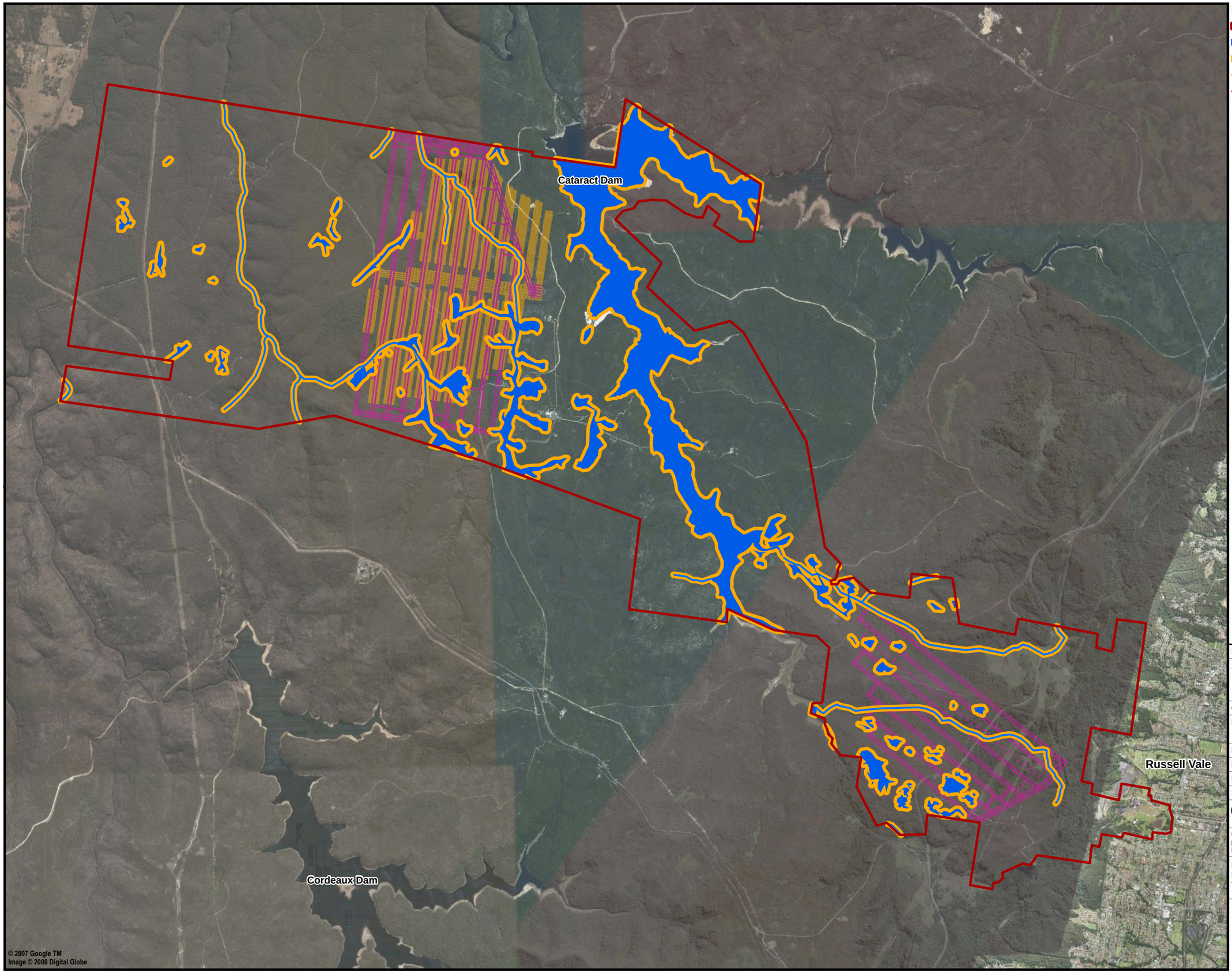

Legend

- Project Application Area
- High Sensitivity Area
- Moderate Sensitivity Area
- Proposed Balgownie Workings (Indicative)
- Proposed Wongawilli Workings (Indicative)

Figure 5.4

Areas of Ecological Sensitivity

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_EC_GIS02_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

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ERM

Endangered Ecological Communities

Two endangered ecological communities have been mapped within the mine lease area (refer *Figure 5.3*):

- Shale/ Sandstone Transition Forest (listed as endangered under the TSC Act and the EPBC Act), occurring in the western part of the leasehold as:
  - Transitional Shale Stringybark Forest;
  - Transitional Shale Open Blue Gum Forest; and
- O'Hares Creek Shale Forest (listed as endangered under the TSC Act), mapped as small pockets to the north of the No. 4 Shaft and to the east of Cataract Dam.

Threatened Species

Review of the DECC (2007) *Submission on the strategic review of the impacts of underground mining in the Southern Coalfield* report identified a number of threatened flora and fauna species which have been recorded in the Southern Coalfield. Those threatened species considered to have habitat susceptible to subsidence impacts are identified in *Tables 5.2* and *5.3*.

Searches of the DECC Wildlife Atlas Database and the DEWHA online search for Matters of NES identified a number of other threatened flora and fauna listed under the TSC Act and/or EPBC Act which have previously been recorded within a 10km radius of the PAA. The background searches also identified a number of Commonwealth listed migratory species which have the potential to occur within the PAA.

Aquatic environments within the PAA provide potential habitat for the following aquatic threatened species:

- Macquarie Perch (*Macquaria australasica*) which is listed as endangered under the EPBC Act and vulnerable under the Fisheries Management Act 1995 (FM Act);
- Sydney Hawk Dragonfly (*Austrocordulia leonardi*) which is listed as endangered under the FM Act; and
- Adam's Emerald Dragonfly (*Archaeophya adamsi)* which is listed as vulnerable under the FM Act.

The threatened Macquarie Perch (*Macquaria australasica*) was recorded in the Cataract River downstream of the PAA by DECC (2007) and Cardno Ecology Lab (2003, 2005). No other threatened aquatic species are known to have been recorded during the aquatic ecology surveys referenced previously.

Table 5.2 Threatened and rare terrestrial fauna species recorded within habitats of the Southern Coalfields that may be impacted by subsidence

Sensitive fauna species	TSC Act	EPBC Act	Habitat in upland swamps	Habitat in creeks or rivers	Habitat on cliffs, rock benches or overhangs
Beautiful Firetail *Stagonopleura bella*	-	-	**Yes**	No	No
Black Bittern *Ixobrychus flavicollis*	V	-	No	**Yes**	No
Broad-headed Snake *Hoplocephalus bungaroides*	E	V	No	No	**Yes**
Brush-tailed Rock Wallaby* *Petrogale penicillata*	E	V	No	No	**Yes**
Eastern Bentwing-bat** *Miniopterus schreibersii oceanensis*	V	-	No	No	**Yes**
Eastern Bristlebird* *Dasyornis brachypterus*	E	E	**Yes**	No	No
Eastern Pygmy Possum *Cercartetus nanus*	V	-	**Yes**	No	No
Giant Burrowing Frog *Heleioporus australiacus*	V	V	**Yes**	**Yes**	No
Green and Golden Bell Frog* *Litoria aurea*	E	V	No	**Yes**	No
Ground Parrot* *Pezoporus wallicus*	V	-	**Yes**	No	No
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	No	No	**Yes**
Large-footed Myotis *Myotis adversus*	V	-	No	**Yes**	No
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	**Yes**	**Yes**	No
Little Tern *Sterna albifrons*	E	-	No	**Yes**	No
Long-nosed Potoroo * *Potorous tridactylus*	V	V	**Yes**	No	No
Platypus*** *Ornithorhynchus anatinus*	-	-	No	**Yes**	No
Red-crowned Toadlet *Pseudophryne australis*	V	-	**Yes**	**Yes**	**Yes**
Rosenberg's Goanna *Varanus rosenbergi*	V	-	**Yes**	No	No
Southern Emu Wren *Stipiturus malachurus*	-	-	**Yes**	No	No

1. Source: DECC (2007, 2008)

2. * May be locally extinct, ** maternity sites in caves and disused mines are a very high conservation priority, *** species has a low conservation priority but is of high interest to the community.

3. V- vulnerable; E - endangered

Table 5.3 Threatened and rare flora species recorded within habitats of the Southern Coalfields that may be impacted by subsidence

Sensitive flora species	TSC Act	EPBC Act	ROTAP status	Habitat in upland swamps	Habitat in creeks or rivers	Habitat on cliffs, rock benches or overhangs
Acacia baueri subsp. aspera	V	-	2RC-	No	No	**Yes**
Blandfordia cunninghamii	-	-	3RCi	**Yes**	No	**Yes**
Lizard Orchid *Burnettia cuneata*	-	-	3RC-	**Yes**	No	No
Darwinia grandiflora	-	-	2RCi	**Yes**	No	No
Epacris coriacea	-	-	3RC-	No	No	**Yes**
Epacris purpurascens var. purpurascens	V	-	2KC-	**Yes**	**Yes**	No
Yellow-topped Mallee-ash *Eucalyptus luehmanniana*	-	-	2RCa	No	No	**Yes**
Creeping Raspwort *Gonocarpus salsoloides*	-	-	3RCa	**Yes**	No	No
Fern-leaf Grevillea *Grevillea longifolia*	-	-	2RC-	No	**Yes**	**Yes**
Small-flower Grevillea *Grevillea parviflora subsp. Parviflora*	V	V	-	**Yes**	No	No
Hibbertia hermanniifolia	-	-	3RCa	No	No	**yes**
Shiny-leaf guinea flower *Hibbertia nitida*	-	-	2RC-	No	**Yes**	No
Woronora Beard-heath *Leucopogon exalasius*	V	V	2VC-	No	**Yes**	No
Lissanthe sapida	-	-	3RCa	No	No	**Yes**
Lomandra fluviatilis	-	-	3RCa	No	**Yes**	No
Yellow Loosestrife *Lysimachia vulgaris var. davurica*	E	-	-	**Yes**	**Yes**	No
Deane's Paperbark *Melaleuca deanei*	V	V	3RC-	**Yes**	No	No
Monotoca ledifolia	-	-	3RCa	No	**Yes**	**Yes**
Rufous Pomaderris / Brown Pomaderris *Pomaderris brunnea*	V	V	2VC-	No	**Yes**	No
Prickly Bush-pea *Pultenaea aristata*	V	V	2V	**Yes**	No	No

V- vulnerable; E - endangered

5.11.2 Potential Project Impacts

Surface Operations

Surface operations will predominantly be within existing areas of operation that have been cleared. A small amount of native regrowth vegetation clearing may be required for construction of new boreholes, which could have a minor localised impact.

Potential impacts on the aquatic ecology of streams in the vicinity of surface facilities would primarily be confined to potential adverse impacts on water quality and flows e.g. associated with discharge/ runoff of water from the site. Water quality impacts are discussed in *Section 5.6.2*.

The Green and Golden Bell frog has been recorded at the various water storage dams at Russell Vale. A special management program will be developed to promote and support the survival of this important species.

Underground Operations

Potential impacts of underground mining on ecological features relate primarily to potential subsidence impacts on waterways, upland swamps and areas of rocky habitat and consequent impacts on species which utilise these areas as habitat. This potentially includes threatened species and endangered ecological communities. 'Alteration of habitat following subsidence due to longwall mining' is listed as a key threatening process in Schedule 3 of the TSC Act (NSW Scientific Committee, 2005).

Subsidence-induced impacts on waterways (identified in *Section 5.6.2*) could lead to:

- loss, degradation or reduced diversity of aquatic or in-stream habitats (e.g. changes in the persistence of stream flow and in-stream pools, stream connectivity and water quality);
- changes to riparian vegetation;
- changes to aquatic biota assemblages (e.g. aquatic macroinvertebrates, macrophytes and fish), and risk of impacts to any threatened aquatic species present; and
- to a lesser extent, impacts on terrestrial organisms which utilise affected waterways.

If subsidence results in surface cracking, there is potential for the following impacts on upland swamps:

- draining of perched water table and loss of swamp soil moisture;
- loss of swamp vegetation dependent on high soil moisture, or changes to species composition;
- loss of fauna dependent on swamp ecosystems;
- loss of water purification and flow regulation function for downstream ecosystems; and
- increased susceptibility to fire.

Subsidence-induced cracking of rocky habitats could result in areas becoming unsuitable for species which utilize these areas as habitat e.g. the threatened Broad-headed snake.

Subsidence impacts on terrestrial ecology are less likely than for aquatic ecology. Potential soil moisture changes pose the greatest potential threat to terrestrial ecology (DECC, 2007).

5.11.3 Proposed Level And Scope Of Further Assessment

Terrestrial and aquatic ecology assessments will be prepared as part of the EA, including:

- compilation and review of existing ecology data, including outcomes of surveys previously conducted in the local area;
- targeted field surveys of:
  - aquatic ecology, both within the potential subsidence zone and at control zones outside of this zone, including characterisation of aquatic biota (macroinvertebrate, macrophyte and fish assemblages) and aquatic habitats;
  - terrestrial flora and fauna, conducted within the areas of sensitivity above the proposed longwall mining area (refer Figure 5.4) and at any previously undisturbed areas which will be subject to clearing or ground disturbance for upgrade of surface infrastructure or construction of new infrastructure. These surveys will aim to identify the likelihood of threatened species or their habitats occurring on-site;
- assessment of potential Project impacts on ecological values;
- assessment of the significance of potential impacts on any threatened species identified as likely to occur in the PAA, conducted in accordance with Guidelines for Threatened Species Assessment for applications assessed under Part 3A of the EP&A Act; and

- development of measures to avoid, mitigate or offset potential impacts.

Baseline monitoring of aquatic ecology has commenced at potential impact locations in Lizard, Wallandoola, Bellambi and Cataract Creeks, and at control sites in the Cataract River and Loddon Creek.

5.12 HERITAGE

5.12.1 Non-indigenous Heritage

Existing Environment

The following sources were searched to identify heritage listed items located within or adjacent to the PAA:

- NSW State Heritage Register;
- National Heritage List;
- Commonwealth Heritage List;
- Wollondilly Local Environmental Plan (LEP) 1991;
- Wollongong LEP 1990;
- Sydney Water Section 170 Heritage and Conservation Register; and
- Register of the National Estate.

Three items of historical heritage significance were identified and these items are notated in *Table 5.4*.

Table 5.4 Items of Historical Heritage Significance Within and Adjacent to the PAA

Item	Listing	Brief Description	Location
Cataract Dam	• NSW State Heritage Register • Wollondilly LEP 1991	Wall of Cataract Dam, completed in 1907. Unique construction.	Cataract Dam, to the north east of the PAA.
Corrimal Reservoirs No.1 and No.2	• Sydney Water Section 170 Heritage and Conservation Register	Two adjacent steel reservoirs of local significance.	Southern part of the Russell Vale Site, within the PAA.
South Bulli Colliery	• Schedule 1 of the Wollongong LEP	Mine site (present-day Russell Vale Site) listed as state significant.	Russell Vale Site, within the PAA.

Impact of Proposed Works

The wall of Cataract Dam is outside of the PAA and the proposed extent of subsidence, and therefore will not be impacted by the Project.

Heritage values of South Bulli Colliery (the Russell Vale Site) and Corrimal Reservoirs No. 1 and No. 2 could be impacted by the proposed surface infrastructure upgrades at the Russell Vale Site. The South Bulli Colliery heritage listing does not provide details of specific items on the site to which heritage value may be attached. Further assessment will be undertaken to determine whether heritage items are located within the proposed development footprint.

Future Assessment Required

A non-indigenous heritage assessment will be prepared as part of the EA. This will include:

- description of the identified heritage sites and values within the PAA, based on:
    - further literature review;
    - consultation with any local heritage societies, Wollongong Council and potentially, Sydney Water; and
    - a targeted survey at the Russell Vale Site, to ground-truth heritage listings and identify any unrecorded heritage values;
- assessment of potential Project impacts on any identified heritage values, including preparation of a Statement of Heritage Impact, in accordance with relevant NSW guidelines; and
- development of mitigation and management recommendations to minimise any potential impacts.

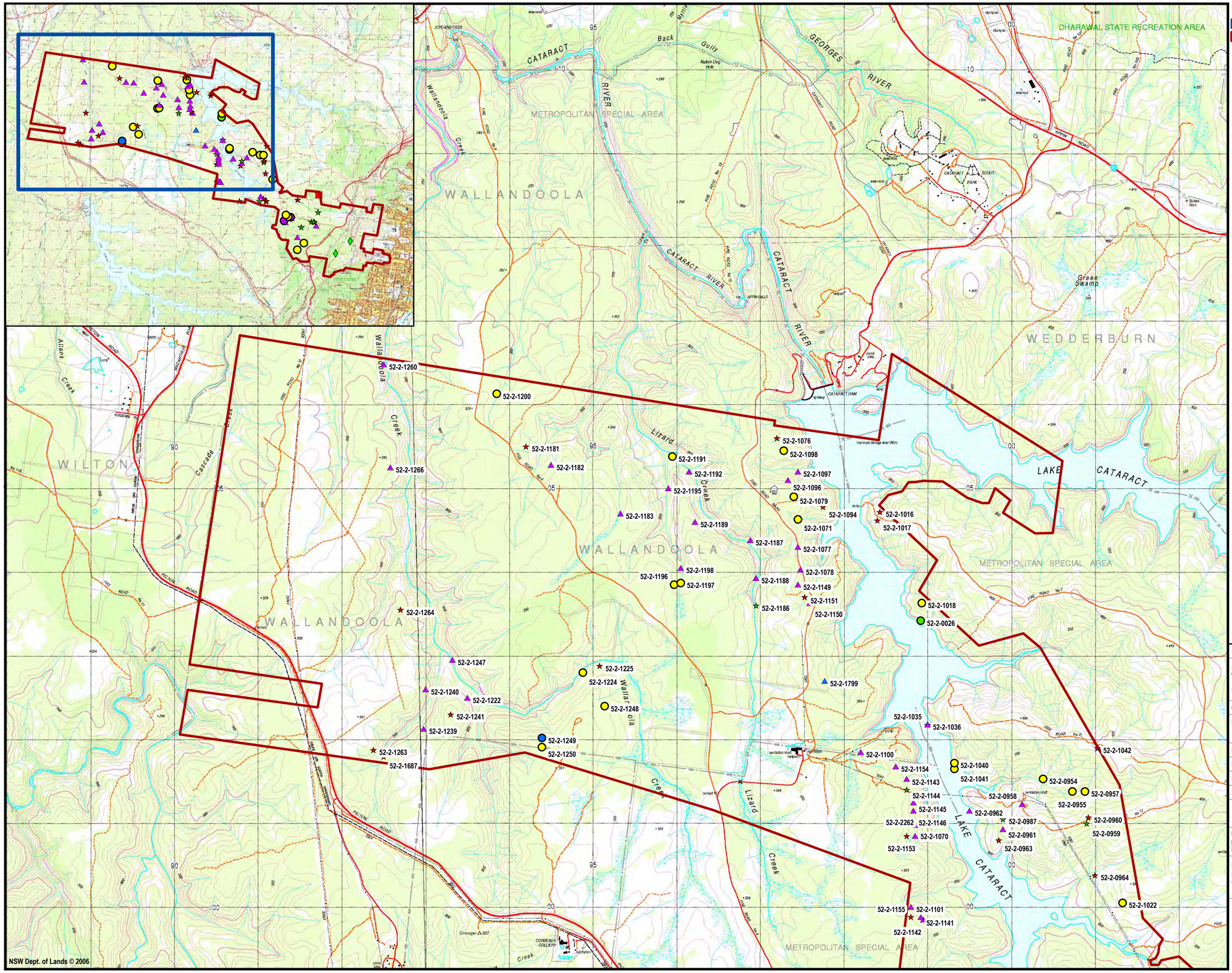
5.12.2 Aboriginal Heritage

Existing Environment

There is extensive evidence of Aboriginal occupation of the Illawarra region, with the earliest evidence dating to 20,000 years before the present (Lampert 1971). Prior to European occupation the Wodi Wodi tribal group occupied the Illawarra region (Tindale 1974).

No systematic survey of the PAA has been conducted to date. However, a number of archaeological surveys have been conducted in the local area, three of which included survey of part of the PAA near to Cataract Dam (Navin 1995, 2001a and 2001b). Numerous archaeological sites were recorded during these surveys and predictive models for Aboriginal occupation of the landscape have been developed.

A search of the DECC Aboriginal Heritage Information Management Systems (AHIMS) database for registered archaeological sites identified 234 sites within an area of 19 km by 21 km centred on the PAA (refer to *Figures 5.5* and *5.6* for locations of sites). Of these, 107 sites are located within the PAA. Archaeological features registered within the PAA are summarised in *Table 5.5*. It is noted that several sites contain a number of archaeological features e.g. a rock shelter may contains both art and an occupation deposit, therefore the total number of archaeological features is greater than the number of sites.



Legend

- Figure Coverage
- Project Application Area
- Axe Grinding Groove
- Axe Grinding Groove, Rock Engraving
- Axe Grinding Groove, Shelter with Art
- Scarred Tree
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Shelter with Deposit

Figure 5.5

Archaeological Sites Recorded Within the Project Application Area (AHIMS) - Western Area

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_AH_GIS01_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

N

0 400 800 1,200m

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Telephone +61 2 8584 8888

ERM

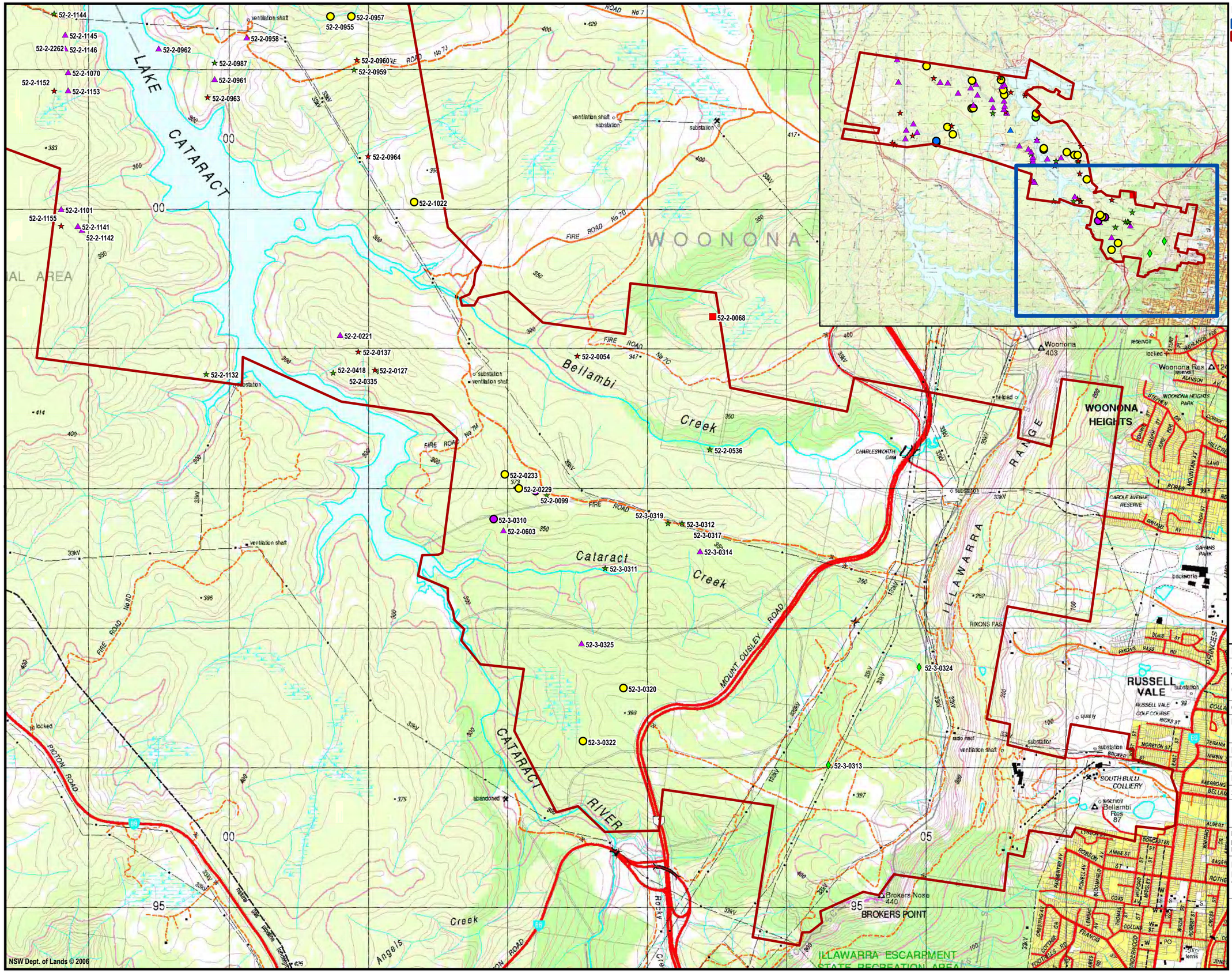

Figure 5.6

Archaeological Sites Recorded Within the Project Application Area (AHIMS) - Eastern Area

Client:	Gujarat NRE Minerals Ltd	
Project:	Preliminary Assessment	
Drawing No:	0079383s_PA_AH_GIS02_R0	
Date:	12/11/2008	Drawing size: A3
Drawn by:	JF	Reviewed by: JK
Scale:	Refer to Scale Bar	

N

0 200 400 600m

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ERM

The majority of the recorded sites are located close to a fresh water source (refer *Figures 5.5* and *5.6*). There are a number of streams within the PAA classified by the Strahler model as 2nd order or above. This indicates that there would have been fresh water year round and the PAA would have provided a good place for habitation and resource gathering.

Table 5.5 Site features registered within the PAA (AHIMS)

Archaeological Feature	No.
Shelter (typically a cave or rock overhang) with Art	67
Shelter (typically a cave or rock overhang) with Deposit	36
Axe Grinding Groove	23
Open Camp Site (typically indicated by surface scatters of stone artefacts)	3
Rock Engraving	1
Scarred Tree	1
Total	**131**

The large number of rock shelters, both with art and deposit, indicates that sites of high cultural significance and potentially high scientific significance, are present within the PAA. However, no significance assessment has previously been completed for the rock shelters or the art or potential archaeological deposits within the shelters.

The background literature reviews and AHIMS search result indicate there is substantial recorded evidence of Aboriginal occupation above the proposed mining area. There is also high potential for the presence of unrecorded sites. Based on the background research, some predictive statements about the types and locations of sites which may be present within the study area have been made and are presented in *Table 5.6*.

Table 5.6 Predictive Model of Site Occurrence

Location	Possible site types
Close to Fresh Water	Artefact scatters, axe grinding grooves, rock engravings
Rock overhangs or shelters	Rock art sites, occupation deposits
Exposed sandstone	Rock engravings, axe grinding grooves
Ridge lines or elevated locations	Artefact scatters, isolated artefacts
Old growth forest	Scarred trees (unlikely to be present)

No archaeological sites have been registered at the Russell Vale Site or No. 4 Shaft. These areas have been cleared and are highly disturbed as a result of historic mining related activities. It is unlikely that any undisturbed surface sites would be located at areas to be disturbed for upgrade of surface infrastructure.

Potential Project Impacts

Surface Operations

Upgrade of surface infrastructure and ongoing mine operations at the Russell Vale site, No. 4 Shaft and ventilation shafts has a low potential to disturb unrecorded archaeological sites, as these activities will occur within the footprint of existing surface operations. These areas have been previously cleared and are highly disturbed. If gas drainage boreholes or the ballast and bulk materials supply borehole are to be constructed at previously undisturbed areas, there is potential for disturbance of archaeological sites during construction works that disturb the soil surface or subsurface.

Underground Operations

Subsidence may impact known and/ or previously unidentified archaeological features. Subsidence could cause surface cracking, rock exfoliation, rock falls and collapse of rock shelters or overhangs present above subsided areas, thereby impacting rock shelters, art sites, axe grinding groves or rock engravings present at impacted areas (DoP, 2008). Subsidence-induced damage to rock shelters has previously been observed in the Southern Coalfield (DoP, 2008). The integrity of potential archaeological deposits, artefact scatters or isolated artefacts would not be affected by subsidence.

Proposed Level and Scope of Further Assessment

An Aboriginal heritage assessment will be prepared as part of the EA, conducted in accordance with the DECC (2005) draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* and the DECC (2004) *Interim Community Consultation Guidelines*. Taking into account the potential for subsidence to impact registered Aboriginal sites and areas which have a high potential for Aboriginal sites, it is proposed that this include:

- consultation with the local Aboriginal community;

- targeted archaeological surveys to identify and record previously unrecorded sites which could be impacted by the proposal and to inform management recommendations. Local representatives of the Aboriginal community will be invited to participate in surveys. Taking into account the predictive model provided in *Table 5.6*, surveys should cover:
    - waterways (2nd order and above) within the proposed subsidence zone;
    - ridges, spur lines or other elevated areas close to water within the proposed subsidence zone;
    - other areas within the proposed subsidence zone where previously unidentified rock shelters may be located;
    - confirmation of location of all previously recorded rock shelters within the proposed subsidence zone; and
    - any areas to be disturbed for upgrade of surface infrastructure or construction of new infrastructure which have not been subject to previous clearing or ground disturbance;
- significance assessment of all rock shelters within the proposed subsidence zone, in conjunction with a conditions assessment to determine if any damage has occurred since the original site recordings;
- impact assessment; and
- development of mitigation and management recommendations to minimise any potential impacts.

5.13 TRAFFIC AND TRANSPORT

5.13.1 Existing Environment

The Princes Highway runs alongside the eastern boundary of the Russell Vale Site. The Russell Vale Site access is at the signalised intersection of Bellambi Lane and the Princes Highway. Bellambi Lane has a marked single carriageway with two lanes in each direction. The haulage route to PKCT used by coal trucks is via Bellambi Lane and the Northern Distributor. No. 4 Shaft is accessed via a private road off Picton Road.

The roads surrounding the Russell Vale Site and No. 4 Shaft and the haul route to PKCT are currently subject to mine-related traffic. This includes heavy vehicles for deliveries and coal transport and light vehicles for movement of staff, contractors and visitors. The regional road network, including the Northern Distributor, is also subject to heavy vehicle traffic from other industry and coal mines in the region.

There are sealed internal circulation roads at the Russell Vale Site and No. 4 Shaft. Site traffic controls are currently being upgraded.

5.13.2 Potential Project Impacts

A minor increase in traffic movements to and from No. 4 Shaft and the Russell Vale Site will occur due to increased employee numbers and deliveries associated with the increased scale of operations. There will also be short-term impacts associated with deliveries of construction materials.

Coal trucks will continue to use the existing haulage route to PKCT but movements will increase due to the increased coal production. Hours of coal haulage along this route will also be extended. Trucking hours will be reviewed for this Project, having regard to the operating hours of PKCT, the Project requirements, the results of acoustic/traffic assessments and the potential impacts on the amenity of adjacent residential areas.

Proposed Level And Scope Of Further Assessment

A traffic and transport impact assessment will be undertaken as part of the EA. This will include:

- characterisation of the existing road network in the vicinity of the PAA, including its capacity and existing traffic volumes;
- assessment of potential traffic impacts on the safety and capacity of the surrounding road network and key intersections, taking into account background and predicted future traffic volumes;
- assessment of safety and efficiency of the proposed internal circulation network and adequacy of parking; and
- identification of any additional management measures to minimise impacts. For example moving to 'state-of-the-art' trucks which have 38t capacity helping reduce additional truck movements on the haulage route.

5.14 VISUAL AMENITY

5.14.1 Existing Environment

The visual landscape is characterised by the steep slopes of the Illawarra Escarpment and variable surrounding landform and topography. Large tracts of undeveloped, densely vegetated land are located west of the Illawarra Escarpment, along with transport and utilities infrastructure, waterbodies and mining-related infrastructure. Visual landscape east of the escarpment reflects low density residential suburbs, commercial, industrial and mining developments, small rural allotments, transport and utilities infrastructure, coastline and the South Pacific Ocean.

The Russell Vale Site is on the lower slopes of the Illawarra Escarpment. Site infrastructure is visible from a number of residences and roads within neighbouring suburbs. Mining-related infrastructure has been a feature of the visual landscape surrounding the site for over 120 years, and views are obscured by distance and screening vegetation (refer to *Photograph 5.x*).

Surface sites west of the Illawarra Escarpment are surrounded by the dense vegetation of the Woronora Plateau and there are no sensitive receivers with views of these areas.

5.14.2 Potential Project Impacts

On rare occasions, subsidence can cause visible alterations to the ground surface. However these alterations are not expected to constitute a significant visual change, and there are no identified sensitive receivers with views of the surface of the proposed mining area.

Upgrades to site infrastructure at the Russell Vale Site will constitute a change to the viewscape, however these are expected to be in keeping with the industrial nature of the site which has constituted part of the existing viewscape for over 120 years. As identified in *Section 5.14.1*, impacts to visual amenity will be minimised by screening vegetation and distance. Moderate short-term visual impacts are expected during construction works.

5.14.3 Proposed Level And Scope Of Further Assessment

Given the limited views of surface infrastructure and the fact that no changes to the mining character of the Russell Vale Site are proposed, a detailed visual assessment is not proposed as part of the EA. A brief visual analysis will be undertaken and include measures to manage, mitigate or avoid any potential visual impacts during construction and operation and reduce unnecessary fugitive light impacts upon the local community at night.

5.15 WASTE MANAGEMENT

Site waste e.g. domestic waste, timber, scrap metal, waste oil etc is typically collected and stored on-site for collection by a licensed contractor and disposal or recycling at a suitable off-site facility. Sewage management is discussed in *Section 2.4.7*.

The anticipated types and volumes of waste to be generated by the Project will be set out in the EAR, along with proposed management and disposal strategies. These are expected to reflect the current situation.

5.16 HAZARD AND RISK

Hazardous Materials

Purpose-built, above-ground bulk storage facilities for fuel, oil and waste oil are located at the Russell Vale Site and No. 4 Shaft and for explosives at the No. 4 Shaft. These facilities will be used during the Project. Below ground diesel fuel storage tanks are also located at the Russell Vale Site and No. 4 Shaft, however are not currently in use.

Storage and handling of these materials will continue to be in accordance with NRE's existing 'License for the Keeping of Dangerous Goods' and Workcover requirements. No additional hazardous materials will be stored or handled on the site as part of this Project.

Spontaneous Combustion

There is no known history of spontaneous combustion issues associated with coal mining or storage of coal at NRE No. 1 Colliery.

Bushfire

Surface sites are surrounded by densely vegetated areas which could pose a bushfire hazard. Buffer zones e.g. low cut grass, will continue to be maintained between site buildings and bushfire hazards. Fire fighting water and equipment is provided at surface sites. Emergency access is provided via the existing road network. No further bushfire hazard assessment will be conducted for the EA.

Mass Movement And Rock Fall

As identified in *Section 5.4.3*, the Russell Vale Site is located on the lower colluvial slopes of the steep to very steep Illawarra Escarpment, which has a mass movement and rock fall hazard. Proposed activities at the Russell Vale Site will occur within the existing development footprint, with no significant land clearing or levelling works required. As such, the Project is not expected to exacerbate the mass movement or rock fall hazards.

Public Safety

Existing measures in place to address public safety will be maintained and where necessary upgraded for the current Project. This includes maintenance of boundary fences, signage at the site entrance, camera surveillance facilities and locking site access gates and the gates across portals when not in regular use, to prevent un-authorised site access. The mine rehabilitation plan will include procedures for ensuring post-mining site safety. Changes to the level of the ground surface above underground mining areas is not expected to pose a public safety issues, as these areas are remote from population centres and access is restricted by the SCA.

The traffic and transport impact assessment will address safety issues associated with internal traffic movements, and coal trucks on public roads.

Emergency Management

The EAR will describe the types of emergencies that could pose a threat to the environment or human health, for example spillage of hazardous materials, and the principles for emergency response management.

5.17 SOCIO-ECONOMIC

5.17.1 Existing Environment

The PAA is within the Wollongong and Wollondilly LGAs, which form part of the Illawarra Statistical Division. Residents within the proximity of the PAA are within the local communities of Russell Vale, Bellambi and Corrimal.

NRE No. 1 Colliery and other mines in the Southern Coalfield contribute to the economic base of the region.

5.17.2 Potential Social And Economic Impacts

The Project will make an important economic contribution to the surrounding community over a time frame of 20 years. Social and economic benefits will include:

- ongoing provision of direct employment and training for local residents, with approximately 370 people to be directly employed during full-scale mining operations;
- indirect and induced employment generated via support services such as maintenance workers and short term sub-contractors (potentially 1500 indirect positions);
- economic multiplier effects to local and regional businesses and industries over the longer term;
- economic benefits to the local community via capital injection (estimated capital expenditure of $250 million), value added spending and purchase of local goods and services; and
- continued provision of government royalties (potentially $18.5 million per year for 20 years totalling $372 million).

There is potential for amenity of local residents to be adversely effected by noise, dust, traffic and visual impacts of short-term construction activities and ongoing operation the Project. These potential impacts are discussed in *Sections 5.8, 5.9* and *5.14*. However with appropriate and suitable controls that will be explained in the EA, these can be kept to an absolute minimum.

Proposed Level and Scope of Further Assessment

Socio-economic impact assessment will be conducted as part of the EA, using both qualitative and quantitative techniques, and will:

- assess the social and economic conditions of the regional and local area in which the PAA is set, including development of demographic, social and economic profiles;
- predict the social and economic impacts of the proposal (including positive and negative, direct and indirect, long term and short term, actual and perceived as well as cumulative impacts);
- identify ways to enhance the benefits of the development; and
- identify, and if possible mitigate any potentially negative impacts.

5.18 CUMULATIVE IMPACTS

Where relevant the EA will assess the potential for impacts of the Project to lead to cumulative impacts associated with past, existing and proposed future industry in the area. This will include assessment of cumulative acoustic, air and subsidence impacts.

5.19 RISK ASSESSMENT

Table 5.7 contains an assessment of the potential environmental, social and economic risks identified for this Project. This risk assessment is intended to guide the level of assessment undertaken in the EA. It is important to note that all risk ratings are based on the proposed activities taking place with no management measures in place.

Table 5.7 Environmental, Social and Economic Risk Assessment

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
Subsidence		Vertical subsidence of ground surface, ground tilts and strains and non-conventional subsidence effects, with associated environmental impacts.	High	• Detailed subsidence assessment, including calculation of vertical subsidence, tensile strains, tilts and non-conventional subsidence that will result from the proposed mining. • Identify impacts of the predicted subsidence on environmental features and overlying infrastructure. • Liaison between subsidence engineer and other environmental specialists.	Subsidence is the main direct effect of underground coal mining, with potential to have adverse impacts on environmental aspects. Detailed subsidence assessment is proposed to be an integral component of impact assessment and the assessment results will inform other impact assessments.
Landform and Topography		Alterations to landform from subsidence or minor earthworks.	Low	• No additional assessment required.	Subsidence is not expected to result in obvious changes to landform. Earthworks will be minor and within the existing footprint of surface operations.
Land Tenure and Ownership		Changes to land tenure status	Low	• Identify tenure and ownership details of properties within the PAA.	Surface operations will be within the existing footprint of surface operations, within surface lease already held by NRE. Identification of existing tenure and ownership details is sufficient for the purpose of describing the PAA.
Land Use		Changes to land use.	Low	• No additional assessment required.	The Project does not involve a change in land use of the site or surrounding areas.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
Infrastructure	Subsidence Impacts	Disruptions/ impacts on Telstra fibre optic cable, customer access cables, electrical transmission lines, water pipelines, fire trails and/ or public roads above the mining area.	High	• Assess subsidence impacts on surface improvements. • Identify required management, mitigation and monitoring measures.	The high risk rating is due to the magnitude of consequences which could occur if public infrastructure is adversely impacted by subsidence. Detailed assessment is warranted to address this high risk rating.
	Demand for Infrastructure	Adverse impact on capacity of existing services e.g. electricity, telecommunications.	Low	• Investigate the potential for the Project to impact the capacity of existing services.	Supply of services and infrastructure to operational areas constitutes a continuation of existing arrangements. Limited investigation is required to confirm no significant increase to demand on this infrastructure will occur.
Surface Water	Surface Operations	Altered water quality and flows in receiving streams due to site runoff or off-site discharges.	Moderate	• Review suitability of site erosion and sediment controls and water and wastewater management strategies. • Assess impacts off-site discharges on potentially impacted streams. • Identify any additional management, mitigation and monitoring measures required.	Detailed assessment is not required as no new surface areas will be disturbed (other than small areas for boreholes) and no changes to off-site discharges are proposed. Existing measures and water treatment devices are in place to minimise impacts on off-site water resources.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
	Underground Operations	Subsidence-related alterations to stream flows, water quality, fluvial geomorphology, bank stability and/ or flooding regime at Lizard, Bellambi, Wallandoola, and/ or Cataract Creeks and tributaries. Altered drainage paths and localised ponding.	High	• Review existing surface water data. • Additional surface water monitoring. • Assess impacts on potentially affected streams and upland swamps. • Identify required management, mitigation and monitoring measures.	The high risk rating is due to the magnitude of consequences which could occur if surface water resources are impacted by subsidence. Detailed assessment and additional monitoring is warranted to address this high risk rating.
	Water supply	Inefficient or excessive water consumption and/ or adverse impact on local water supplies.	Low	• Prepare water balance model. • Assess impacts of Project water usage on town water supply. • Identify any additional water conservation measures which could be applied.	The proposed level of assessment is warranted as no changes to the current supply arrangement are proposed, including maximising use of recycled water.
Groundwater	Underground Operations	Subsidence-induced changes to groundwater levels, flow paths, water chemistry and/ or recharge rates, resulting in potential impacts to groundwater dependent ecosystems and groundwater users.	High	• Review existing groundwater data. • Additional ground water monitoring. • Assess potential impacts on groundwater levels, quantity and quality. • Identify required management, mitigation and monitoring measures.	The high risk rating is due to the magnitude of consequences which could occur if groundwater is impacted by subsidence, and the need for additional data on existing groundwater. Rigorous assessment and additional monitoring is warranted.
	Mine Water Management	Additional groundwater inflow into mine workings.	Moderate	• Assess potential for additional groundwater flows into mine workings. • Identify required management measures to address any increase in inflow.	Groundwater inflows will be managed by NRE's existing mine water management system. Some additional assessment is required to quantify any potential changes to inflow and inform mine management.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
Air Quality		Adverse impacts of dust on surrounding residences.	Moderate	• Quantify existing air quality and proposed Project emissions. • Predict future dust levels at sensitive receivers by air dispersion modelling. • Assess acceptability of predicted particulate matter concentrations. • Identify any additional management, mitigation and monitoring measures required.	This level of assessment is in keeping with DECC (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*.
Greenhouse Gas		GHG emissions from electricity consumption, releases from coal and rock strata and combustion of fossil fuels.	Moderate	• Calculate Scope 1, 2 and 3 GHG emissions. • Impact assessment. • Identify GHG reduction and energy conservation measures.	This level of assessment is in keeping with relevant legislation and guidance, including methodologies outlined in the *Australian Greenhouse Office Factors and Methods Workbook*.
Acoustics	Construction noise	Short-term increase in noise levels at sensitive receivers near the Russell Vale Site.	Low	• Calculate construction noise levels to be experienced at surrounding residence. • Assess predicted noise levels against DECC guidelines.	Construction impacts are short-term in nature and the proposed assessment approach is in keeping with DECC policy.
	Operational noise	Increase in noise levels at sensitive receivers near the Russell Vale Site.	Moderate	• Quantify the existing noise environment, including monitoring of noise levels. • Predict future noise levels at sensitive receivers by quantitative modelling. • Assess predicted noise levels against DECC guidelines. • Identify any additional management, mitigation and monitoring measures required.	This level of assessment is in keeping with DECC guidance. Detailed assessment is warranted to address the high potential for changes to noise levels at sensitive receivers.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
		Increased traffic noise levels at residences surrounding the site and haul route.	High	• Calculate future road traffic noise levels to be experienced at residences near the haul route. • Assess predicted noise levels against DECC guidelines. • Identify any additional management, mitigation and monitoring measures required.	This level of assessment is in keeping with DECC guidance and is warranted to address community concerns and potential traffic noise impacts of the vehicle movements and proposed extended hours of coal haulage.
Ecology	Surface Operations	Adverse impacts on aquatic ecology associated with potential impacts on receiving streams for site runoff and discharges.	Low	• Assess potential changes to receiving water quality and flows and qualitatively describe any potential impacts on ecological values.	As discussed above, proposed changes to surface operations are not expected to significantly alter site run-off or discharges. Impacts on off-site water resources are minimised through existing site water management. Therefore detailed assessment is not deemed necessary.
	Underground Operations	Subsidence impacts on habitat of threatened flora and fauna species and endangered ecological communities.	Moderate	• Review existing ecology data. • Conduct targeted field surveys of aquatic ecology and terrestrial flora and fauna. • Impact assessment, including assessment of the significance of potential impacts on any threatened species and endangered ecological communities. • Develop measures to avoid, mitigate or offset potential impacts.	This level of assessment is justified given the ecological sensitivities of the PAA and the potential for threatened species and endangered ecological communities to be impacted.

Aspect	Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
Non-indigenous heritage	Impacts to heritage values of heritage listed items at the Russell Vale Site.	Moderate	• Review existing studies/ data. • Conduct heritage survey of the Russell Vale Site. • Prepare a Statement of Heritage Impact. • Develop measures to avoid, mitigate or offset potential impacts.	To identify impacts and required management measures, survey and background research is first required to identify locations and values of heritage items.
Aboriginal heritage	Impacts to Aboriginal heritage items or values as a result of subsidence or construction activities.	Moderate	• Consult with the local Aboriginal community. • Targeted archaeological surveys to identify and record sites. • Significance and conditions assessment of rock shelters within the proposed subsidence zone. • Impact assessment. • Develop mitigation and management recommendations.	The proposed level of assessment is warranted, given the high potential for Aboriginal sites with potential to be impacted by subsidence above the proposed underground mining area. Upgrade of surface infrastructure has a low potential to disturb unrecorded archaeological sites, as this will be within the footprint of existing surface operations.
Traffic and transport	Impacts on the safety and capacity of the surrounding road network due to projected increased vehicle movements.	Moderate	• Characterise the existing road network. • Quantitatively assess potential traffic impacts on the safety and capacity of the surrounding road network and key intersections. • Assess safety and efficiency of the internal circulation network and adequacy of parking. • Identify any additional management measures required.	Quantitative impact assessment is warranted to address the projected increased vehicle movements and haulage hours.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
Visual		Adverse impact on visual amenity of sensitive receivers.	Low	• Brief visual analysis. • Identify measures to minimise visual impact of construction and operation.	Given the limited views of surface infrastructure and the fact that no changes to the mining character of the Russell Vale Site are proposed, a detailed visual assessment is not proposed.
Waste Management		Increased waste generation.	Low	• Identify types and volumes of waste to be generated. • Identify proposed management and disposal strategies.	Waste production at the site is not expected to increase significantly.
Hazard and Risk	Hazardous materials	Release of hazardous material to the environment.	Low	• No additional assessment required.	Storage and handling of hazardous materials is in accordance with license conditions and Workcover requirements. No additional hazardous materials will be stored or handled on the site.
	Spontaneous Combustion	Fire.	Low	• No additional assessment.	There is no known history of spontaneous combustion issues associated with coal mining at NRE No. 1 Colliery.
	Bush Fire	Fire damage to property or person.	Low	• No further assessment	The bush fire risk is managed by existing buffer zones, response procedures and on-site fire fighting water and equipment.
	Mass movement and rock fall	Damage to property or person.	Low	• No further assessment	The Project is not expected to exacerbate the mass movement or rock fall hazards.
	Public Safety	Injury to persons.	Low	• No further assessment	Public safety is addressed by existing measures. The mine rehabilitation plan will include procedures for post-mining site safety.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Proposed Scope of Works for Environmental Assessment	Justification
	Emergency Management	Risk to environment, property or person.	Low	• Describe types of emergencies that could occur and principles for emergency response management.	The Project is not likely to result in potential for any new emergency situations. Therefore documentation of existing emergency response measures/ procedures is considered adequate for the purpose of the EA.
Socio-economic Considerations		Social and economic benefits to the local and regional community and government through employment and revenue generation.	Positive Impact	• Identify ways to enhance the benefits of the development.	Documentation of positive impacts of the Project aids decision makers weigh up the positive and negative outcomes of the Project proceeding.
		Adverse impacts to amenity of nearby residents.	Moderate	• Assess the social and economic conditions of the area. • Impact prediction and assessment. • Identify measures to mitigate any potentially negative impacts.	A moderate level of assessment is warranted, as there is existing research into socio-economic impacts of mining in the Illawarra region, however Project and site-specific assessment is required to ensure potential impacts on the community immediately surrounding the mine are understood and managed.

6 CONCLUSION

NRE seeks approval for ongoing operation of its underground coal mine and associated surface facilities at NRE No. 1 Colliery in the Southern Coalfield. This includes upgrade of existing surface infrastructure and construction of some new surface infrastructure. It is proposed to increase coal production to a maximum of 3 mtpa over a period of up to 15 years. The unwashed coal will be trucked to PKCT for shipment to India.

This preliminary assessment has identified the potential environmental, social and economic implications associated with the Project and outlined the proposed scope of works to be undertaken as part of the EA. In summary the key environmental considerations identified in this preliminary assessment for the Project are:

- subsidence
- infrastructure and surface improvements
- surface water;
- groundwater;
- air quality
- greenhouse gas;
- acoustics
- ecology;
- heritage (indigenous and non-indigenous);
- traffic and transport; and
- socio-economic considerations.

These issues will be addressed in greater detail in the EAR and suitable mitigation, monitoring and management measures developed to address potential impacts identified. The Project poses a low risk to other identified environmental aspects, including visual amenity, waste management and hazards. These aspects will be assessed to a lesser extent in the EA.

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